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1. Incidence and Outcomes of Pediatric Magnet Exposures Reported to the National Poison Data System: 2008-2019

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Background: High-powered magnets are often small (<5mm diameter) and sold in sets as a novelty item. Because of their strength, ingesting more than one can lead to significant injury. In 2014, the U.S. Consumer Product Safety Commission (CPSC) issued a federal rule that effectively halted high-powered magnet sales. This rule was over-turned in 2016. There are no studies that explore exposure trends and outcomes since magnets re-emerged in the U.S. market. We present the number and outcomes of magnet injuries in NPDS between 2009–2019, with a focus on the incidence and outcomes after the CPSC rule was overturned in 2016.
Methods: NPDS was queried for human exposures from January 1, 2008 through October 31, 2019 that had: 1) single substance ingestion, 2) substance code as "magnet" and 3) age 0 to 19 years old. "Confirmed non-exposures" were verified by x-ray and excluded. Exposures with "unrelated effects" were excluded.
Age groups were classified by single-years of age and by composite age groups (0 to 5 years, 6 to 12 years, and 13 to 19 years). For the purposes of analysis, an additional group called "serious outcome" was created by combining the categories moderate effect, major effect, and death.
Data were analyzed for three periods from 2008 to 2012, 2013 to 2017, and 2018 to 2019. Statistical significance was established at $\alpha = 0.05$. Descriptive statistics with 95% confidence intervals (CIs) were calculated. This study was exempt by the Institutional Review Board of the authors' institution.
Results: 5,738 single substance magnet ingestions were reported to US PCCs during 2008 to 2019. 39% of cases occurred in 2018-2019. The mean age was 5.2 years (SD =4.1). The majority were male (55%) and less than 6 years old (62%).
The annual number of magnet ingestions increased 4.9 fold following 2017 (322 in 2017 to 1580 in 2019). There was a 4.2 fold increase in patients seen in the hospital for magnet ingestion during this time. There was a significant 292% increase in the annual mean of pediatric magnet ingestions after 2017 and a 225% increase in the annual mean in pediatric patients seen in the hospital. The increase occurred across all age groups, but was most prominent in children in the 0 to 5 years and 6 to 12 years age groups.
There was a significant 500% increase in the annual mean of serious medical outcomes prior to and after 2017: annual mean 2/year 2008-2017 (SD 1.26, 95% CI 1.25–2.74) and 10/year 2018-2019 (SD 2.83, 95% CI 6.07–13.92), respectively.
There was a significant decrease in mean monthly number of magnet ingestions during non-school months (June, July, August) compared with traditional school months in the 13 to 19 year age group (5.6/month vs 9.3/month, $p < 0.05$).
Conclusions: The number of high-powered magnet ingestions and the number of serious outcomes increased dramatically after the CPSC-issued federal rules restricting their sale was overturned in 2016. Children less than 6 years old constitute the majority of these exposures.

KEYWORDS High-powered magnet, magnet, exploratory ingestion

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2. Physical Compatibility of Physostigmine with Intravenous Fluids and Medications Used in the Treatment of Antimuscarinic (Anticholinergic) Toxidrome

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Background: Physostigmine is a carbamate which inhibits acetylcholinesterase and may be used in the treatment of antimuscarinic toxidrome. Physostigmine salicylate is commercially supplied as a 1 mg/mL injectable solution and is traditionally administered in bolus form. However, the short duration of action limits the utility for prolonged agitation and delirium. Continuous infusion has been used successfully and safely, but intravenous (IV) fluid and medication compatibility is unavailable, limiting its use in clinical practice. In a pediatric setting, continuous infusion of undiluted physostigmine is further limited by IV syringe pump minimum flow rate requirements. The objective of this study is to determine physical compatibility of 14 commonly co-administered IV fluids and medications with physostigmine 1 mg/mL injectable solution using simulated y-site mixing.
Methods: Agents listed in Tables 1 and 2 were mixed in a 1:1 ratio with physostigmine salicylate 1 mg/mL injection solution in a United States Pharmacopeia (USP) 797 compliant sterile processing area and incubated in a syringe for 4 hours at room temperature.
For aqueous combinations, USP 788 method 1 was used to assess physical compatibility. Visual inspection analysis was performed immediately after mixing and after 4 hours of incubation, while light obscuration (HIAC 9703+ Beckman-Coulter instrument) and flow imaging (FlowCam™ VS Fluid-Imaging Technologies instrument) analysis were performed at the 4 hour time point. Per USP 788 large-volume parenteral thresholds, a combination was considered physically compatible if there were

Table 1(#2). IV fluids mixed 1:1 with physostigmine 1 mg/mL.

IV Fluid	Visual inspection analysis	HIAC particle count (P/mL) ≥10 μm	HIAC particle count (P/mL) ≥25 μm	FlowCam particle count (P/mL) ≥10 μm	FlowCam particle count (P/mL) ≥25 μm	Y-site physical compatibility assessment
5% Dextrose-0.9% sodium chloride with potassium chloride 20 mEq/L	Clear	5.25	0	13	1.4	Compatible
Lactated Ringers solution	Clear	4.5	0	7.2	0	Compatible
Plasma-Lyte A Injection 7.4 (Multiple Electrolytes Injection, Type1, USP)	Clear	7	0	14.4	0	Compatible
Intralipid fat emulsion 20%	No obvious disruption of emulsion	Mean PFAT5% (SD) 0.02 (0.0023)		–		Compatible

Table 2(#2). Medications mixed 1:1 with physostigmine 1 mg/mL.

Medication	Concentration	Visual inspection analysis	HIAC particle count (P/mL) ≥10 μm	HIAC particle count (P/mL) ≥25 μm	FlowCam particle count (P/mL) ≥10 μm	FlowCam particle count (P/mL) ≥25 μm	Y-site physical compatibility assessment
Sodium Bicarbonate 8.4%	1 mEq/mL	Clear	1.5	0	11.6	1.4	Compatible
Midazolam Hydrochloride	5 mg/mL	Clear	2.75	0	2.9	0	Compatible
Lorazepam Hydrochloride	***2 mg/mL***	***"gelled" upon mixing***	***0.25***	***0***	***184.1***	***1.4***	***Incompatible***
Acetylcysteine (in 5% dextrose)	40 mg/mL	Clear	2.25	0	15.9	0	Compatible
Propofol	10 mg/mL	No obvious disruption of emulsion	Mean PFAT5% (SD) 0.038 (0.0029)		–		Compatible*
Phenobarbital	65 mg/mL	Clear	1	0	17.3	1.4	Compatible
Magnesium sulfate	80 mg/mL	Clear	2.5	0	7.2	1.4	Compatible
Lidocaine hydrochloride	10 mg/mL	Clear	2.25	0	15.9	2.9	Compatible
Dexmedetomidine hydrochloride	4 mg/mL	Clear	8.75	0	14.4	1.4	Compatible
Morphine sulfate (in dextrose 5%)	5 mg/mL	Clear	2.5	0	10.1	0	Compatible

*Propofol/Physostigmine combination is below USP 729 thresholds but does approach 0.05%. Caution is recommended.

less than or equal to 25 particles per mL (P/mL) ≥ 10 μm in size, and less than or equal to 3 P/mL ≥25 μm in size.

For lipid-containing combinations, emulsion stability was assessed using light obscuration analysis (HIAC instrument). USP 729 method 2 was used to measure the volume-weighted percentage of lipid droplets 5 μm or larger diameter (P5FAT) at the 4-hour time point. Per USP 729 standards, the lipid-containing combinations were considered compatible if the PFAT5% was less than 0.05%.

Results: All combinations tested were physically compatible per USP standards using light obscuration alone (Tables 1 and 2). The only combination that met criteria for incompatibility using flow imaging was lorazepam with physostigmine, with an average particle count of 184.1 P/mL for particles ≥10 μm. Additionally, visual inspection of this combination demonstrated obvious "gelling" upon mixing.

Conclusion: Physostigmine 1 mg/mL injection solution demonstrated simulated y-site physical compatibility with 13 out of 14 IV fluids and medications tested per USP standards across all instruments. USP 788 does not contain specific guidance for use of flow imaging, however this instrumentation was utilized due to its increased sensitivity for particle sizing and identification when compared to light obscuration. The combination of physostigmine and lorazepam technically meets USP 788 standards by light obscuration but was found to be physically incompatible using flow imaging and by visual inspection. Simultaneous infusion of physostigmine with lorazepam at the y-site is not recommended.

KEYWORDS physostigmine, y-site, compatibility

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3. The Effect of a Product Ban: Pediatric Magnet Ingestion Review in the National Electronic Injury Surveillance System

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Background: Magnets made from rare earth elements are much stronger than the typical household magnet. Since their introduction on the market, there have been multiple cases of pediatric ingestions and significant injury from those ingestions. In response to this, the Consumer Product Safety Commission increased regulation on toy magnets in 2012 and issued a subsequent ban on specific magnets in 2014. This ban was overturned two years later and sales were resumed. The National Electronic Injury Surveillance System (NEISS), a public database, was reviewed for pediatric magnet ingestions to determine the effect of both the ban and its subsequent overruling.

Statistical Analysis: Data was categorized into three time periods: 2009-2012 was prior to an increase in regulation, 2013-2016 was during an increase in regulation, and 2017-2018 after regulation removed.

Using weights provided by NEISS, we calculated national estimates of the number of ED visits for injuries related to rare earth magnets. Variance estimates were calculated using the Taylor-series linearization method.

To determine if there was a significant change in risk of injury requiring a visit to the ED from ingestion of rare earth magnets related to regulation, we conducted a Poisson regression analysis to calculate incidence rate ratios comparing the three time periods. To account for heteroskedasticity in the Poisson model, we used the sandwich method to calculate robust standard errors. We further calculated the predicted number of events within each time period and corresponding standard error via the Delta-method to calculate the absolute yearly difference in cases between time periods.
All data analysis was conducted in Stata 15 (StataCorp, College Station, TX). All tests conducted were two-sided, and p-values of less than 0.05 were considered statistically significant.
Results: As compared to the four years prior to increased regulation, there was a 22% reduction (95% CI: 1 to 38%, $p = 0.04$) in risk of injury requiring an ED visit in the four years during the increased regulation. In the two years after the regulation was overturned, there was a 70% increase (95% CI: 46 to 99%, $p < 0.01$) in risk of injury requiring an ED visit when compared to the four years before. The estimated absolute yearly reduction of cases during the period of increased regulation was 513 (95% CI: −38 to 1063, $p = 0.07$) as compared to the time prior to regulation. There was an estimated absolute yearly increase of 1314 (95% CI: 964-1664, $p < 0.01$) cases when comparing the period of regulation to the time after regulation was removed.
Conclusions: Our results indicate that an increase in regulation was associated with a reduction in emergency department visits for pediatric magnet ingestions. Had the increased regulation continued, many more emergency department visits and healthcare costs could have been avoided.

KEYWORDS magnet, pediatric, ingestion

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4. A Randomized Trial comparing Physostigmine vs Lorazepam for Treatment of Antimuscarinic (Anticholinergic) Toxidrome

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Background: Overdose and abuse of antimuscarinic xenobiotics such as antihistamines or Jimson Weed is a common scenario in medical toxicology. Antagonism of muscarinic receptors precipitates a constellation of signs and symptoms (antimuscarinic toxidrome), characterized by severe agitation and delirium. Benzodiazepines are commonly used for treatment; physostigmine may also be effective but is underutilized due to concerns for safety and short duration of action. The objective of this study was to compare lorazepam and physostigmine for the treatment of antimuscarinic agitation and delirium.
Methods: This was a double-blinded randomized clinical trial in patients presenting for clinically suspected antimuscarinic toxidrome, conducted at a tertiary care children's hospital emergency department and intensive care unit from 3/2017-6/2020. Inclusion criteria were: 10-18 years old, at least 1 central and 2 peripheral antimuscarinic symptoms, RASS Agitation score of at least 1+, and positive 3D-CAM delirium score. Exclusion criteria were history of epilepsy/seizures or asthma, bradycardia, QRS >120 ms, known tricyclic antidepressant ingestion, pregnancy, or previous administration of physostigmine during clinical course. Eligible subjects were randomized to either 1) lorazepam bolus followed by a 4-hour normal saline infusion, or 2) physostigmine bolus followed by a 4-hour physostigmine infusion. Expanded urine drug screens (HPLC-MS/MS) were performed. Primary outcome was the control of agitation and delirium as measured by the RASS and 3D-CAM.
Results: To date, there were 19 of 22 patients successfully enrolled. The mean age was 14.1 years (SD 1.4 years), and 9 (47%) were male. After the initial bolus dose, 9 (47%) of patients had improvements from their initial RASS score, and 8 (42%) had resolution of delirium. There were no adverse events with bolus dosing. During the infusion, 3 (16%) patients experienced over sedation and 1 (6%) had vomiting. There were no seizures, bradycardia, bronchorrhea, bronchospasm, diaphoresis or intubation, or cardiac dysrhythmias during the study. Other clinical variables compared between study groups included vital signs, antimuscarinic symptoms, RASS agitation score and 3D-CAM Delirium score every hour during the 4-hour infusion period. Hospital length of stay, time in restraints, and additional sedation requirements were compared between treatments. Satisfaction with therapies was also assess in both provider treatment teams and guardians.
Conclusion: The results of this randomized clinical trial will provide robust evidence for the most efficacious pharmacologic treatment of antimuscarinic delirium and agitation.

KEYWORDS Physostigmine, Anticholinergic, Lorazepam

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5. Droperidol or Olanzapine: a Natural experiment for Undifferentiated Toxicologic Sedation (DONUTS)

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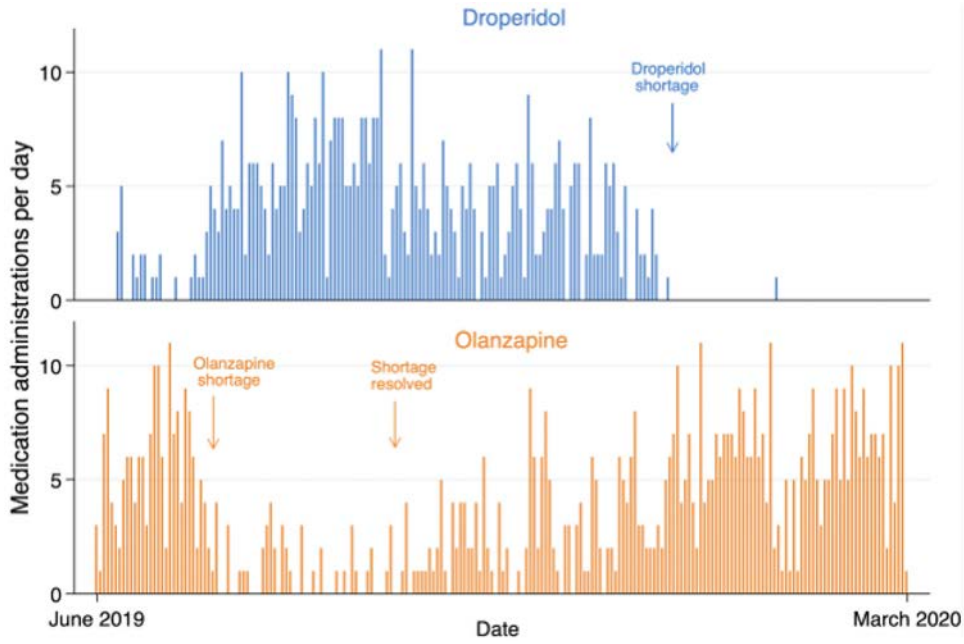
Background/Objectives: Acute agitation secondary to intoxication is a common problem in the emergency department (ED). Both droperidol and olanzapine are routinely used treatments, however no study has compared intramuscular droperidol to olanzapine for this indication. The purpose of this study was to compare time to adequate sedation for both medications.
Methods: This was a prospective observational study of patients receiving intramuscular droperidol or olanzapine for acute agitation secondary to intoxication from June 2019 - March 2020. Data were collected for the purposes of quality assurance after the return of droperidol to the U.S. market and our hospital. Medication and dose were always determined by the treating physician, however over the study period drug-shortages made either olanzapine (July-September 2019) or droperidol (November 2019 - March 2020) unavailable (Graph). Data acquisition volunteers were trained in the Altered Mental Status Scale (AMSS), an ordinal scale of agitation from -4 (coma) to 0 (normal) to +4 (most agitated) and recorded time to adequate sedation, defined as AMSS ≤0, as well as adverse events and other clinical data. Time to adequate sedation was analyzed using differences in medians with 95% confidence intervals (CIs) as well as a Cox proportional hazard model. Secondary outcomes included use of additional (rescue) sedation, adverse events, and time in the ED. The medical record was also screened for return visits for dystonia for the following week.



Graph(#5). Use of medications over time. Display of the number of daily administrations of each medication over time. Drug shortages caused variations in use over time, and this figure provides evidence of a natural experiment.

Table 1(#5). Demographic and Baseline Patient Data.

Parameter, n	Droperidol (n = 522)	Olanzapine (n = 735)
Age, median (IQR) - years	40 (32-54)	43 (32-54)
Men	366 (70%)	549 (75%)
Baseline AMSS Score (IQR)	2 (2 to 3)	2 (1 to 3)
Droperidol or Olanzapine dose, median (IQR) - mg	5 (5-5)	10 (10-10)
Vital Signs, median (IQR)		
Heart rate - beats per minute	95 (84-105)	91 (80-102)
Respiratory rate - breaths per minute	18 (16-18)	18 (16-18)
Systolic blood pressure - mm Hg	123 (110-138)	124 (112-138)
SpO_2 - %	97 (95-99)	98 (96-99)
Alcohol concentration, median g/dL (IQR) - %	0.190 (0.134-0.245) Range: 0-0.5	0.188 (0.135-0.236) Range: 0-0.459
Presumed Etiology of Agitation, n (%)*		
Alcohol intoxication	477 (91)	665 (90)
Methamphetamine	32 (6)	44 (6)
Cocaine	15 (3)	14 (2)
Other	23 (4)	28 (4)
Disposition, n (%)		
Home / Street	438 (84)	595 (81)
Acute Psychiatric Services	53 (10)	87 (12)
Hospital Admission	17 (3)	33 (4)
Other	14 (3)	20 (3)

*determined clinically by treating physician; multiple etiologies possible for each patient.

Table 2(#5). Outcome Data.

Effectiveness	Droperidol (n = 522)	Olanzapine (n = 735)
Proportion Adequately Sedated, n (%)		
15 minutes	224 (44)	328 (46)
30 minutes	425 (83)	562 (77)
60 minutes	446 (88)	604 (84)
120 minutes	463 (91)	629 (89)
Adverse Events		
Extrapyramidal events, n (%)		
Dystonia in the ED	2 (<1)	0
Repeat ED visit for dystonia within 7 days	3 (1)	0
Akathisia	0	1 (<1)
Cardiovascular events, n (%)		
Hypotension	14 (3)	18 (2)
Bradycardia	3 (1)	1 (<1)
Respiratory events, n (%)		
Hypoxemia (SpO_2 < 93%)	24 (5)	41 (6)
Oxygen supplementation	9 (2)	25 (3)
Jaw thrust	2 (<1)	5 (1)
Bag mask ventilation	0	0
Aspiration, as determined by treating physician	1 (<1)	3 (<1)
Tracheal intubation	4 (1)	9 (1)

AMSS: altered mental status scale; IQR: interquartile range; SpO_2: pulse oximetry value.

Results: We enrolled 1,257 patients; 552 received droperidol, 735 received olanzapine. Baseline characteristics, including vital signs, were similar between groups (Table 1). Etiology of intoxication, determined clinically by the treating physician, was ethanol in 1,142 (91%) cases followed by illicit drugs in 194 (15%; methamphetamine being the most common drug). Time to adequate sedation was 16 minutes for both drugs (hazard ratio =1.09; 95%CI: 0.98 - 1.23). Results were similar for subgroups with alcohol intoxication and with methamphetamine intoxication. The proportion of patients adequately sedated at 15 minutes was 44% (n = 224) for droperidol and 45% (n = 328) for olanzapine (absolute difference -2%, 95% CI -7% to 4%). Rescue sedation was needed less often in patients receiving droperidol (n = 82, 16%) compared with olanzapine (n = 176, 24%) (absolute difference -8%, 95% CI -13% to -4%). We found no difference in extrapyramidal, cardiovascular, or respiratory adverse events between drugs (Table 2) with the exception of dystonia, which was more common with droperidol (n = 5; 1%) than olanzapine (0%; p = 0.012, Fisher's exact). Median time in the ED was shorter for droperidol (446 minutes) than for olanzapine (500 minutes) (median difference 57 minutes, 95%CI: 39 - 76 min).

Conclusions: We found no difference in time-to-adequate sedation between intramuscular droperidol or olanzapine for acute agitation secondary to intoxication. We observed no difference between drugs regarding adverse effects with the exception of dystonia, which was more common with droperidol. Droperidol was associated with fewer episodes of rescue sedation and a shorter length of ED stay.

KEYWORDS alcohol, methamphetamine, agitation

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6. Neurotoxic Effects of the Nephrotoxic Compound Diethylene Glycol

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Background: Diethylene glycol (DEG) can be found in some consumer products (brake fluid, chafing fuels) but has also been an adulterant in liquid medications, primarily by acting as counterfeit glycerin. DEG poisonings have been characterized predominately by acute kidney injury (AKI) and specifically necrosis of the proximal tubule cells of the kidney. DEG is also known to affect the nervous system in some patients 2-7 days after ingestion as noted by neurological sequelae such as decreased reflexes, face and limb weakness, or ataxia.
Objectives: To characterize possible neurological symptoms of DEG poisoning in a subacute animal model and investigate connections between the kidney injury and the neuropathy.
Methods: Male Wistar-Han rats were administered by oral gavage a water control or doses of 4 - 6 g/kg DEG every 12 or 24 h. Animals were closely monitored in metabolic housing for 7 days in order to collect urine was collected every 12 h. Motor function tests were conducted before and after treatment. Endpoint blood and cerebrospinal fluid (CSF) samples were collected for a renal plasma biomarkers and total protein estimation, respectively. Kidney, brain, and spinal cord tissue were harvested after euthanasia for later pathology analysis.
Results: Of the 43 animals that were treated with DEG, 11 developed AKI as confirmed by increased BUN and plasma creatinine levels; AKI developed primarily in the animals dosed with 6 g/kg every 12 h. Hematoxylin and Eosin (H&E) staining of kidney cortical tissue showed significant necrosis in animals that developed AKI, as well as minor vacuolization in DEG-treated but non-AKI animals. Kidney DGA concentrations were markedly increased in animals that developed AKI, as compared to animals without AKI (which had levels similar to controls), confirming the role of DGA in the nephrotoxicity. The concentrations of DEG in the urine of all treated animals were in the same range (15-25 mg/mL) from 12–48 h, with no obvious differences between animals with and without AKI. The total protein content of CSF in animals with kidney injury was significantly higher compared to control and to DEG-treated animals without AKI. Significant decreases in forearm grip strength as well as decreases in locomotor and rearing activity were observed in animals with AKI compared to control and to DEG-treated animals without AKI.
Conclusions: DEG-treated rats exhibited decrements in forelimb function and in motor function, along with marked increases in total CSF protein, which are similar neurological characteristics that have been reported in DEG-poisoning in humans. Notably these neurological effects were observed only in animals with AKI, suggesting that kidney injury must occur before neurological symptoms are observed. These studies confirm the development of neurotoxicity in this subacute animal model of DEG exposure.

KEYWORDS diethylene glycol, neurotoxicity, nephrotoxicity

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7. QTc Prolongation in poison center exposures to CredibleMeds list of substances with "Known Risk of Torsades de Pointes"

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Table 1(#7). Demographic, clinical effect, medical outcome and treatment data for exposures substances on the Credible Meds QT Drug List.

	All cases (N = 1125)	Cases with QTc ≥500 (N = 138)	Cases with VT/VF (N = 7)	Cases with Asystole (N = 12)	Cases with Death (N = 10)
Demographics					
Male	500 (44%)	38 (27%)	2 (29%)	5 (41.7%)	5 (50%)
Age (mean)	39 (SD 17)	43 (SD 16)	41 (SD 16)	44 (SD 18)	50 (SD17)
Medical outcome					
No Effect	123 (10.9%)	0	0	0	0
Minor Effect	411 (36.5%)	13 (9.4%)	0	1 (8.3%)	0
Moderate Effect	499 (44.4%)	103 (74.1%)	0	0	0
Major Effect	81 (7.2%)	19 (13.7%)	4 (57.1%)	2 (16.7%)	0
Death	10 (0.89%)	4 (2.9%)	3 (42.9%)	9 (75%)	10 (100%)
Clinical Effects					
Asystole	12 (1.1%)	4 (2.9%)	3 (42.9%)	12 (100%)	9 (90%)
Afib/Aflutter	6 (0.53%)	1 (0.72%)	0	1 (8.3%)	1 (10%)
Bradycardia	110 (9.8%)	20 (14.4%)	1 (14.3%)	4 (33.3%)	4 (40%)
Dysrhythmia N.O.S.	20 (1.8%)	7 (5%)	2 (28.6%)	2 (16.7%)	3 (30%)
Hypotension	137 (12.2%)	33 (23.7%)	2 (28.6%)	6 (50%)	7 (70%)
PEA	6 (0.53%)	3 (2.2%)	2 (28.6%)	5 (41.7%)	5 (50%)
Tachycardia	351 (31.2%)	68 (48.9%)	2 (28.6%)	6 (50%)	4 (40%)
TdP	1 (0.089%)	1 (0.72%)	1 (14.3%)	0	0
VTach/VFib	7 (0.62%)	18 (12.9%)	7 (100%)	3 (25%)	3 (30%)
Acidosis	80 (7.1%)	18 (12.9%)	1 (14.3%)	6 (50%)	5 (50%)
Electrolyte Abnormality	142 (12.6%)	35 (25.2%)	4 (57.1%)	7 (58.3%)	6 (60%)
Therapies					
Antiarrhythmic	5 (0.44%)	4 (2.9%)	3 (42.9%)	1 (8.3%)	1 (10%)
Calcium	28 (2.5%)	10 (7.2%)	2 (28.6%)	7 (58.3%)	5 (50%)
Cardioversion	4 (0.36%)	3 (2.2%)	2 (28.6%)	1 (8.3%)	2 (20%)
CPR	18 (1.6%)	6 (4.3%)	3 (42.9%)	11 (91.7%)	9 (90%)
ECMO	2 (0.18%)	0	0	1 (8.3%)	1 (10%)
Magnesium	85 (7.6%)	81 (58.3%)	4 (57.1%)	4 (33.3%)	4 (40%)
Pacemaker	2 (0.18%)	2 (1.4%)	1 (14.3%)	1 (8.3%)	1 (10%)
Potassium	149 (13.2%)	45 (32.4%)	2 (28.6%)	3 (25%)	3 (30%)
Vasopressors	51 (4.5%)	16 (11.5%)	3 (42.9%)	10 (83.3%)	10 (100%)

SD: Standard Deviation.

Table 2(#7). Known Risk Substances Involved.

Generic Name	Total # adult HCF exposures (N = 1125)	CASES WITH NUMERICAL QTC (N = 760)	QT Prolongation (N = 351)	QTc ≥500 (N = 138)	#VT/VF (N = 7)	Asystole (N = 12)	Death (N = 10)
Amiodarone	17 (1.5%)	8 (1.1%)	6 (1.7%)	2 (1.4%)	0	0	0
Azithromycin	4 (0.36%)	1 (0.13%)	1 (0.28%)	1 (0.72%)	0	0	0
Chloroquine	1 (0.09%)	1 (0.13%)	0	0	0	0	0
Chlorpromazine	28 (2.5%)	17 (2.2%)	7 (2%)	2 (0.57%)	0	0	0
Ciprofloxacin	7 (0.62%)	6 (0.79%)	1 (0.28%)	0	0	0	0
Citalopram	324 (28.8%)	244 (32.1%)	123 (35%)	54 (38.8%)	2 (28.6%)	5 (41.7%)	4 (40%)
Clarithromycin	4 (0.36%)	1 (0.13%)	1 (0.28%)	0	0	0	0
Cocaine	289 (25.7%)	177 (23.3%)	74 (21.1%)	23 (16.5%)	1 (14.3%)	4 (33.3%)	5 (50%)
Dofetilide	4 (0.36%)	5 (0.66%)	3 (0.85%)	0	0	0	0
Donepezil	29 (2.6%)	10 (1.3%)	2 (0.57%)	0	0	0	0
Dronedarone	2 (0.18%)	1 (0.13%)	1 (0.28%)	0	0	0	0
Erythromycin	2 (0.18%)	2 (0.26%)	1 (0.28%)	0	0	0	0
Escitalopram	209 (18.6%)	154 (20.3%)	67 (19.1%)	30 (21.6%)	0	1 (8.3%)	1 (10%)
Flecainide	15 (1.3%)	14 (1.8%)	7 (2%)	5 (3.6%)	3 (42.9%)	2 (16.7%)	2 (20%)
Fluconazole	1 (0.09%)	1 (0.13%)	0	0	0	0	0
Haloperidol	55 (4.9%)	50 (6.6%)	29 (8.3%)	10 (7.2%)	0	0	0
Levofloxacin	7 (0.62%)	4 (0.53%)	3 (0.85%)	2 (1.4%)	0	0	0
Methadone	72 (6.4%)	48 (6.3%)	24 (6.8%)	10 (7.2%)	2 (28.6%)	2 (16.7%)	0
Ondansetron	35 (3.1%)	30 (3.9%)	13 (3.7%)	8 (5.8%)	0	0	0
Pimozide	1 (0.09%)	2 (0.26%)	0	0	0	0	0
Sotalol	14 (1.2%)	9 (1.2%)	4 (1.1%)	1 (0.72%)	0	0	0
Thioridazine	1 (0.09%)	1 (0.13%)	1 (0.28%)	0	0	0	0

Table 3(#7). Substances.

	Numerical QTc (N = 760)	QTc Prolongation (N = 351)	% by substance	QTc ≥500 (N = 138)	% by substance
Known Risk Substances					
Amiodarone	8 (1.1%)	6 (1.7%)	75%	2 (1.4%)	25%
Azithromycin	1 (0.13%)	1 (0.28%)	100%	1 (0.72%)	100%
Chloroquine	1 (0.13%)	0	0	0	0
Chlorpromazine	17 (2.2%)	7 (2%)	41.2%	2 (1.4%)	11.8%
Ciprofloxacin	6 (0.79%)	1 (0.28%)	16.7%	0	0
Citalopram	244 (32.1%)	123 (35%)	50.4%	54 (38.8%)	22.1%
Clarithromycin	1 (0.13%)	1 (0.28%)	100%	0	0
Cocaine	177 (23.3)	74 (21.1%)	41.8%	23 (16.5%)	13%
Dofetilide	5 (0.66%)	3 (0.85%)	60%	0	0
Donepezil	10 (1.3%)	2 (0.57%)	20%	0	0
Dronedarone	1 (0.13%)	1 (0.28%)	100%	0	0
Erythromycin	2 (0.26%)	1 (0.28%)	50%	0	0
Escitalopram	154 (20.3%)	67 (19.1%)	43.5%	30 (21.6%)	19.5%
Flecainide	14 (1.8%)	7 (2%)	50%	5 (3.6%)	35.7%
Fluconazole	1 (0.13%)	0	0	0	0
Haloperidol	50 (6.6%)	29 (8.3%)	58%	10 (7.2%)	20%
Levofloxacin	4 (0.53%)	3 (0.85%)	75%	2 (1.4%)	50%
Methadone	48 (6.3%)	24 (6.8%)	50%	10 (7.2%)	20.8%
Ondansetron	30 (3.9%)	13 (3.7%)	43.3%	8 (5.8%)	26.7%
Pimozide	2 (0.26%)	0	0	0	0
Sotalol	9 (1.2%)	4 (1.1%)	44.4%	1 (0.72%)	11.1%
Thioridazine	1 (0.13%)	1 (0.28%)	100%	0	0
Possible Risk Substances					
Aripiprazole	15 (2%)	5 (1.4%)	33.3%	2 (1.4%)	13.3%
Atomoxetine	1 (0.13%)	0	0	0	0
Buprenorphine	5 (0.66%)	0	0	0	0
Clomipramine	1 (0.13%)	1 (0.28%)	100%	1 (0.72%)	100%
Clozapine	6 (0.79%)	3 (0.85%)	50%	1 (0.72%)	16.7%
Iloperidone	1 (0.13%)	1 (0.28%)	100%	1 (0.72%)	100%
Lithium	13 (1.7%)	5 (1.4%)	38.5%	1 (0.72%)	7.7%
Memantine	5 (0.66%)	1 (0.28%)	20%	1 (0.72%)	20%
Mirtazapine	25 (3.3%)	14 (4%)	56%	9 (6.5%)	36%
Nortriptyline	1 (0.13%)	1 (0.28%)	100%	1 (0.72%)	100%
Paliperidone	2 (0.26%)	1 (0.28%)	50%	0	0
Promethazine	1 (0.13%)	1 (0.28%)	100%	0	0
Risperidone	9 (1.2%)	5 (1.4%)	55.6%	1 (0.72%)	11.1%
Tamoxifen	1 (0.13%)	1 (0.28%)	100%	1 (0.72%)	100%
Tizanidine	10 (1.3%)	3 (0.85%)	30%	2 (1.4%)	20%
Tramadol	19 (2.5%)	9 (2.6%)	47.4%	3 (2.2%)	15.8%
Venlafaxine	13 (1.7%)	6 (1.7%)	46.2%	2 (1.4%)	15.4%
Conditional Risk Substances					
Amitriptyline	18 (2.4%)	10 (2.8%)	55.6%	7 (5%)	38.9%
Cimetidine	1 (0.13%)	1 (0.28%)	100%	1 (0.72%)	100%
Diphenhydramine	36 (4.7%)	23 (6.6%)	63.9%	12 (8.6%)	33.3%
Doxepin	4 (0.53%)	1 (0.28%)	25%	1 (0.72%)	25%
Famotidine	2 (0.26%)	0	0	0	0
Fluoxetine	14 (1.8%)	8 (2.3%)	57.1%	2 (1.4%)	14.3%

(*continued*)

Table 3(#7). Continued.

	Numerical QTc (N = 760)	QTc Prolongation (N = 351)	% by substance	QTc ≥500 (N = 138)	% by substance
Fluvoxamine	1 (0.13%)	0	0	0	
Furosemide	10 (1.3%)	8 (2.3%)	80%	4 (2.9%)	40%
Galantamine	1 (0.13%)	1 (0.28%)	100%	0	0
Hydrochlorothiazide	7 (0.92%)	3 (0.85%)	42.9%	2 (1.4%)	28.6%
Hydroxyzine	32 (4.2%)	13 (3.7%)	40.6%	7 (5%)	21.9%
Metoclopramide	4 (0.53%)	3 (0.85%)	75%	1 (0.72%)	25%
Metolazone	1 (0.13%)	1 (0.28%)	100%	1 (0.72%)	100%
Olanzapine	12 (1.6%)	8 (2.3%)	66.7%	1 (0.72%)	8.3%
Omeprazole	22 (2.9%)	7 (2%)	31.8%	2 (1.4%)	9.1%
Pantoprazole	5 (0.66%)	2 (0.57%)	40%	2 (1.4%)	40%
Paroxetine	8 (1.1%)	1 (0.28%)	12.5%	1 (0.72%)	12.5%
Quetiapine	62 (8.2%)	27 (7.7%)	43.5%	11 (7.9%)	17.7%
Sertraline	24 (3.2%)	7 (2%)	29.2%	3 (2.2%)	12.5%
Trazodone	56 (7.4%)	32 (9.1%)	57.1%	18 (12.9%)	56.3%

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Background: In the setting of an acute ingestion, many drugs carry some risk of QT prolongation. QT prolongation can lead to life-threatening dysrhythmias, such as Torsades de Pointes (TdP) and death. The Credible Meds QT Drug List identifies 58 medications listed under the category of "Known Risk of Torsades de Pointes" that prolong the QT even at therapeutic dosing. This list does not address or stratify risk of TdP in the setting of acute supratherapeutic ingestion.
Objective: We sought to determine the proportion of cases exhibiting QTc prolongation, ventricular tachycardia (VT)/ventricular fibrillation (VF), TdP, and asystole in patients exposed the 58 agents listed on the Credible Meds QT Drug List with a "Known Risk of TdP" reported to our Regional Poison Center (RPC).
Methods: This was a retrospective chart review of all cases reported to our RPC from October 1, 2014 through October 1, 2019 that were treated at a health care facility and were coded as exposures to one or more of the 58 substances on the Credible Meds QT Drug List. Exposure demographics, treatments provided by healthcare facilities, clinical effects, and medical outcome for each case were characterized via descriptive statistics and logistic regression.
Results: During this 5-year period, there were 1125 health care facility exposures, of which 760 had documented QTc intervals. Overall, the average age was 39 years and 44% were male. Clinical effects, treatments, and medical outcomes are listed in Table 1. Of the 1125 cases, the most common substances were citalopram, escitalopram, and cocaine. A QTc ≥500msec was reported in 138 (18.2%) of the 760 cases with a documented QTc. Female sex (OR 2.01, 95%CI 1.35-3.03), age in years (OR 1.02, 95%CI 1.01-1.03) and number of substances ingested (OR1.10, 95%CI 1.03-1.19) were associated with an increased likelihood of a QTc >500msec, as was exposure to mirtazapine (OR 2.82, 95%CI 1.21-6.59), amitriptyline (OR 2.71, 95%CI 1.05-7.03), diphenhydramine (OR 2.37, 95%CI 1.16-4.87) and trazodone (OR 2.24, 95%CI 1.24-4.05). Flecainide was present in the most VT/VF cases (42.9%). Flecainide (OR 11.1, 95%CI 2.22-55.8) and methadone (OR 7.10, 95%CI 2.10-24.0) were associated with increased risk of life-threatening dysrhythmia (a composite of TdP, VT/VF, and asystole, of which there were 13 total cases). Limitations include retrospective design, voluntary reporting to one poison center, lack of exposure confirmation, lack of EKGs available for QTc verification, and inability of regression analysis to establish causality.
Conclusion: In our review of 5 years of data involving exposures to medications on the Credible Meds list with "Known Risk of TdP" QTc prolongation was common, however dysrhythmias were rare. The most likely substances to prolong the QTc were mirtazapine, amitriptyline, diphenhydramine, and trazodone. Flecainide and methadone had the highest associated risk of life-threatening dysrhythmias. Next steps will be to expand the data set by regionality, time, and exposure substances.

KEYWORDS QTc Prolongation, Torsades de Pointes, arrhythmia

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8. Trends and Risk Markers of Student Hazardous Drinking – A Comparative Analysis Using Longitudinally Linked Datasets in a U.S. Public University

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Objectives: Alcohol misuse continues to be a significant health problem among college students resulting in numerous adverse health consequences. While self-report surveys on a sample of students using the binge drinking threshold is the primary source of data to identify at risk drinkers and monitor the burden of student alcohol misuse. Using a large, longitudinally linked cohort study, we compared the trends in incidence and risk markers of student alcohol intoxication associated with Emergency Department (ED) visits and alcohol-related incidents in a U.S. university.
Methods: Our study population consisted of students aged 16-49 enrolled in a U.S. public university in 7 (2009/10 - 2015/16) years. We used an open cohort design, which allows students to enter the study population throughout the study period rather than on a fix entry date. Student enrollment data were linked to subsequent ED visits with alcohol intoxication identified using ICD codes and alcohol-related incidents reported to campus authorities within one year following the index annual enrollment. Incidence rate per 10,000 person-years was calculated, and annual trends were analyzed. Multivariate Cox proportional hazard regression models were performed to provide hazard ratios (HRs) and 95% confidence intervals (CI) for the relationships between student characteristics and each outcome (first ED visit with alcohol intoxication and first incident related to alcohol recorded). The temporal trend in the incidence rate of each outcome was evaluated using Poisson regression.
Results: The study cohort consisted of 204,423 students aged 16-49. Over the 7 year study period, 1041 students had at least 1 ED visit with alcohol intoxication, and 5,359 students had at least 1 alcohol-related incident within one year after the index enrollment. The overall incidence rate was 59/10,000 person-years and

311/10,000 person-years, respectively. Both incidences increased linearly in the first 6 years then declined in the last year. In multivariable Cox proportional hazard regression models, risk markers associated with ED visits with alcohol intoxication were: males (versus females): 1.34 (1.18, 1.51); below 20 years of age (versus 25-29 years): 3.22 (1.98-5.26); Hispanic (versus Asian) students: 1.42 (1.06, 1.92); parental tax dependency: 1.65 (1.30-2.09); Greek life member: 1.87 (1.64-2.14) and undergraduate (versus graduate) students: 2.51 (1.82, 3.45). Alcohol-related incidents shared the aforementioned common risk markers. In addition, past year alcohol-related clinic visit: HR =2.13 (1.27-3.56), past year clinic visit for injury: HR =1.61 (1.26-2.05), and having been diagnosed with a depressive disorder: HR =1.49 (1.23-2.32) were also statistically significant risk markers for such incidents. Being student athletes was associated with lower risk of ED visits with alcohol intoxication, whereas transfer students were at lower risk for alcohol-related incidents.

Conclusion: Building on a large, well-defined, and longitudinal student cohort, this study was able to study the incidence and risk markers of student risky drinking ascertained from 2 independent datasets in a major public university. Linking student enrollment data with subsequent hazardous drinking events can help not only more fully capture and better monitor student hazardous drinking behavior but also identify high risk students who can subsequently be targeted in intervention efforts.

KEYWORDS Alcohol Intoxication, Longitudinal Data Linkage, Risk Markers

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9. Reduction in analytically confirmed exposures to new psychoactive substances in patients attending emergency departments with severe clinical toxicity in the United Kingdom, 2015-2019

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Objective: The United Kingdom (UK) Identification Of Novel psychoActive substances (IONA) study has been recording clinical features and analytical findings in patients presenting with severe toxicity after suspected novel psychoactive substance (NPS) use. Here we present trends in substances identified from March 2015 to December 2019

Methods: With ethical approval, patients (≥16y) presenting to 30 participating hospitals (in England, Scotland and Wales) with severe acute toxicity (according to specific definitions) after suspected NPS exposure were recruited with informed consent. Those lacking capacity were included with the agreement of an appropriate relative/representative but were able to confirm/refuse their own consent on recovery. Clinical features were recorded using a structured data collection sheet. Blood and urine samples were collected and analysed by liquid chromatography-tandem mass spectrometry. Substances identified were compared by year.

Results: Clinical and analytical data were available for 579 study participants. Their median age was 33 years (range 16-75 years), 457 (79%) were male, 91 (15.7%) were intubated and ventilated and 10 (1.7%) died. The highest numbers of patients were included in 2016 and 2017, after most research sites had been initiated, but recruitment subsequently fell because of reduced presentations with severe NPS toxicity. Multiple drug exposure was common with conventional drugs of misuse identified in samples from 488 (84.3%). The most common NPS groups identified were Synthetic Cannabinoid Receptor Agonists (SCRAs), cathinones and NBOMe compounds. The most common SCRAs identified were 5F-ADB (5F-MDMB PINACA), FUB-AMB (AMB-FUBINACA) and MDMB-CHMICA (Table). The proportion of patients where an NPS was detected in at least one sample has fallen since 2016, contributed to by reductions for SCRAs and NBOMe compounds in particular (Table). Temporal changes differed between the most commonly identified SCRAs, with reductions seen for MDMB-CHMICA, increases followed by earlier reductions for 5F-NPB-22 and 5F-PB-22, and increases followed by later reductions for 5F-ADB and FUB-AMB. During 2019, increased exposures were observed involving the SCRAs 4F-MDMB PICA, FUB PB-22 (QUFUBIC) and 4F-MDMB BUTINACA (4F-MDMB BINACA).

Conclusions: NPS, including SCRA and NBOMe compounds, have been less commonly identified in this UK patient cohort since

Table(#9). Changes with time in numbers (%) of patients with at least one positive sample for commonly identified new psychoactive substances (NPS) and conventional drugs of misuse, March 2015-December 2019.

	2015	2016	2017	2018	2019	TOTAL
n	56	177	165	94	87	579
Any NPS	41 (73.2%)	117 (66.1%)	74 (44.8%)	40 (42.6%)	19 (21.8%)	291 (50.3%)
Any conventional	44 (78.6%)	143 (80.8%)	147 (89.1%)	80 (85.1%)	74 (85.1%)	488 (84.3)
SCRA*	24 (42.9%)	78 (44.1%)	45 (27.3%)	28 (29.8%)	11 (12.6%)	186 (32.1)
Cathinone	4 (7.1%)	19 (10.7%)	10 (6.1%)	7(7.4%)	3 (3.4%)	43 (7.4%
NBOMe compunds	5 (8.9%)	6 (3.4%)	10 (6.1%)	1 (1.1%)	1 (1.1%)	23 (4.0%)
Selected individual SCRA*						
5F-ADB	0 (-)	43 (24.3%)	25 (15.2%)	15 (16.0%)	2 (2.3%)	85 (14.7%)
FUB-AMB	3 (5.4%)	21 (11.9%)	27 (16.4%)	5 (5.3%)	0 (-)	56 (9.7%)
MDMB-CHMICA	16 (28.6%)	21 (11.9%)	12 (7.3%)	8 (8.5%)	0 (-)	57 (9.8%)
5F-NPB-22	1 (1.8%)	22 (12.4%)	3 (1.8%)	1 (1.1%)	0 (-)	27 (4.7%)
5F-PB-22	3 (5.4%)	21 (11.9%)	0 (-)	1 (1.1%)	0 (-)	25 (4.3%)
5F-MDMB PICA	0 (-)	0 (-)	0 (-)	1 (1.1%)	8 (9.2%)	9 (1.6%)
FUB PB-22	1 (1.7%)	0 (-)	0 (-)	0 (-)	3 (3.4%)	4 (0.7%)
4F-MDMB BUTINACA	0 (-)	0 (-)	0 (-)	0 (-)	4 (4.6%)	4 (0.7%)

*Synthetic cannabinoid receptor agonists.

2016. One potential reason is enactment of legislation directed at controlling NPS in that year, including the Psychoactive Substances Act in May 2016 and control of 3rd generation synthetic cannabinoids in December 2016. NPS continue to be involved in a minority of episodes and new compounds continue to emerge, so continuing vigilance remains important.

KEYWORDS New psychoactive subtsances, Synthetic cannabinoid receptor agonists, Drug misuse

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10. Reports of e-Cigarette Exposures and Acute Pulmonary Illness to NPDS Implicate New Marijuana Substances

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Objectives: Beginning June 2019, Centers for Disease Control and Prevention (CDC) reported e-Cigarette (eCig) exposure and associated pulmonary illness (eCAPI) including deaths nationwide. The National Poison Data System (NPDS) collects data in near real-time from the 55 US poison centers. We examined all NPDS eCAPI cases through 31-Mar-2020 for substances, treatments, clinical effects, and medical outcome. We also examined all NPDS eCig exposures for earlier reports of eCAPI.
Methods: We extracted all exposures coded to IBM/Micromedex eCAPI emergent product code 7322608 and all closed, human, single substance exposures to any of 6 NPDS eCig generic codes (GCs) for 1 January 2001 through 31 Mar 2020. We developed an eCAPI score (ECS) based on the eCAPI clinical effects (CEs) and treatments weighted by the % of cases for each was reported. We used ECS to search for eCAPI candidate cases from 2001 to 31-Mar-2020. We examined substance association, patient characteristics, and exposure details on the severity of eCAPI via multivariate analyses. Descriptive statistics for case characteristics change over time via linear and quadratic regression, and multivariate analyses were via (SAS JMP, 12.0.1).
Results: Through 31-Mar-2020, PCs reported 822 eCAPI cases. The eCAPI profile (Figure 1) over time 15-Aug - 12-Sep-2019 for 196 cases was described by exponential increase: Doubling Time [95% CI] of 8.31 [8.24, 8.37] days. Age: median [min, max] was 22 [1, 77] years, Male: 64.9%, Chronic 50.3%. Medical Outcomes included Death 1.95%, Major 17.9%, and Moderate 57.1%. Table 1 shows the count for the most frequently reported CEs and treatments. Multivariate analysis of the first 107 eCAPI cases as of 14 Sep 2019 implicated Marijuana Products ($p = 0.0007$). Similar analyses of all 822 cases confirmed Marijuana ($p < 0.00001$), Chronicity ($p = 0.00031$), and Age ($p = 0.0152$) contributing to CE score. Of the 23,252 eCig exposures (23,463 - 211 eCAPI cases), 133 (0.567%) had an ECS > median and 370 (1.57%) scored >25%tile of eCAPI cases (eCAPI-25+). Figure 2 shows the time course of these 370 eCig cases showing the distinct increase (inflection) ~ 16-Aug-2019.
Conclusions: The first 107 NPDS eCAPI case scores were related to marijuana product exposure. This was confirmed via similar analyses for all 822 cases. The numbers of eCAPI-25+ cases show a distinct increase in Aug-2019, suggesting eCAPI was a newly emerging phenomenon among eCig users. When CDC reported vitamin E acetate oil as the culprit, officials described difficulties in collecting the eCAPI cases – they "had to write code for every single state to transfer the information into the CDC system" and "had to create a separate, parallel system exclusively using state department of health (DOH) data-to collect the information, which took several weeks". CDC's rationale was state DOH cases could be tracked back and investigated. The timeliness of NPDS trumps this arduous process similar to onerous COVID-19 contact traces. This event should encourage public health agencies to utilize NPDS, especially in data collection.

KEYWORDS eCigarette exposure, Pulmonary Illness, Marijuana vaping products

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11. Multiclass Classification Machine Learning Identification of Common Poisonings

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Background: Machine learning is a novel and powerful branch of artificial intelligence which has yet to make significant impacts in the field of clinical toxicology despite its demonstrated applications in emergency medicine and other clinical specialties. Multiclass classification, a machine learning approach that seeks to determine to which of multiple "classes" a case might belong based on data features, is directly applicable to the problem of differential diagnosis in clinical toxicology. Poisoning case data from local and national level electronic record systems may offer the necessary volume of data to develop multiclass classification machine learning algorithms that can accurately identify the causative agent of poisonings based on clinical presentation. Accurate and validated machine learning algorithms could serve as the foundation of useful clinical decision support tools.
Methods: Human exposure cases reported to the National Poison Data System (NPDS) from a single regional Poison Control

Table 1(#10). Counts of the 15 most frequently reported Clinical Effects and 11 most frequently reported Therapies reported for the 822 eCAPI reports.

Count	% of 822 cases	Clinical Effect	Count	% of 822 cases	Treatment
446	54.3	Dyspnea	385	46.8	Antibiotics
393	47.8	X-ray findings(+)	363	44.2	Steroids
362	44.0	Cough/choke	338	41.1	Oxygen
253	30.8	Fever/hyperthermia	151	18.4	Fluids, IV
247	30.0	Other - Respiratory	146	17.8	Bronchodilators
181	22.0	Vomiting	137	16.7	Other
175	21.3	Nausea	100	12.2	Intubation
159	19.3	Chest pain (incl. noncardiac)	97	11.8	Ventilator
130	15.8	Pneumonitis	55	6.7	Sedation (other)
120	14.6	Tachycardia	41	5.0	Benzodiazepines
104	12.7	Diarrhea	40	4.9	Ventilation, Non-invasive (CPAP, BiPAP)
101	12.3	Hyperventilation/tachypnea			
99	12.0	Respiratory depression			

Table 1(#11). Comparison of 5-fold Cross-validation Accuracy by Algorithm/ Model Type.

Algorithm	BNB	SVM	DT	RF	XGB	Mean
Mean Accuracy	65.04%	63.97%	51.43%	63.10%	65.92%	61.89%
Standard Deviation	3.96%	4.03%	3.94%	4.23%	3.73%	

Table 2(#11). Comparison of Model Accuracy by Toxicant Class.

Toxicant Class	n	BNB	SVM	DT	RF	XGB	Mean
Acetaminophen	39 (8%)	27 (69%)	27 (69%)	19 (49%)	22 (56%)	26 (67%)	24.2 (62%)
Anticholinergics	53 (10%)	30 (57%)	31 (58%)	29 (55%)	29 (55%)	28 (53%)	29.4 (55%)
Benzodiazepines	61 (12%)	50 (82%)	41 (67%)	50 (82%)	36 (59%)	40 (66%)	43.4 (71%)
Bupropion	28 (5%)	10 (36%)	10 (36%)	4 (14%)	7 (25%)	13 (46%)	8.8 (31%)
Carbon Monoxide	31 (6%)	29 (94%)	31 (100%)	25 (81%)	31 (100%)	31 (100%)	29.4 (95%)
Clonidine	28 (5%)	15 (54%)	16 (57%)	18 (64%)	15 (54%)	19 (68%)	16.6 (59%)
Ethanol	43 (8%)	17 (40%)	19 (44%)	23 (53%)	14 (33%)	20 (47%)	18.6 (43%)
Opioids	141 (27%)	112 (79%)	115 (82%)	84 (60%)	127 (90%)	119 (84%)	111.4 (79%)
Selective Serotonin Reuptake Inhibitors	61 (12%)	37 (61%)	34 (56%)	0 (0%)	31 (51%)	31 (51%)	26.6 (44%)
Sympathomimetics	30 (6%)	15 (50%)	14 (47%)	8 (27%)	12 (40%)	12 (40%)	12.2 (41%)
Total Correctly Classified	515	342 (66%)	338 (66%)	260 (50%)	324 (63%)	339 (66%)	320.6 (62%)

Center (PCC) in calendar years 2014 through 2018 with a documented exposure to one of ten common toxicant classes (acetaminophen, anticholinergics, benzodiazepines, bupropion, carbon monoxide, clonidine, ethanol, opioids, selective serotonin reuptake inhibitors (SSRIs), and sympathomimetics), and resulting in at least moderate clinical effects were extracted and converted into a format interpretable by machine learning algorithms. Models were generated using the SciKit-Learn package in the Python programming language, using several multiclass classification algorithms including Bayesian Naïve Bayes (BNB), Support Vector Machines (SVM), Decision Trees (DT), Random Forests of Trees (RF), and Gradient Boosted Decision Trees (XGB). Data utilized by algorithms to generate models included reason for exposure, route of exposure, and presence or absence of NPDS-specified clinical features (symptoms, vital signs abnormalities, etc.). Five-fold cross validation was used to compare accuracy between algorithms. A standardized 75%/25% train-test split was used to compare algorithm accuracy by toxicant class, defined as correctly classified cases out of total cases for each class.

Results: 2057 cases were identified meeting the above criteria. Cross-validation experiments revealed mean overall accuracy in toxicant class identification of 61.89% across all algorithms, varying from 51.43% for DT based models to 65.92% for XGB models (Table 1). Within a standardized train/test split, accuracy varied by both toxicant class and algorithm type (Table 2). Relative to other agents tested, carbon monoxide, opioid, and benzodiazepine exposures appeared to be easier for algorithms to identify (mean accuracy 95%, 79%, and 71% respectively), while bupropion, sympathomimetics, ethanol, and SSRIs were more challenging to identify (mean accuracy 31%, 41%, 43%, and 44% respectively). DT models appeared less accurate than other algorithm types (50% vs 63-66%).

Conclusions: Machine learning algorithms are able to retrospectively identify the causative toxicant class in several common exposures, though accuracy of identification varies by algorithm type and toxicant class. In order to reach an end goal of clinical usefulness, further work is needed to refine accuracy of models, expand the number of included toxicant classes, and prospectively validate accuracy in the clinical environment.

KEYWORDS Machine learning, Differential diagnosis, artificial intelligence

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12. Identification of the Mechanisms of Bupropion-Induced Neuro- and Cardiovascular Toxicity

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Background: Bupropion, a norepinephrine/dopamine-reuptake-inhibitor, is commonly abused and often used in suicide attempts. While seizures with toxicity are well-known, cardiovascular effects are less infamous and can include cardiac conduction abnormalities. These rarely present as unstable tachydysrhythmias, but most ominous is refractory cardiogenic shock.

Although excessive norepinephrine likely causes some effects, the mechanisms of more the severe consequences are undetermined. Because both seizures and cardiac conduction changes may result from ion channel interactions, further investigations on channel effects by bupropion are needed.

Bupropion is commonly abused and results in significant morbidity and mortality. Determining the mechanisms of toxicity and developing safe and effective treatments are incredibly important.

Methods: This is a randomized, unblinded, placebo-controlled study on Sprague-Dawley rats. Subjects' femoral veins were cannulated and tunneled to an access port. Subcutaneous EEG and ECG leads were placed, and 200 mg/kg bupropion was administered intraperitoneally. Subjects were monitored for seizure activity, upon which they were given one of four intravenous treatments: normal saline (placebo, 1.5 mL/hr), sodium bicarbonate (1.5 mEq/kg IV bolus, repeated until pH $>$7.45), ezogabine (10 mg/kg IV bolus), or NS1643 (1.2 mg/kg/min). Ezogabine is an anticonvulsant which activates neuronal Kv7 channels. NS1643 activates human cardiac *Ether-à-gogo* related gene (hERG) and neuronal Kv7 channels. The primary outcome is termination of seizures (5 minutes without seizure). Secondary outcomes include mortality, QRS and QTc intervals, and correlation between seizures and QRS/QTc changes.

Results: Forty-six subjects were included in the final analysis (15 placebo, 7 sodium bicarbonate, 11 ezogabine, 13 NS1643). In general, the probability of achieving seizure termination without dying was proportional to time elapsed, but no treatment was more efficacious compared to placebo (Figure 1). The ezogabine group demonstrated a statistically-significant higher hazard ratio of death compared to placebo (HR 14.27). The probability of death at 5 minutes was 0.53 ($p = 0.01$) in the ezogabine group, compared to 0.05-0.13 in the other 3 groups (Figure 2).

No differences were seen in QRS duration from baseline to seizure onset, or from seizure onset to antidote administration in any group. QTc increased after bupropion administration in all four treatment groups. The QTc continued to increase in the placebo group through 2 minutes after treatment, not in other groups. No other differences were found in measures of cardiotoxicity (QRS duration, QTc, deviation between QRS and QTc, and heart rate) compared to placebo.

Comparison of seizure termination and cardiotoxicity was not conducted owing lack of statistical significance.

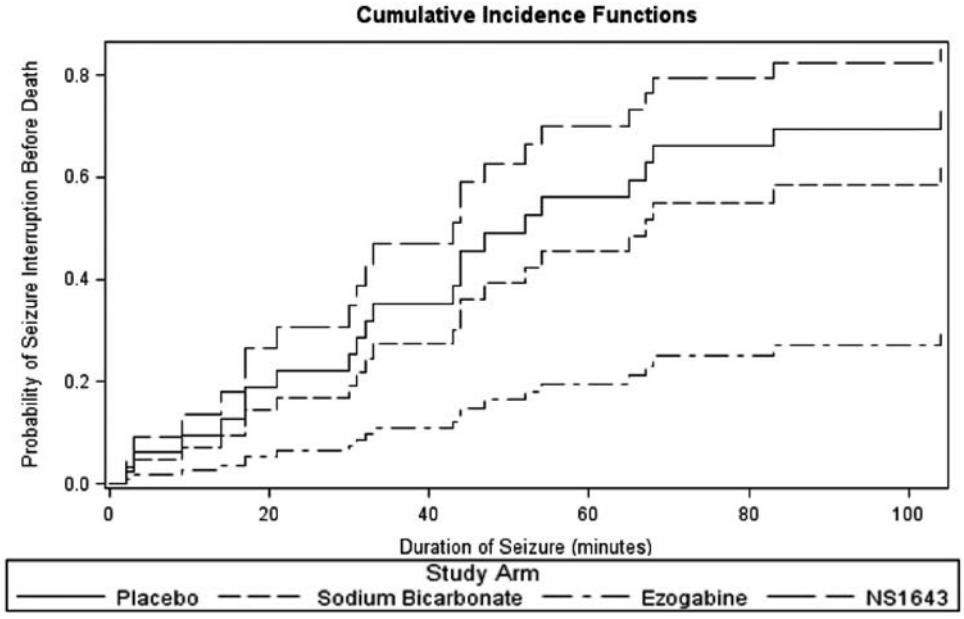

Figure 1(#12). Plot of cumulative incidence function by study arm – **Probability of seizure interruption** before death.

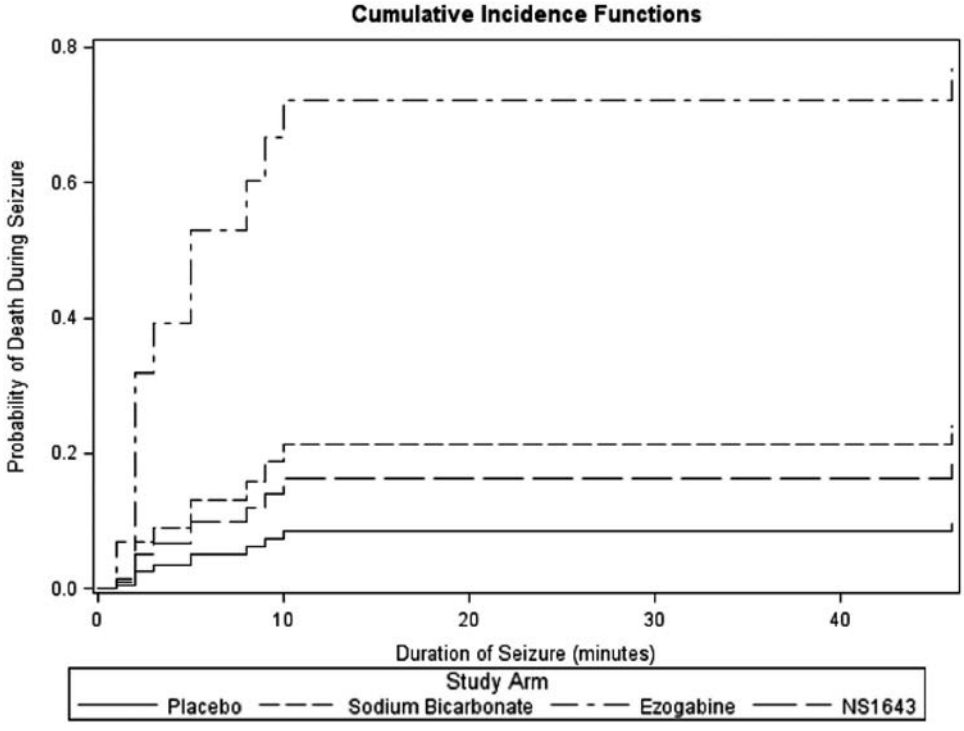

Figure 2(#12). Plot of cumulative incidence function by study arm – **Probability of death** before seizure interruption.

Conclusions: We were unable to determine the mechanisms of bupropion-induced neuro and cardiac toxicity. Seizures occurred very early after overdose, correlating with human experience. Study treatments were ineffective in terminating seizures compared to placebo. Ezogabine was clearly lethal. Bupropion increased QTc quickly, but not QRS. This supports recent experiments demonstrating bupropion noninteraction with fast sodium channels.

Limitations of our study include small group size, confounding by the lethality of IV ezogabine, and the inability to generalize these results to humans.

This study was graciously funded by the AACT Junior Investigator Research Grant and by the HealthPartners Institute Discovery Grant.

KEYWORDS bupropion, cardiotoxicity, seizure

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Table 1(#12). Comparison of cardiotoxicity within study groups – Baseline to seizure onset and seizure onset to antidote.

Table 3.1 Difference in Cardiotoxicity Measurements

QRS	Baseline to Onset	p-value*	Onset to Antidote	p-value*
Placebo	0.004 (-0.001,0.008)	0.059	−0.002 (-0.006, 0.002)	0.340
Sodium Bicarbonate	0.006 (-0.001, 0.012)	0.063	0.000 (-0.003, 0.002)	0.664
Ezogabine	0.001 (-0.005, 0.007)	0.616	0.004 (-0.001, 0.009)	0.109
NS1643	−0.001 (-0.006, 0.005)	0.751	0.002 (-0.001, 0.005)	0.134
QTc				
Placebo	0.043 (0.015, 0.071)	0.007**	0.020 (0.003, 0.037)	0.024**
Sodium Bicarbonate	0.072 (0.008, 0.135)	0.037**	−0.013 (-0.142, 0.116)	0.766
Ezogabine	0.042 (0.026, 0.057)	0.001**	0.038 (-0.002, 0.078)	0.059
NS1643	0.039 (0.010, 0.068)	0.013**	0.008 (-0.013, 0.028)	0.414
Deviation between QRS and QTc				
Placebo	0.039 (0.012, 0.066)	0.009**	0.022 (0.007, 0.038)	0.010**
Sodium Bicarbonate	0.066 (0.009, 0.124)	0.035**	−0.013 (-0.142, 0.116)	0.771
Ezogabine	0.040 (0.025, 0.055)	0.001**	0.034 (-0.005, 0.073)	0.082
NS1643	0.040 (0.01, 0.070)	0.014**	0.006 (-0.013, 0.025)	0.514
Heart Rate				
Placebo	−16.6 (-43.6, 10.3)	0.196	−8.5875 (-17.7, 0.5)	0.062
Sodium Bicarbonate	−71.8 (-172.5, 29.1)	0.108	−29.2584 (-107, 48.5)	0.317
Ezogabine	2.2 (-15.0, 19.4)	0.779	−59.2201 (-100.3, -18.2)	0.009
NS1643	−14.8 (-36.7, 7.0)	0.159	4.9653 (-11.9, 21.8)	0.522

* As determined by a one sample t-test.
** Significant difference in mean measurements (p-value <0.05).

13. Poison center consultation is associated with reduced hospital length of stay and charges

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Background: The impact of Poison Centers (PCs) on quality of inpatient care is often intangible and not easily quantified. Value measures are increasingly relevant as competition for healthcare dollars intensifies. But endpoints can be elusive - PCs must continue to demonstrate quality and value in our evolving economic and medical environments.
Hospital length of stay (LOS) is an accepted metric that encompasses both cost and efficiency in healthcare facilities (HCFs). Reduced LOS may reflect "streamlined" care, at lower cost and greater efficiency. But reduced LOS may translate into reduced revenue opportunity for the treating HCF. Premature discharge from a HCF may have negative medical and economic consequences. Neither of these scenarios is popular in today's healthcare market.
Objective: Determine the impact of poison center consultation on hospital LOS and charges for poisoned or potentially poisoned hospital patients in one state.

Table (#13). Results.

	PC Case	No PC Case	
	Median (IQR)	Median (IQR)	p-value
LOS (days) for age ≤ 12 yrs	1.0 (1.0, 2.0) n = 847	2.0 (1.0, 5.0) n = 1873	<0.00001
LOS (days) for age 13–18 yrs	1.0 (1.0, 2.0) n = 2373	2.0 (1.0, 5.0) n = 3931	<0.00001
LOS (days) for age >18 yrs	2.0 (1.0, 4.0) n = 8224	3.0 (2.0, 4.0) n = 109,976	<0.00001
Charges ($) for age ≤ 12 yrs	7,258 (4884,10893) n = 847	16,727 (8463,34661) n = 1873	<0.00001
Charges ($) for age 13–18 yrs	9,053 (6220,13427) n = 2373	9,396 (6103,16507) n = 3930	<0.00075
Charges ($) for age >18 yrs.	12,042 (7941,19394) n = 8224	11,169 (6565,20248) n = 109,976	<0.00001

Methods: HCFs within the statewide catchment of a single PC routinely report all patient billing and discharge coding data to a state Hospital Association (HA) database. Cases tabulated by the HA between 01/01/2010 and 12/31/2017 were directly matched against those within the PC case database. Included cases were hospitalized under an ICD 9 or 10 code for poisoning. Exclusion criteria (psychiatric or rehab admissions, medical complications noted by certain ICD9 and 10 codes) were used to ensure that the only cases included were for those hospitalized primarily for poisoning. "PC Cases" were identified in both the PC and the HA databases during a specific hospitalization. "No PC Cases" were identified only in the HA records (i.e. the PC was not consulted). Negative binomial regression and Mann-Whitney U test were used to compare LOS and charges between the groups, respectively. Medians and interquartile range (IQR) are reported. Payor status and mortality was also documented and tracked.
Results: See table. Government payors covered 59% of hospitalizations, while 3rd party insurers covered 30%. Charges were not significantly different based upon insurance status. There was no significant difference in mortality between the groups.
Conclusion: This study was designed to characterize the relationship of one regional PC's involvement in the care of poisoned patients on hospital LOS and charges over an 8-year period while excluding potentially confounding alternate diagnoses. Significantly improved median hospital lengths of stay were demonstrated in the PC Case group in all age groups specified. Reduced median charges were also seen in children and adolescents.

KEYWORDS length of stay, charges, poison center
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14. Prevalence of Non-Medical Use of Over-the-Counter Medications by Healthcare Providers

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Background/Objectives: Substance misuse and abuse among healthcare providers have been reported to have a higher rate of drug misuse and addiction than the general population. The majority of substance use research focuses on prescription and illicit drug use; however, misuse of other drug products also poses a concern. Over the counter (OTC) drugs are often taken in a way inconsistent with the drug labeling. The objective of this study was to describe the prevalence and reasons for non-medical use of OTC medications among healthcare providers.
Methods: The Survey of Non-Medical Use of Prescription Drugs Program is a semiannual online panel-based general population survey of adults in the United States which includes questions about both prescription and over the counter drugs. The drugs included in this analysis were OTC acetaminophen, aspirin, dextromethorphan, diphenhydramine, ibuprofen, loperamide, naproxen, and other non-specified OTC medications. Prevalence of non-medical use of OTC medications was estimated from the 3rd quarter 2019 survey. Non-medical use (NMU) was defined as use in a way other than what was stated on the label or directed by a healthcare provider. Percentages were weighted to create nationally representative estimates. Reasons for NMU were compared using Rao-Scott chi-square tests; p-values were adjusted for multiple comparisons using the Holm correction.
Results: Healthcare providers comprised an estimated 4.9% of the adult population in the United States, representing 12,450,537 individuals. OTC medications were widely used in the past 12 months by both healthcare providers and non-healthcare providers (86.7% and 87.8%, respectively; Table 1). Among those who had used OTC medications in the last 12 months, an estimated 24.7% of healthcare providers and 19.4% of non-healthcare providers non-medically used in the last 12 months. The OTC drugs with the highest percentage of NMU out of last 12 month use were aspirin (19.4% for healthcare providers; 14.1% for non-healthcare providers), ibuprofen (19.3%; 16.2%) and acetaminophen (14.0%; 12.0%).
Among those who used an OTC medication in the last 12 months, a significantly greater percentage of healthcare providers non-medically used to hurt themselves or end their life (3.3% vs 0.6%; $p < 0.0001$), to come down from a high or another drug (3.2% vs 0.6%; $p < 0.0001$), for enjoyment or to get high (3.2% vs 0.9%; $p < 0.0001$), to prevent or treat withdrawal symptoms (3.8% vs 1.6%; $p < 0.0001$), or to relax, reduce stress, or sleep (10.0% vs. 6.3%; $p < 0.0001$; Table 2).
Conclusions: Healthcare providers were more likely to NMU OTC medications than non-healthcare providers, and they are more likely to NMU for high risk reasons. Especially concerning are the proportions of healthcare providers who NMU to hurt themselves, get high, or come down from a high.

Table 1(#14). Prevalence of use and non-medical use of OTC medications by healthcare provider status.

	Healthcare Provider Prevalence (95% CI)	Not a Healthcare Provider Prevalence (95% CI)
Past 12 month use of any OTC drug	86.7% (84.9%, 88.6%)	87.8% (87.4%, 88.3%)
Past 12 month NMU of any OTC drug as a percentage of past 12 month use	24.7% (22.2%, 27.3%)	19.4% (18.9%, 20.0%)

KEYWORDS Over the counter, Non-medical use, Healthcare providers

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15. Addiction Consultation and Medication-Assisted Treatment Hotline Support through the Poison Center

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Background: As the growing need for addiction consultation and care continues, delivery methods in an individual institution may include establishing a 24/7 physician on-call schedule. This expectation poses significant manpower limitations for a newly developed service. On a larger scale, the increased need for prescribing of medication-assisted treatment such as buprenorphine, has exceeded the number of prescribers with sufficient expertise.
Methods: Through the NJ Poison Information and Education System (NJPIES), we established 2 separate hotlines to assist with the development of the addiction medicine (AM) service at the institution, as well as to support a statewide MAT Provider hotline to connect healthcare providers with addiction medicine physicians.
Results: From September 2019-March 2020, the AM service at our institution directed callers from the hospital to a direct line unique to NJPIES, through flyers and email advertisement to the medical staff. Specialists in Poison Information obtained the information about the patient including demographics, reason for consultation, and provided preliminary guidance on patient management while the care team awaited in-person addiction consultation. The PC communicated case information to the AM team through a secure email system., including preliminary guidance on managing withdrawal. Following the encounter, the addiction physician contacted the PC to provide case resolution. The PC fielded approximately 41 calls/month, with peak volume during daytime hours. Separately, NJPIES established a workflow to support a statewide MAT Provider hotline grant, including a separate phone line, answered "NJ MAT provider hotline", to connect healthcare providers throughout the state with addiction specialists to guide prescribing and care. From August 2019 until May 2020, the MAT provider line answered 34 requests, with increasing call frequency except during the COVID19 surge in March 2020. Calls primarily involved guidance for buprenorphine therapy.

Table 2(#14). Reasons for non-medical use of any over the counter drug in the last 12 months by healthcare provider status.

NMU Reason	Healthcare Provider Percentage of last 12 month use (95% CI)	Not a Healthcare Provider Percentage of last 12 month use (95% CI)	p-value[a]
To treat a medical condition or symptom	15.1% (13.0%, 17.2%)	12.9% (12.4%, 13.4%)	0.0731
For enjoyment or to get high	3.2% (2.4%, 4.0%)	0.9% (0.8%, 1.1%)	<.0001
To relax, reduce stress, or sleep	10.0% (8.3%, 11.8%)	6.3% (6.0%, 6.7%)	<.0001
To come down from a high or another drug	3.2% (2.4%, 4.0%)	0.6% (0.5%, 0.7%)	<.0001
To prevent or treat withdrawal symptoms	3.8% (2.8%, 4.7%)	1.6% (1.5%, 1.8%)	<.0001
To hurt yourself or end your life	3.3% (2.4%, 4.1%)	0.6% (0.5%, 0.7%)	<.0001
For another reason	4.3% (3.1%, 5.6%)	4.3% (4.1%, 4.6%)	0.9827

[a]Adjusted for multiple comparisons using Holm correction.

Discussion: These 2 hotline services through the NJ Poison Control Center helped to expand addiction services both in our institution as well as statewide. The AM consultation service transitioned out of using the PCC as volume and support for the service grew. The MAT provider hotline continues to grow.
Conclusion: The Poison Center, as an established 24/7 hotline staffed with healthcare professionals, can provide clinical and infrastructure support to expand addiction consultation services at both an institutional and a broader statewide effort.

KEYWORDS Addiction, Medication-Assisted Treatment, Poison Control Centers
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16. Postmarket Experience with Crotalidae Immune F(ab')2 Compared with Crotalidae Polyvalent Immune Fab in Rattlesnake Envenomations Reported to a Regional Poison Center in 2019

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Background: There are now 2 FDA approved antivenoms available for rattlesnake envenomations in the United States: the equine derived F(ab')2 product sold under the brand name Anavip and the ovine derived Fab product sold under the brand name CroFab. There is limited data comparing clinical outcomes between these products.
Objective: To compare the clinical characteristics of patients treated with F(ab')2 vs Fab antivenom in rattlesnake envenomations reported to a regional poison center (RPC) during 2019.
Methods: This was a retrospective observational chart review of all human rattlesnake envenomations requiring antivenom reported to one RPC in 2019. Patients were grouped as receiving F(ab')2, Fab, or a combination of both. Baseline characteristics included demographics, time between envenomation and antivenom, an abbreviated snakebite severity score (ASSS), and presence of coagulopathy at presentation. Primary outcomes included the total number of antivenom vials administered and the administration of additional loading doses. For patients with a complete 2 week post-discharge follow-up, the occurrence of late coagulopathy was also analyzed. Secondary outcomes included antivenom-associated adverse reactions.
Results: In 2019 the RPC managed a total of 123 patients requiring antivenom. Of these, 57 (46.3%) received Fab, 53 (43.1%) received F(ab')2, and 13 (10.6%) received a combination. Those receiving F(ab')2 were younger, with an average age of 40.8 (± 25.0) years versus 51.3 (± 19.9) years, ($p = 0.0161$). Baseline demographics including time between envenomation and antivenom administration, ASSS, and coagulopathy at presentation were otherwise similar. Patients treated with F(ab')2 received a similar total number of vials [16.0 (± 6.1) vs 14.5 (± 5.4), $p = 0.189$] but more frequently received additional loading doses [31 (58.5%) vs 22 (38.6%), $p = 0.0051$]. In patients with complete outpatient follow-up, fewer patients treated with F(ab')2 developed late coagulopathy [5 (11.1%) vs 22 (48.9%), $p = 0.0004$]. Adverse events were generally mild and uncommon with no difference in frequency between F(ab')2 and Fab' groups [3 vs 5, $p = 0.6557$].
Conclusions: We found no indications of a clinically significant difference in the baseline demographics, characteristics, or severity of envenomation between patients receiving F(ab')2 and Fab antivenom. Patients receiving F(ab')2 antivenom were more likely to be given an additional loading dose but less likely to develop late coagulopathy. Adverse events were uncommon and generally mild. These findings are consistent with data from previous clinical trials. This study's primary limitation is the use of retrospective poison center data.

KEYWORDS Rattlesnake, Antivenom, Toxinology
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17. Gabapentin Abuse and Misuse Reported to Poison Centers

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Background: Gabapentin is one of the newer anticonvulsant medications. It is structurally similar to gamma-aminobutyric acid (GABA), a major inhibitory neurotransmitter in the brain. Prescribed for epilepsy and mood disorders, gabapentin also may be prescribed off-label for analgesia. Since the drug may cause euphoria and sedation, it has the potential to be abused. Reports of abuse and misuse of gabapentin have been increasing in recent years. The objective of this study was to describe gabapentin abuse and misuse reported to a poison center network.
Methods: Cases were gabapentin exposures reported to a large, statewide poison center network during 2000-2018 where the exposure reason was intentional abuse or misuse. Exposures involving substances in addition to gabapentin and exposures not followed to a final medical outcome were included. The distribution of cases was determined for various factors related to patient demographics, exposure circumstances, management, and outcome.
Results: A total of 688 cases of gabapentin abuse and misuse were identified. The number of cases increased from 12 in 2000 to 78 in 2018. The distribution of patients by age was 5 (0.7%) 0-12 years, 114 (16.6%) 13-19 years, 123 (17.9%) 20-29 years, 115 (16.7%) 30-39 years, 121 (17.6%) 40-49 years, 105 (15.3%) 50-59 years, 56 (8.1) 60 years or older, and 49 (7.1%) unknown age; 375 (54.5%) of the patients were female, 312 (45.3%) male, and 1 (0.1%) sex unknown. The exposure route was ingestion in 674 (98.0%) cases, inhalation in 21 (3.1%), parenteral in 4 (0.6%), dermal in 3 (0.4%), rectal in 2 (0.3%), and unknown in 5 (0.7%). Additional substances were reported in 407 (59.2%) of the exposures. Most ($n = 613$, 89.1%) of the exposures occurred at the patient's own residence, 13 (1.9%) another residence, 9 (1.3%) school, 9 (1.3%) public area, and 34 (4.9%) other/unknown location. The management site was 467 (67.9%) already at or en route to healthcare facility, 105 (15.3%) referred to a healthcare facility, 107 (15.6%) on site, and 9 (1.3%) at unspecified other/unknown location. The medical outcome was 130 (18.9%) no effect, 178 (25.9%) minor effect, 153 (22.2%) moderate effect, 24 (3.5%) major effect, 4 (0.6%) not followed-judged nontoxic, 101 (14.7%) not followed-minimal clinical effects possible, 83 (12.1%) unable to follow-potentially toxic, and 14 (2.0%) unrelated effect. One death was reported. The most frequent clinical effects were drowsiness/lethargy ($n = 282$, 41.0%), tachycardia ($n = 95$, 13.8%), slurred speech ($n = 72$, 10.5%), hypertension ($n = 59$, 8.6%), confusion ($n = 48$, 7.0%), agitated/irritable ($n = 44$, 6.4%), dizziness/vertigo ($n = 35$, 5.1%), and ataxia ($n = 30$, 4.4%). The most frequent treatments were intravenous fluids ($n = 229$, 33.3%) activated charcoal ($n = 79$, 11.5%), cathartic ($n = 60$, 8.7%), oxygen ($n = 53$, 7.7%), and benzodiazepines ($n = 51$, 7.4%).
Conclusions: The number of gabapentin abuse and misuse cases increased during the 19-year period. The majority of cases involved adult females. The leading exposure route was ingestion. Most exposures were managed at a healthcare facility. The most common clinical effects were neurological and cardiovascular in nature.

KEYWORDS gabapentin, drug abuse, drug misuse
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18. Antimuscarinic Toxicity Due to Lupini Bean Ingestion

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Background: Plant alkaloids are one of the largest groups of secondary plant metabolites, with a breadth of potential physiologic and toxicologic effects when ingested, handled, or used parenterally as medication. Lupini beans are legumes in the Lupinus family, primarily seen in Mediterranean cooking. The process of safely cooking lupini requires extensive rinsing and soaking, as improperly prepared beans contain variable amounts of toxic quinolizidine alkaloids, which also lend a bitter taste. Although these alkaloids have varying effects on the acetylcholine receptors the presentation is typically consistent with an antimuscarinic toxidrome. While the toxicity of lupini is well-described in the veterinary literature, human cases are quite rare and under-reported.
Case: A 73-year-old Italian man presented to the ED complaining of throat tightness and dry mouth which began shortly after finishing lunch. He reported one episode of vomiting prior to presentation and endorsed dizziness. On exam, the patient was found to be confused, anxious appearing with irregular heart rhythm, dry mucous membranes, and mydriasis. He and his wife confirmed the ingestion of minimally soaked lupini beans which had occurred several hours prior. Mental status remained altered and the patient was treated with benzodiazepines for his anxiety. CT imaging was normal and laboratory studies were without acute perturbation. He was admitted to the hospital for observation and returned to baseline by the next morning. He was discharged in stable condition.
Discussion: Lupini beans contain various quinolizidine alkaloids. While the effects of these alkaloids are not entirely understood and appear to vary, they are likely to be mediated by their action on muscarinic acetylcholinergic receptors. The lupini bean must be prepared in a laborious and time-consuming way prior to ingestion in order to eliminate the alkaloids. This gentleman presented with features suggesting an antimuscarinic toxidrome. His new atrial fibrillation, mydriasis, psychomotor agitation, and altered mentation in the setting of ingestion of improperly prepared beans certainly suggests they were the likely cause of his presentation. No other causes of altered mental status were identified during his hospitalization and he returned to baseline by morning, which again is more suggestive of a toxicologic rather than neurologic etiology.
Conclusion: While rare, lupini bean ingestion should be considered in the differential of an antimuscarinic appearing patient. These legumes must be pre-treated properly before consumption to remove the toxic alkaloids within.

KEYWORDS lupini bean, antimuscarinic toxicity, quinolizidine alkaloids
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19. Intravenous Acetaminophen Overdose in an Infant

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Introduction: Intravenous (IV) acetaminophen (APAP) use has increased recently, especially in operative and post-operative patients. Despite increasing use there are relatively few cases of iatrogenic overdose reported in the literature. This is a report of a case of IV APAP overdose in an infant that resulted in a benign outcome following treatment with N-acetylcysteine (NAC).
Case Report: A 3 month old (6kg), otherwise healthy, infant was undergoing general anesthesia for removal of a vallecular cyst. The child inadvertently received a 500mg (83 mg/kg) IV APAP dose intraoperatively. This error was discovered at the end of the case. Post-operatively, the child had normal vital signs and a normal examination other than some mild inspiratory stridor. The child was started on IV NAC 4 hours post-operatively at 150mg/kg bolus followed by 15 mg/kg/hr. At 4 hours post-IV APAP overdose the electrolytes were normal. LFTs showed total bilirubin 0.5, AST 50, ALT 22, INR 0.9 and serum APAP was 52 mcg/ml. The child did well and was able to feed without vomiting. At 20 hours post-overdose the child remained well and LFTs demonstrated total bilirubin 0.8, AST 29, ALT 22 and serum APAP was <9 mcg/ml. NAC was discontinued and the child was discharged home that same day.
Discussion: IV acetaminophen use is increasing however there are limited reports in the literature of iatrogenic overdose. The normal therapeutic dose of IV APAP is 15 mg/kg; thus, our patient received more than a 5 fold overdose but did well following IV NAC therapy. There are only a few case reports in the literature of IV APAP overdose in pediatric patients. In these cases patient received between 75-300 mg/kg of IV APAP. Two IV APAP overdose patients (75mg/kg and 300mg/kg) had delayed recognition of the overdose which resulted in initiation of NAC at 24 hours and 22 hours post IV overdose respectively. Both of these patients developed hepatotoxicity and had ALT/AST that peaked at 1946 IU/L/1633 IU/L and ALT 2819 IU/L, respectively. Whereas, the other patients that received 75-150 mg/kg IV APAP were started on IV NAC within 4 hours and both did well and didn't develop hepatotoxicity. Our patient was started on IV NAC within 4 hours of IV APAP overdose and did well and LFTs remained normal at 20 hours post overdose. Evaluation of IV APAP overdoses is complicated given the lack of a standardized approach unlike oral APAP overdoses. Although the Rumack-Matthew nomogram is well studied with oral overdoses it can't be used in cases of IV overdose as the pharmaco/toxicokinetics are not equivalent between oral and IV overdoses. Therefore, without a well-defined toxic dose of IV APAP and given the relative safety of IV NAC it seems prudent to consider liberal use of IV NAC following IV APAP overdoses.
Conclusion: We present a case of an infant that received a 5 fold overdose of IV APAP that did well and did not develop any liver injury following early initiation of IV NAC.

KEYWORDS acetaminophen, pediatric, intravenous
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20. Cobra Snakebite Mimicking Brain Death Treated with a Novel Combination of Polyvalent Snake Antivenom and Anticholinesterase: case report

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Introduction: In toxicology literature, snake bites were the second toxicology-relevant cause, after baclofen, mimicking brain death.

Case Report: A 57-year-old woman with a history of cobra snakebite prior 30 minutes of presentation. She developed trouble breathing; but, her mentation was normal. Upon arrival in the emergency room, her breathing ceased, and she became non-responsive. She was immediately intubated and placed on mechanical ventilation. On examination, the brain stem reflexes were absent with Glasgow coma score of 3. We started the protocol of five vials of PSA diluted in 250ml D5W every two hours. Giving no neurological improvement after 30 vials, we administered intravenous neostigmine 3 mg over 5 minutes along with an intravenous dose of atropine 0.5mg. Instantly, the pupils showed a slight reaction to light. We extended the PSA administration for 24 hours with a total dose of 50 vials. Along with three doses of neostigmine, the patient received pyridostigmine 60mg via a nasogastric tube, every 6 hours for 24 hrs. The patient accomplished full neurological recovery within 48 hours of using a novel combination of Polyvalent Snake Antivenom (PSA) and anticholinesterases.
Discussion: In Saudi Arabia, the PSA is manufactured to neutralize the toxic effects of the six Saudi snake venoms, which are Bitis arietans, Cerastes cerastes, Echis carinatus, Echis coloratus, Naja haje, and Walterinnesia aegyptia venoms. We required 50 vials of the PSA to reverse the neuroparalytic effect of Arabian cobra, which is considered as a mega dose comparing with 2-5 vials to reverse the hemotoxic effect of Viperidae species. The World Health Organization (WHO) highly recommended using Anticholinesterase drugs in the management guidelines of Snakebites in South-East Asia using, especially in cobra species.
Conclusion: This case highlights a unique presentation of cobra bite induced brain death mimicking. Thus, intensivists should exclude the neuroparalytic effect of snakebite before considering the withdrawal of ventilatory support or organ donation. Also, the life-threatening presentation of cobra envenomation mandates the use of higher doses of PSA to reverse the neuroparalytic toxicity. We should consider the rule of anticholinesterase as adjunctive therapy to PSA in severe cobra envenomation.

KEYWORDS snakebite, brain-death mimick, polyvalent snake antivenom

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21. Three-year-old Female with Sickle Cell Disease, Plumbism and SIADH

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Background: The American Academy of Pediatrics reports that a blood lead level (BLL) below 5μg/dL can impair cognition; therefore, there is no safe level of lead in blood. Very high BLL (>100μg/dL) can cause significant symptoms such as protracted vomiting and encephalopathy, and even death. Nonspecific symptoms such as abdominal pain, nausea, vomiting, constipation, joint pains, and anemia can be manifestations of lead poisoning or a vaso-occlusive crisis of sickle cell disease, potentially leading to a significant delay in diagnosis and treatment. A case of a 3-year-old child with underlying sickle cell disease and pica who after getting lead toxicity developed encephalopathy and syndrome of inappropriate antidiuretic hormone secretion (SIADH) is described.

Table (#20).

White blood cell 11 10^9 /L	Hemoglobin 8.9 g/L	platelet: 230 10^9 /L
Serum creatinine: 4.6 mg/dl	urea: 142 mg/dl	
Venous blood gas PH: 7.34	PCo2: 39 mmHg	Bicarbonate: 19 mEq/L
Sodium: 133 mEq/L	Potassium 5.3 mEq/L	Calcium: 8.2 mg/dl.
International ratio: 1.0	PT: 12 seconds	PTT: 28 seconds

Case Report: A 3-year-old female presented to an outside emergency department (ED) with abdominal pain and vomiting. Her past medical history consisted of sickle cell disease, type SS, with functional asplenia, chronic anemia with a baseline hemoglobin between 7-8g/dL, and vitamin D deficiency. In the ED, the patient was diagnosed with pyelonephritis; urine culture was positive for *Escherichia coli*. She was transitioned to ciprofloxacin after receiving 2 doses of IV ceftriaxone. On hospital day (HD) 3, her BLL was 103.7μg/dL; she was transferred to our facility for further treatment.
BLL upon arrival was 110.2μg/dL. Medical Toxicology was consulted, and chelation therapy was started with British Anti Lewisite (BAL) and calcium disodium EDTA. On HD 4, the patient developed brief periods of confusion and irritability that continued into HD 5; her sodium was 115mmol/L. A peripherally inserted central catheter (PICC) line was immediately placed, and hypertonic saline infusion was started. Ciprofloxacin was discontinued, and cefdinir was initiated. Maintenance fluids were decreased to half weight-based maintenance volumes. Sodium levels soon increased to normal range. Mental status rapidly improved until she was discharged on HD 8. After 3 days of BAL injections and 5 total days of EDTA, her BLL was 15.3μg/dL. The patient and family moved into another family member's home.
Case Discussion: Our patient had an elevated BLL as a result of pica involving the consumption of paint chips at home. Among patients with sickle cell disease, pica is a known risk factor for lead poisoning. Additional risk factors for the development of lead poisoning among young children include: an incomplete blood-brain barrier, iron deficiency anemia, and lower socioeconomic status and ethnicity. Our patient developed SIADH in the setting of lead toxicity and fluoroquinolone administration. In the setting of SIADH, abnormally elevated ADH levels result in the pathologic concentration of urine despite a low plasma osmolality. This resultant water retention increases total body water and causes a dilutional hyponatremia. Hyponatremia can occur with persistent ADH stimulation, medications like ciprofloxacin, pain, infection and non-steroidal anti-inflammatory agents.
Conclusion: The development of SIADH may be a complication in patients with severe lead toxicity, and may be more likely to occur in those with underlying sickle cell disease, as well as those with the concomitant use of medications associated with iatrogenic SIADH.

KEYWORDS lead poisoning, sickle cell disease, SIADH

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22. A prolonged Course of Amanita Muscaria Mushroom Poisoning, a case report

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Background: We report the case of a 56 year-old-male patient who presented to the emergency department (ED) with altered mental status and reported *Amanita muscaria* mushroom ingestion. Amanita muscariaor, or Fly Amanita mushrooms are known to be poisonous to humans and hallucinogenic by nature.
Case Report: 56 year-old-male with an unknown past medical history presented to the ED with altered mental status. The patient, found covered in vomit, urine and feces was described

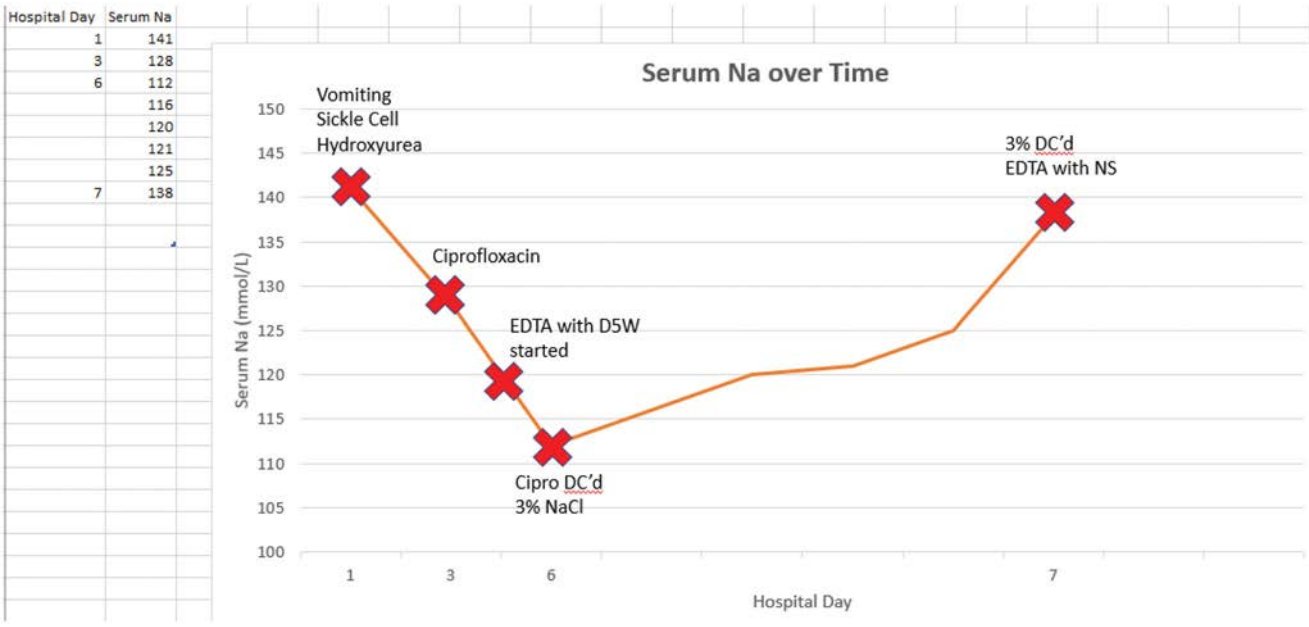

Figure (#21).

as obtunded with intermittent periods of agitation. According to the police accompanying the patient to the ED, the patient took ~10 grams of Fly agaric mushrooms approximately 7 hours prior to arrival. Friends reported patient laying down for several hours before becoming unresponsive. The patient was intubated in the ED. The patient's initial vital signs were blood pressure 136/112, heart rate 125 beat per minute, temperature 96°.
Fahrenheit (35.6° Celsius), respiratory rate 19, oxygen saturation 94%. The patient was given a Glasgow Coma Scale score of 3. Lab results revealed a leukocytosis, high anion gap metabolic acidosis, hypokalemia, acute kidney injury, hyperglycemia, and elevated lactate level (Table 1). Ethanol, salicylate, acetaminophen, and the Rapid Urine Drug Screen were all negative. The patient was admitted to the intensive care unit (ICU). While ventilated and sedated with propofol, the patient was noted to have alternating periods of excitability, muscle fasciculations, and myoclonic activity followed by periods of apnea. An electroencephalogram was performed which did not reveal true seizures. On ventilator day (VD) 3, he was still experiencing myoclonus. We administered intravenous (IV) phenobarbital. The patient was extubated on hospital day (HD) 5 and remained in the ICU until day 6 due to persistent delirium. The patient was discharged on HD 14 after a prolonged course for a workup of low grade fevers and management of diabetic ketoacidosis in the setting of newly diagnosed diabetes. After his delirium resolved, the patient reported eating at least 8 dried mushroom caps believed to be *Amanita muscaria,* and describes the mushrooms as orange in color.
Case Discussion: The ingestion of *Amanita muscaria* rarely causes death. Toxicity typically resolves within 24 hours. Our case demonstrates an unusually prolonged course from a large ingestion that demonstrated good clinical improvement after phenobarbital administration. *Amanita muscaria* toxicity results from ibotenic acid, an NMDA agonist, and muscimol, a GABA agonist. The waxing and waning CNS excitation and depression result from this NMDA and GABA agonism respectively. Despite GABA agonist administration, our patient demonstrated persistent neuroexcitation. Phenobarbital, being both a GABA agonist and NMDA antagonist, resulted in clinical improvement.
Conclusion: Phenobarbital, in addition to traditional supportive care, may be a useful adjunct in patients presenting with prolonged Amanita muscaria poisoning.

KEYWORDS Amanita muscaria, Mushroom Toxicity, Fly agaric mushrooms
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23. Severe Chronic Carboxyhemoglobinemia Due to Smoking Hookah

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Background: Smoking hookah is a traditional form of tobacco consumption popular to Middle Eastern countries which has gained popularity in western countries (1,2). In the water pipe, burning charcoal heats tobacco mixed with molasses which generates a vapor that passes through a water bubbler before inhalation through a long tube (3). The smoke contains tobacco smoke as

Table 1(#22). Lab Results.

Component	Value	Abnormal Levels	Reference Range	Units
Glucose	416	High	65 – 99	mg/dL
BUN	27		7 – 28	mg/dL
Creatinine	2.14	High	0.53 – 1.30	mg/dL
Sodium	144		135 – 145	mmol/L
Potassium	3.4	Low	3.5 – 5.2	mmol/L
Chloride	103		100 – 109	mmol/L
Carbon Dioxide	21	Low	23 – 31	mmol/L
Calcium	10.1		8.5 – 10.1	mg/dL
Alkaline Phosphate	75		35 – 120	U/L
Albumin	4.8		3.5 – 4.8	g/dL
Bilirubin, Total	0.4		0.2 – 1.0	mg/dL
Protein, Total	9.3	High	6.3 – 8.3	g/dL
AST	44	High	<41	U/L
ALT	62	High	<56	U/L
Anion Gap	20	High	3 – 11	
GFR, Calculated	33	Low	>60	mL/min/1.73m2
Hemoglobin	16.9		12.5 – 17.0	g/dL
Hematocrit	51.6	High	37.0 – 48.0	%
WBC	22.3	High	4.0 – 10.5	thou/cmm
RBC	5.62	High	4.00 – 5.40	mill/cmm
Platelet count	299		140 – 350	thou/cmm

well as by-products of charcoal combustion (2). Incomplete combustion of any carbonaceous material will produce carbon monoxide (CO). Chronic CO poisoning has been shown to cause fatigue, difficulty concentrating, and mild erythrocytosis; though hyperbaric oxygen (HBO) therapy is not typically recommended (3,4).

Case Report: A 51-year-old male with history of benign prostatic hyperplasia was referred to hematology due to erythrocytosis of unknown etiology (hemoglobin 23.7 g/dl, hematocrit 67%) found during routine laboratory evaluation.

He denied dyspnea, chronic cough, lightheadedness, headache, and symptoms of paroxysmal nocturnal dyspnea. The patient's only medication was tamsulosin. During evaluation, patient was asymptomatic and had an unremarkable physical examination without evidence of splenomegaly (prior abdominal imaging also without splenomegaly).

His hematology evaluation determined an isolated erythrocytosis, with reassuring counts in other cell lines on the complete blood count and 1.9% reticulocytes. Serum carboxyhemoglobin (HbCO) was found to be 33.6%. Patient admitted to smoking hookah 3-4 times daily and stated he last smoked one hour prior to presentation. Patient was referred to the emergency department (ED) for evaluation of possible HBO.

In the ED, vital signs were as follows: temperature of 35.7oC, pulse 83 bpm, blood pressure 153/98 mmHg, SpO2 97% on room air, and respiratory rate of 14 bpm. An EKG did not reveal signs of ischemia. A repeat HbCO was 24% on room air (approximately three hours after initial value). It was determined that patient would not benefit from HBO due to his asymptomatic and chronic state with potential risks associated with HBO. Patient was placed on 100% oxygen via nonrebreather mask for 6 hours. A subsequent HbCO was 8.9% approximately 6.5 hours after initial value. Counseling was performed regarding reduction in hookah smoking and patient was discharged home.

Case Discussion: Acute CO poisoning due to smoking hookah has been studied and presents with nausea, headache, and loss of consciousness (4). However, chronic CO poisoning and long-term adverse health effects are far less studied. In this case report, we presented a chronic hookah smoker with secondary erythrocytosis and HbCO of 33.6%. This is the highest recorded hookah-related HbCO concentration in the medical literature; and the development of secondary erythrocytosis supports the chronicity of a significantly elevated HbCO (3). Additionally, this is also the most severe case of secondary erythrocytosis due to chronic CO exposure reported. It is important to note that in this case, HBO was not indicated despite the severe elevation of HbCO.

Conclusion: Smoking hookah has gained popularity amongst young adults all over the world (1,2). It is important that healthcare providers obtain detailed social histories from patients who present with any signs or symptoms suggesting CO poisoning and even in those who are asymptomatic.

KEYWORDS chronic carbon monoxide poisoning, carboxyhemoglobinemia, hookah smoking

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24. Severe Poisoning Associated with Prunus Armeniaca Toxicity in a Patient with Underlying Cardiac Disease: A Significant Risk for an Aging Population

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Background: Despite a general awareness of cyanide toxicity associated with the ingestion of apricot kernels, reports are very infrequent in the literature. Significant cardiac ischemia, especially in the setting of undiagnosed and untreated atherosclerotic cardiovascular disease, however may pose a significant risk for individuals consuming apricot kernels for their purported health benefits.

Case Report: A 76-year-old 75kg man with a history of tobacco abuse, coronary artery disease with one drug eluting stent, and hypertension ingested approximately 20 apricot kernels that he blended to make a smoothie despite a manufacture recommendation of only three kernels. Within several minutes he complained of severe shortness of breath, lightheartedness, and demonstrated several myoclonic movements associated with a notable decrease in his level of consciousness. EMS was called, and he was transferred to the emergency department (ED). In the ED his vital signs were: P-109 bpm, BP-195/99 mmHg, R-40 bpm, T-96.5F, SpO2 100% on a face mask. He was noted to be more alert but in severe respiratory distress. Ancillary studies demonstrated a lactate of 16 mmol/L, HCO3 16meq/L, Glucose 237 mg/dl, and an arterial blood gas (ABG): pH of 7.15, pCO2 25.6mmHg, and pO2 of 226mmHg. His initial troponin I was 0.01 ng/mL. His chest x-ray demonstrated pulmonary edema and his EKG was concerning for ischemic anterolateral ST changes. He was given hydroxocobalamin 5g IV and rapidly improved. His lactate down trended to 3.0 mmol/L within 2 hours and cleared completely within 6 hours. His troponin I increased to 2.78 ng/mL and his EKG changes persisted. Given his persistent EKG changes and elevated troponin I, he received a left heart cardiac catheterization on day 2 which resulted in the placement of three stents associated with both restenosis of his preexisting ostial-proximal 1st diagonal stent as well as significant mid left circumflex and moderate stenosis of his proximal 2nd marginal branch of his distal RCA. The patient clinically improved and was discharged the following day.

Case Discussion: Apricot kernels *(Prunus armeniaca)* can contain approximately 0.5mg of cyanide per apricot kernel, though this varies based on the kernel's size. Although deaths related to apricot kernels are rare (often requiring 0.5-3.5mg/kg dosing), lower doses are associated with encephalopathy, respiratory distress, lactic acidosis, hyperglycemia, bradycardia, hypotension, and seizures. Significant cardiac demand ischemia and mismatch, however, is not frequently reported. Our patient had significant underlying cardiovascular disease that was exposed after ingestion of *Prunus armeniaca* associated cyanide toxicity, resulting in myocardial injury. Individuals with preexisting cardiac disease may be at increased risk for severe symptoms associated with this reported therapy at lower doses than are other individuals without cardiovascular disease may often tolerate.

Conclusions: Toxicologists and poison specialists should have a lower threshold for referral to emergency care after Prunus armeniaca ingestion in older adults given the higher incidence of significant cardiovascular disease in this population. Specific triage and referral values associated with this ingestion, however, continue to be difficult to determine and future studies may be of benefit for both this as well as the general population.

KEYWORDS Apricot, Cyanide, Elderly

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25. Association of Daily High Temperature with Increased Snake Envenomations: A Retrospective Case Cross-Over Study

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Background: Prevention of snake envenomations in North America often focuses on avoiding interactions between humans and snakes. Previous methods have focused on the influence of geography, type of habitat, and time of year. Little has been described regarding a detailed analysis of weather patterns on snakebite envenomation behavior.
Methods: This study was a retrospective case crossover study of non-pregnant adults (n = 489) who reported snake envenomations to a single state's poison control center from 2014-2018. Age and gender of the individual, as well as the date, time, and zip code associated with the envenomation, and the snake description were collected. Primary outcomes included barometric pressure, actual temperature, high and low daily temperature, and weather condition (fair, cloudy, or rain/precipitation) were collected and compared to the same zip code, date, and time exactly one week and one year prior to the envenomation using historical data from the Weather Underground database. Paired t-tests and Stuart-Maxwell tests were used to determine differences in weather conditions during the study period. This study was IRB-approved.
Results: The study population was 72% male with the highest number of envenomations having occurred in the month of July (19.6%) in between 7-8pm (12.1%). The snakes involved were *Agkistradons* (37.8%), Crotalids (19%), non-venomous (4.3%, or unidentified (38.9%). At the time of envenomation the weather was most often fair (52.2%), then cloudy (44%), and least frequently demonstrated rain/precipitation (3.9%). Snake envenomations increased significantly ($p < 0.0001$) on days with a higher daily high temperature when compared with days of both one week and one year prior in the same zip codes at the same time of day. There were no statistically significant differences noted when comparing the actual temperature at the time of envenomation, daily low temperature, barometric pressure, or precipitation to dates one week and one year prior. There were statistical differences in the distribution of weather conditions (fair, cloudy, or rain/precipitation) on the day of envenomation compared to one week prior ($p < 0.0001$) and one year prior ($p < 0.0008$), supporting differences in the weather conditions at the time of envenomation compared to dates one week and one year prior. Limitations of this study include its retrospective nature, location in a single state in the United States, and low total number of envenomations.
Conclusions: In our single-center study, snake envenomation behavior, as it relates to easily reportable weather measurements, appears to be associated with the warmer days and the overall high temperature on the day of envenomation. Actual temperature, low temperature, barometric pressure, and precipitation at the time of envenomation do not appear to be associated with an increased risk of evenomation.

KEYWORDS Snake, Weather, Envenomation

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26. Early Administration of N-acetylcysteine in Clove Oil Ingestion

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Background: Essential oils pose a significant threat to children given their variety in concentrations, appeal, and lack of regulation. Parents often do not recognize the danger in these preparations that are readily available over the counter. Eugenol is the major component of clove oil and ingestions as small as 10 milliliter (mL) have been associated with severe effects such as fulminant hepatic failure, metabolic acidosis, seizure, and coma. N-acetylcysteine (NAC) has been used in the management of acute hepatic injury that develops in the setting of eugenol ingestion.
Case: A 14-month-old male weighing 11 kilograms (kg), presented to a community children's emergency department 45 minutes after an exploratory ingestion of 15 mL of clove oil. The patient was started on NAC per acetaminophen ingestion institutional protocol 1 hour and 45 minutes after reported ingestion which included a loading dose of 150 milligrams (mg)/kg over 60 minutes followed by a dose of 50 mg/kg over 4 hours followed by 100 mg/kg over 16 hours. The patient was admitted to the pediatric intensive care unit (PICU) for close monitoring of his neurologic status and for frequent laboratory testing. The patient's AST level peaked at 123 international units (IU)/liter (L) (normal range 20-60 u/L) about 14 hours after ingestion. The remainder of his laboratory studies including glucose, alanine aminotransferase (ALT), coagulation studies, and chemistry remained unremarkable. The patient was observed off of NAC for 24 hours and had repeat liver function studies without evidence of rebound and was subsequently discharged home.
Discussion: Eugenol ingestion is rare but potentially serious given the popularity of essential oil products in the home and critical illness associated with small volume ingestions. Eugenol is thought to cause acute hepatic necrosis similar to acetaminophen toxicity. NAC has been used for the management of acute hepatic injury in the setting of eugenol ingestion, although only after evidence of injury. There is a case report of a 15 month old patient who ingested 10 mL of clove oil that went on to develop fulminant hepatic failure 24 hours after ingestion with an ALT peak of 13,000 IU/l. NAC was initiated. Our case is clinically similar except our patient was started on NAC early in the course of the ingestion and did not develop the degree of liver injury seen in the earlier case report.
Conclusion: Early administration of NAC may prevent liver injury associated with eugenol ingestion.

KEYWORDS Eugenol, N-acetylcysteine, Clove Oil

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27. Massive Ibuprofen Overdose with Multisystem Toxicity

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Background: Ibuprofen toxicity following massive overdose is rare, but potentially dangerous. Literature review confirms serious toxic effects from isolated ibuprofen overdose are unusual, and there are few reports of life-threatening complications. A review of large ibuprofen ingestions showed 50% of patients suffered no effects. Symptomatic overdoses most commonly occur with ingestions greater than 100mg/kg, while severe toxicity is more likely to occur with "massive ingestions" greater than 400 mg/kg. The management of acute ibuprofen overdose consists of prevention of further toxicity, correction of acidosis, and addressing organ-system injury. Activated charcoal is recommended for acute NSAID overdoses who present within two hours of ingestion. A serum pH <7.0 unresponsive to adequate fluid resuscitation can be corrected with sodium bicarbonate though this is controversial. Recent case reports, including the first documented fatalities due to isolated ibuprofen toxicity, attempted to use bicarbonate treatment in the correction of metabolic acidosis without success.
Case Report: We present a case of massive ibuprofen overdose without co-ingestion, who developed severe, multiple organ system toxicity with rare cardiac and unique neurologic effects. A

23-year-old male was brought to the ED after a suicide attempt by intentional overdose of ibuprofen, estimated dose of approximately 100 grams, or 1470mg/kg of ibuprofen. His serum ibuprofen level twelve hours after ingestion was 446 ug/ml.
Upon ED arrival, the patient had a heart rate of 58 BPM, a blood pressure of 128/69 mmHg, and a core temperature of 95.7*F. The patient was combative on arrival, and cycled through alternating periods of acute delirium/agitation and unresponsiveness. Electrocardiograms a prolonged QTc interval of 591 ms, which improved with magnesium and sodium bicarbonate treatment. Classically, he developed an acute metabolic acidosis, kidney injury and gastrointestinal bleeding. After ED stabilization, the patient was continued on a bicarbonate infusion in the intensive care unit where his alternating mental status eventually required sedation and intubation. Ultimately the patient fully recovered and was discharged to a psychiatric facility.
Case Discussion: The most striking feature of this case was the patient's fluctuating mental status. While previous reports of NSAID toxicity describe drowsiness, ataxia, nystagmus, headaches, disorientation and seizures, to our knowledge no patient has presented alternating repeatedly between significant agitation and complete unresponsiveness. Intubation was necessitated not only for airway protection during his unresponsive episodes, but also to prevent him injuring himself while agitated.
Cardiotoxicity is previously described, but is also rare. One animal study demonstrated cardiotoxic effects of ibuprofen are due to prolonging the duration of cardiac action potentials by inhibition of sodium and calcium channels. Tachycardia is the most frequently described abnormality. Our patient was relatively unique as he presented with bradycardia and prolonged QTc, which have rarely been reported.
Conclusions: We feel this case demonstrates a unique patient presentation in a rarely seen overdose. His ibuprofen toxicity was complicated by multisystem organ failure including uncommon cardiac and neurologic effects. We hope to help practitioners recognize the diverse clinical signs of ibuprofen toxicity by further adding to the literature of described effects.

KEYWORDS ibuprofen, delirium, overdose

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28. Sodium glucose co-transporter 2 inhibitor ingestions reported to poison centers

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Background: Sodium glucose co-transporter 2 (SGLT2) inhibitors are a new class of oral antidiabetic medications. SGLT2 proteins located in the proximal convoluted tubules of the kidneys are responsible for reabsorbing glucose back into the blood. SGLT2 inhibitors allow more glucose to be excreted in the urine, thus reducing the amount of glucose in the blood. Adverse clinical effects have been reported with SGLT2 inhibitors. The objective of this study was to describe SGLT2 inhibitor ingestions reported to a statewide poison center network.
Methods: Cases were SGLT2 inhibitor exposures reported during 2013-2018 where the exposure route was ingestion. Cases were identified by searching all records with PoisIndex codes for any of the SGLT2 inhibitors (canagliflozin, dapagliflozin, empagliflozin, ertugliflozin) alone or in combination with other medications. Ingestions involving substances in addition to the SGLT2 inhibitor-containing product and ingestions not followed to a final medical outcome were included. The distribution of the cases was determined for various factors: patient demographics, ingestion circumstances, management, and outcome.
Results: A total of 293 SGLT2 inhibitor ingestions were identified: 137 (46.8%) canagliflozin, 94 (32.1%) dapagliflozin, and 63 (21.5%) empagliflozin (1 ingestion involving canagliflozin and dapagliflozin). The annual number of ingestions was 4 in 2013, 19 in 2014, 62 in 2015, 66 in 2016, 79 in 2017, and 63 in 2018. The distribution of patients by age was 92 (31.4%) 0-5 years, 8 (2.7%) 6-12 years, 15 (5.1%) 13-19 years, and 178 (60.8%) 20 years or older; 172 (58.7%) of the patients were female and 121 (41.3%) male. The reason for ingestion was 247 (84.3%) unintentional (including 148 or 50.5% therapeutic error), 42 (14.3%) intentional (including 40 or 13.7% suspected attempted suicide), and 4 (1.4%) adverse reaction. Most (n = 285, 97.3%) ingestions occurred at the patient's own residence. The management site was 173 (59.0%) on site, 87 (29.7%) already at or en route to a healthcare facility, and 33 (11.3%) referred to a healthcare facility. Of 120 patients seen at or referred to a healthcare facility, 58 (48.3%) were treated/evaluated and released, 13 (10.8%) admitted to a critical care unit, 16 (13.3%) admitted to a non-critical care unit, 15 (12.5%) admitted to a psychiatric facility, 4 (3.3%) refused referral, and 14 (11.7%) lost to follow-up. The medical outcome was 97 (33.1%) no effect, 15 (5.1%) minor effect, 19 (6.5%) moderate effect, 4 (1.4%) major effect, 16 (5.5%) not followed-judged nontoxic, 128 (43.7%) not followed-minimal clinical effects possible, 12 (4.1%) unable to follow-potentially toxic, and 2 (0.7%) unrelated effect; no deaths were reported. The most frequent clinical effects were tachycardia (n = 18, 6.1%), drowsiness/lethargy (n = 16, 5.5%), vomiting (n = 8, 2.7%), hypertension (n = 7, 2.4%), and nausea (n = 7, 2.4%). The most frequent treatments were dilute/irrigate/wash (n = 100, 34.1%), food/snack (n = 112, 38.2%), intravenous fluids (n = 37, 12.6%), and activated charcoal (n = 28, 9.6%).
Conclusions: The majority of SGLT2 inhibitor ingestions involved patients who were female and adults. Most ingestions were unintentional, particularly therapeutic errors. The majority of the ingestions were managed outside of a health care facility and did not result in serious outcomes.

KEYWORDS sodium glucose co-transporter 2 (SGLT2) inhibitors, gliflozins, poison center

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29. 'Cause I Know That It's Delicate: Dapsone-Induced Methemoglobinemia in a Pediatric Kidney Transplant Patient

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Background: Dapsone may be used as a second-line agent for Pneumocystis carinii pneumonia (PCP) prophylaxis in transplant recipients in the setting of allergy or poor response to sulfamethoxazole-trimethoprim (SMX-TMP). Methemoglobinemia has been recognized as a toxicological emergency induced by dapsone. However, this phenomenon may be a challenge in both its recognition and management in transplant patients, as their signs and symptoms at presentation may be non-specific and confused with other common complications of the transplant patient that may be immunologic, hematologic, or infectious in nature.
Case Report: A 14-year-old, 80 kg male presented to the emergency department with tachycardia, pallor, and fatigue. Vital signs included a heart rate of 119 beats per minute, blood pressure of 119/72 mmHg, respiratory rate of 20 breaths per minute, temperature of 97.6 °F, and oxygen saturation of 96% on room air. Past medical history was significant for two kidney transplant surgeries, asthma, and hepatitis B. One week prior to presentation, he underwent a kidney biopsy, and was found to have both acute cellular- and antibody-mediated rejection. Discharge

medications included immunosuppressive therapy as well as anti-infective prophylaxis with dapsone due to his allergic reaction to SMX-TMP. In the emergency department, he had a serum hemoglobin level of 7.9 g/dL and received one blood transfusion. Despite an improvement in hemoglobin to 8.9 g/dL, he was noted to have peripheral cyanosis upon transfer to the pediatric floor. His oxygen levels desaturated in the range of 88 to 89%, requiring high-flow oxygen delivered via nasal canula. Differential diagnosis included intracardiac shunt and methemoglobinemia. His cardiac echocardiogram was within normal limits. However, a venous blood gas revealed a pH of 7.53, pCO_2 of 27 mmHg, pO_2 of 41 mmHg, HCO_3 of 22.6 mEq/L, oxyhemoglobin of 67.5%, and methemoglobin of 20.1%. Methylene blue was administered at a dose of 100 mg IV. One hour post-administration of the antidote, his methemoglobin level improved to 3.4%. He was able to comfortably transition to room air oxygen and required no further antidotal therapy. However, his hospital course was complicated by ongoing cellular- and antibody-mediated rejection. Dapsone was discontinued for PCP prophylaxis, and he was switched to atovaquone. He was discharged three weeks later.

Case Discussion: The onset of methemoglobinemia in our patient is similar to the time frame reported in the literature. However, given his complex medical history of kidney transplant with organ rejection, it has been hypothesized that such patients may be at increased risk for developing methemoglobinemia secondary to dapsone, as both the parent drug and metabolite may accumulate in the setting of kidney failure. In addition, cellular hypoxemia in these patients may pose patients at risk for ultimate loss of the transplanted organ.

Conclusions: Clinicians prescribing dapsone for PCP prophylaxis as an alternative to SMX-TMP in kidney transplant patients should be aware of the potential for methemoglobinemia as an adverse effect. These patients should be counseled on the risks, signs, and symptoms of methemoglobinemia. Routine monitoring of methemoglobin levels may be recommended in these patients in the outpatient setting.

KEYWORDS Dapsone, Methemoglobinemia, Pediatric toxicology

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30. COVID-19 Crisis Collaboration: The Poison Center and Health Department in the Time of Pandemic

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Background: Although the first confirmed positive COVID-19 test was not reported in Texas until March 6th, the Texas Poison Center Network received its first call regarding COVID-19 on January 28th. As news of the emerging threat in other parts of the world grew, local, regional, and state agencies planned their responses in anticipation of its arrival. The Texas Poison Center Network, comprising the six regional poison centers of Texas, offered to assist the state's health department in responding to the public's calls with questions on COVID-19. Instead the state decided to manage its hotline independently. Despite the lack of state interest, as a result of successful collaboration on projects such as the Flu on Call initiative and other preparedness activities throughout the years, El Paso's Department of Public Health (DPH) called upon the West Texas Regional Poison Center (WTRPC) to immediately assist in their response to COVID-19 while the city developed its infrastructure to respond to the pandemic.

Methods: Following work plans previously established between the DPH, its 211 center, and the WTRPC, El Pasoans were able to call 211 and agents would transfer callers with clinical questions regarding the pandemic to the WTRPC.

Results: After being activated on February 28th, the WTRPC received its first transfer call from 211 on March 10th. Once the first positive COVID-19 case was reported 3 days later, the public's concern grew and call volumes increased to 275 calls over the following week. As of May 16th, 479 calls have been transferred to the WTRPC with 86.7% requesting testing; 9.8% with general questions on signs and symptoms of COVID-19, recommendations for prevention or for travel; and 3.5% with questions from other healthcare providers or occupational-based settings preparing for COVID-19.

Discussion: In addition to answering callers' questions on COVID-19 based on information available through public health agencies, WTRPC specialists of poison information were able to screen the callers to see if they were eligible for the limited testing that was initially available based on the CDC's recommendations and the health department's practice. The lack of access to testing and the public's fears resulted in a spike in calls to the WTRPC primarily from those wanting to be tested. The demand subsided as the city opened its own hotline to respond to COVID-19 and the availability of testing for the community has expanded in the weeks since. The WTRPC continues to receive transfers from 211 and the DPH's COVID-19 hotline with clinical questions centered around testing that are not found in their script of Frequently Asked Questions.

Conclusion: Although the state did not rely upon the TPCN as its designated hotline for COVID-19, the WTRPC was able to effectively support the local health department and serve the community as the pandemic began to evolve in El Paso, Texas. Poison centers are a critical public health resource, and health departments should strongly consider coordinating response efforts with poison centers throughout the country in times of public health emergency.

KEYWORDS poison control center, COVID-19, public health

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Table (#30).

Week	COVID-19 Calls from DPH to WTRPC	Testing Request	General – Prevention, Signs & Symptoms, Travel, …	Planning and Preparing – Healthcare Providers/Occupational
3/8 – 3/14	22	16	4	2
3/15 – 3/21	275	233	30	12
3/22 – 3/28	105	98	4	3
3/29 – 4/4	19	14	5	0
4/5 – 4/11	7	6	1	0
4/12 – 4/18	11	9	2	0
4/19 – 4/25	12	12	0	0
4/26 – 5/2	7	6	1	0
5/3 – 5/9	11	11	0	0
5/10 – 5/16	10	10	0	0
Total	479	415	47	17

31. Rattlesnake Envenomations Reported to a Southwestern United States Poison Center Analysed by Season, Daily Temperature, and Recent Rainfall

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Background: Previous studies demonstrating relationships between monthly, seasonal, and macroscale weather patterns on snakebite occurrence are largely limited to tropical climates or the context of drought. Effects of weather on snakebite incidence and clinical outcomes in the temperate climates of North America is a nascent field.
Objective: Evaluate if there is a correlation between meteorological parameters of ambient temperature (daily high, average, and low) and 48-hour total precipitation on occurrence of snakebites, and secondarily, if there is seasonal variation in the clinical characteristics of snakebites.
Methods: Retrospective chart review of snakebites reported to a poison center from January 1, 2017 to December 31, 2019. Temperature (daily high, average, and low) and preceding 48-hour total precipitation on the date of the envenomation were recorded according to zip code. A Pearson correlation was used to determine if increasing daily ambient temperatures (high, average, and low) over a bimonthly period (15 days) was associated with an increase in total number of snakebites over the same timeframe. The same was done for 48-hour precipitation and total number of snakebites. If a significant correlation was found, bites were grouped into a cooler out-of-season group and warmer in-season group to see if the association persisted despite season. Lastly, clinical characteristics between seasons were analyzed by comparing patient demographics, dry bites, initial coagulopathy, total vials of antivenom, need for additional loading doses, Abbreviated Snakebite Severity Score, and rates of late coagulopathy.
Results: Of the 443 snakebites included, 68% occurred between mid-June and late-October. Modes for daily low, average, and high temperatures occurred from 75-80 °F, 85-90 °F, and 90-95 °F respectively. A positive correlation with low, average, and high daily temps was noted. The strongest correlation was with daily low temp ($r = 0.77$, $p = 0.00002$), followed by average temp ($r = 0.74$, $p = 0.00007$), then high temp ($r = 0.71$, $p = 0.0002$). No correlation was found for rainfall ($r = 0.42$, $p = 0.85$). When split by season, the warmer in-season period no longer demonstrated a correlation (r-low temperature $= 0.15$, $p = 0.71$). There was no significant difference in the clinical characteristics of snakebites in-season vs. out-of-season.
Conclusions: The peak snakebite season was defined as mid-June to late October. Most rattlesnake bites occurred during ambient temperature ranges from 75-95 °F with seasonal peaks in late August and early September. There was a correlation with increasing temperatures and increasing rattlesnake bites during the cooler out-of-season group from November to early June but not in the in-season group. Further research is needed to clarify the relationship between temperature patterns and snakebite incidence given a number of confounders in the current study. No correlation was found between recent rainfall and the incidence of snakebites. There were no differences in demographics and clinical characteristics of snakebites in-season and out-of-season.

KEYWORDS Envenomation, Rattlesnake, Climate

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32. Ventricular Bigeminy After Unintentional Pediatric Methadone Ingestion

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Background: Methadone is a long acting opioid agonist used in the treatment of chronic pain and opioid use disorder. While QTc interval prolongation and torsade de pointes are well-described phenomena of methadone use, ventricular ectopy is not described in isolated methadone ingestion in pediatric patients.
Case Report: A previously healthy 18-month old female ingested up to 140 mg of liquid methadone preparation, and developed sedation, miosis, and significant bradypnea with hypoxic respiratory failure. The methadone belonged to her parent, who, due to COVID-19, was receiving several days-worth of take-home doses at a time from her clinic. The child received an initial 0.09 mg/kg of intranasal naloxone by EMS with transient improvement, though required a second bolus of 0.1 mg/kg intravenous naloxone and subsequent continuous infusion. Electrocardiogram at 6 and 12 hours post ingestion demonstrated ventricular bigeminy with unifocal PVCs which originated from the right-ventricular outflow tract. At 16 hours post-ingestion, she had 3 PVCs within a 10 second rhythm strip, and by 24 hours post ingestion, none. During this period, she had no evidence of poor perfusion or apparent symptoms. Her QTc interval peaked at 441 msec. Her magnesium ranged from 2.0-2.5 mg/dL and potassium from 4.0 to 4.57 mmol/L during this period. She had no further hypoxia or respiratory depression while on the naloxone drip. Serum methadone concentration obtained 20 hours post-ingestion was 164 ng/mL. Urine comprehensive drug screen (Quest Diagnostics) revealed methadone and its metabolite without any other compounds identified.
Case Discussion: Our patient's classic opioid toxidrome responded well to naloxone. Despite normal electrolytes, QTc interval, and vital signs, she had frequent ventricular ectopy. Unifocal ventricular ectopic beats originating from the right ventricular outflow tract can be a benign process in some patients. However, the frequency of ectopic beats correlated with the patient's gradual resolution of opioid toxicity in the setting of methadone overdose suggests that drug effect may have precipitated this finding. It is possible that a period of hypoxia may have resulted in irritable myocardium, leading to this ectopy, though no ischemic changes were noted on any EKG. We did not identify any co-ingestants. In review of the literature, one adult developed ventricular bigeminy with concomitant administration of methadone, voriconazole, and esomeprazole. Rare instances of ventricular tachycardia have been seen after naloxone was used after surgery or for opioid toxicity in the setting of chronic opioid use; neither of these conditions apply to our patient, and those findings may be due to precipitated opioid withdrawal.
Conclusions: Ventricular ectopy or ventricular bigeminy may be a rare arrhythmia associated with pediatric methadone toxicity. In our case, it appeared to be asymptomatic and resolved over 16-24 hours.

KEYWORDS Methadone, ventricular ectopy, pediatric

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33. Pediatric Clonidine and Guanfacine Poisoning: A Single-Center Retrospective Review

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Objectives: Pediatric patients frequently present with clonidine and guanfacine poisoning. The appropriate management and disposition of the patients is controversial. It is not clear how frequently patients with clonidine and guanfacine poisoning require medical interventions after hospitalization that would necessitate admission to an intensive care unit (ICU). We performed a retrospective review of pediatric patients with clonidine and guanfacine poisoning managed by our medical toxicology service.
Methods: We conducted an IRB exempt, retrospective, single-center chart review using an internal database. We reviewed cases from January 2007 through December 2019. Patients <18 years old presenting to our affiliated children's hospital with clonidine or guanfacine exposure were included. Patients were excluded if medical records were not available for review. We assessed co-ingestants, intent of overdose, level of care required, medical interventions, length of stay, and hospital outcomes.
Results: We reviewed 56 cases of clonidine exposure and 19 cases of guanfacine exposure. Most cases of clonidine exposure involved exploratory ingestions; a plurality of cases of guanfacine exposure involved ingestions with suicidal intent. Patients with both exposures were frequently admitted to the ICU (clonidine 66%, guanfacine 32%), but very few patients stayed in the ICU longer than one day (clonidine 7%, guanfacine 11%).
The most common medical interventions were intravenous fluid resuscitation (clonidine 34%, guanfacine 21%) and naloxone (clonidine 39%, guanfacine 5%). Atropine (clonidine 14%, guanfacine 5%) was occasionally given. Endotracheal intubation (clonidine 11%, guanfacine 5%) and administration of activated charcoal (clonidine 7%, guanfacine 0%) were uncommon. Naloxone was generally under-dosed, with no patient receiving greater than 4 milligrams.
With the exception of one patient who developed iatrogenic charcoal pneumonitis and one patient who co-ingested a large amount of bupropion, no patients were treated with inotropes or vasopressors, no patient remained on a ventilator for longer than one day, and there were no deaths.
Almost all medical interventions were performed prior to hospital admission; very few patients underwent *any* medical intervention *after* hospital admission (clonidine 7%, guanfacine 5%). When the two unusual patients described above were excluded, only 5% of patients with clonidine exposure, and no patients with guanfacine exposure, underwent post-admission medical intervention. The post-admission interventions performed were the administration of atropine (2 cases), glycopyrrolate (1 case), and naloxone (1 case). No patient underwent post-admission intubation or initiation of vasopressors or inotropes.
Conclusions: Pediatric clonidine and guanfacine exposures are usually benign and well-tolerated. Patients with clonidine and guanfacine exposures rarely require medical intervention after hospitalization, and thus may not require ICU admission. There were no deaths in our study that were attributable to the effects of clonidine or guanfacine.

KEYWORDS Clonidine, Guanfacine, Pediatrics

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Table 1(#33). Demographics of pediatric patients with clonidine or guanfacine poisoning.

Variable	Clonidine [n (%)]	Guanfacine [n (%)]
Age		
<2 years	11 (19.6)	1 (5.3)
2-6 years	27 (48.2)	5 (26.3)
7-12 years	7 (12.5)	3 (15.8)
13-18 years	11 (19.6)	10 (52.6)
Sex		
Male	27 (48.2)	11 (57.9)
Female	29 (51.8)	8 (42.1)
Type of Ingestion		
Single substance	47 (83.9)	11 (57.9)
Polysubstance	9 (16.1)	8 (42.1)
Intent of Ingestion		
Exploratory	31 (55.4)	5 (26.3)
Therapeutic misadventure	3 (5.4)	1 (5.3)
Suicidal	12 (21.4)	8 (42.1)
Intentional non-suicidal	1 (1.8)	5 (26.3)
Unclear	9 (16.1)	0 (0)

34. Candlenut Seed (Aleurites Moluccanus), an Herbal Weight Loss Supplement with Possible Cardiotoxic Effects in Overdose

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Background: There is a widely held belief that herbal dietary supplements are safer than pharmaceutical medications. Herbal dietary supplements are a popular method for patients to attempt weight loss. Due to the lack of regulatory oversite regarding the quality and safety of herbal supplements there have been multiple reports of patients developing serious side effects and even deaths from the use of these products. This product contains candlenut seeds from the *Aleurites coluccanus* tree and is easily obtained from the internet. It is promoted to have fat burning properties and used as a gentle laxative and diuretic among multiple other claims. The doses vary, but a typically recommend dose of a quarter of a seed several times a week.
Case Report: We present the case of a 43-year-old woman who was taking Nuez Dela India for weight loss. Our patient reported she misunderstood and accidently took a quarter cup of the seeds instead of the recommended quarter of a seed dose the night before presenting to an emergency department with

Table 2(#33). Medical outcomes of pediatric patients with clonidine or guanfacine poisoning.

Outcome	Clonidine [n (%)]	Guanfacine [n (%)]
ICU admission	37 (66.1)	6 (31.6)
ICU admission >1 day	4 (7.1)	2 (10.5)
Hospital admission	56 (100)	18 (94.7)
Hospital admission >1 day	15 (26.8)	8 (42.1)
Any intervention	37 (66.1)	6 (31.6)
Any intervention after admission	4 (7.1)	1 (5.3)
Activated charcoal	4 (7.1)	0 (0)
Intravenous fluid resuscitation	19 (33.9)	4 (21.1)
Naloxone	22 (39.3)	1 (5.3)
Atropine	8 (14.3)	1 (5.3)
Vasopresors and/or inotropes	1 (1.8)	1 (5.3)
Endotracheal intubation	6 (10.7)	1 (5.3)
Death	1 (1.8)	1 (5.3)

Table 3(#33). Use of naloxone in pediatric patients with clonidine or guanfacine poisoning.

Outcome	n
Naloxone given	20
Naloxone infusion	4
Naloxone bolus dose known	12
<1mg	3
1-1.9mg	2
2-4mg	7
>4mg	0

weakness and fatigue, reported to be too ill to even say her name. On exam she was diaphoretic with hypotension and bradycardia. Her home medications included buspirone, clonazepam, propranolol, ropinirole, and venlafaxine. Her laboratory evaluation showed hyperkalemia at 7.7 mmol/L and an undetectable digoxin level. She responded briefly to initial interventions including atropine, epinephrine, calcium, sodium bicarbonate, insulin, and glucose, and was able to provide additional history. She denied taking an overdose of these medications or having suicidal ideations. Several hours after arrival to the emergency department she had a seizure followed by a non-survivable cardiac arrest.

Case Discussion: Candlenut is known to contain phorbol esters and saponins, but there is no definitive evidence that it contains a cardiac glycoside. Despite this there are several reports of candlenut ingestions causing hypotension, bradycardia, and cardiac dysrhythmias including some echocardiogram findings that resemble those seen with patients taking a cardiac glycoside. The test for digoxin was not designed to detect other naturally occurring cardiac glycosides, and while it can detect the presence of some, it is possible it may miss others.

Conclusions: In light of her denial of overdose on her home medications, this patient's presentation of hypotension, bradycardia, hyperkalemia, and subsequent cardiac arrest could be explained by the presence of a cardiac glycoside and accidental overdose of a supplement containing candlenut.

KEYWORDS Candlenut, Supplement, Cardiac Glycoside

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35. The Inception, Execution and Sunsetting of a Poison Center based COVID-19 Information Line

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Background: On 1/24/20 the state Poison Center (PCC) contacted the state Division of Public Health and within five days activated an information line using a separate 1-800 number for the public's COVID-19 concerns on 1/29 (Day 1). When case volume began increasing in late February, additional paid staff were recruited from a pool of allied health students utilizing pre-existing agreements with their schools. Once the state Division of Public Health established their own call center, the hotline number was re-routed, and the dedicated PCC COVID-19 information line ceased on 4/29/20 (Day 92).

Methods: Retrospective review of PCC information cases with COVID-19 substance codes 7325206 or 7324190. Cases from two early days (Day 5 and 6, n = 65), the median day (Day 46, n = 570) and one of the ending days (Day 91, n = 104) were reviewed by a single researcher. The caller's question was categorized into one of ten categories; for cases where the question could not be categorized into a single category, a secondary category was also selected. The percentage of each question category during the three time periods was determined. Cases with a secondary question were weighted 0.66 for the primary and 0.33 for the secondary question.

Initial resources consisted of a clinical guideline with an algorithm to assist with testing decisions and inform of CDC updates. A message map was developed on Day 34 to address the need for consistent, key information about specific topics. A document containing lists of virtual visit and testing sites for all regional major health care systems was established on Day 57. All tools were updated independently and frequently as caller questions changed.

Results: There were a total of 22,191 cases managed during the 92-day period; the busiest day was Day 55 (3/23) with 988 cases; (Figure 1). The busiest days of the week were Tuesdays (16%) and Wednesdays (16.8%); Saturday (10.5%) and Sunday (11.2%) had the least calls. There were 542 calls made to the state epidemiologist with 73.2% of them during Days 41-55. The phone greeting recording was changed on Day 58 to redirect non-medical related callers to appropriate resources with a 46% fall in case volume comparing the two days prior and the two days afterward.

The types of caller questions changed over time. The most frequent questions from the early days (Day 5 &6) were clinical without symptoms (39%), travel related (22%) and viral spread from inanimate objects (16%); from the median day (Day 46) were clinical with symptoms (42%), clinical without symptoms (23%) and travel related (11%); and from the ending day (Day 91) were clinical with symptoms (44%), testing logistics (31%) and clinical without symptoms (14%).

Conclusions: PCCs can rapidly establish a clinical information line and maintain it for more than 90 days using their existing platforms and additional paid staff recruited from allied health schools. The tools required for management should be expected to change over time.

KEYWORDS Coronavirus, Public Health, Surge Capacity

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36. The Effects of Limb Elevation on Reported Pain and Swelling from North American Crotalid Envenomations

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Background: Human crotalid limb envenomations can result in significant morbidity due to local tissue damage and swelling. There is no standard of care regarding limb elevation in these cases; some believe it improves pain and swelling which if true could potentially reduce the amount of antivenom and analgesia used, while others do not elevate. Studies of the effect of elevation on the clinical course of crotalid limb envenomations are lacking.

Methods: Retrospective review of one Poison Center's (PCC) cases of human crotalid envenomations from 1/1/2014 to 12/31/2017. Case notes (and electronic hospital records when available) were reviewed with collection of the patient's age, type of snake, body location bitten, presence of swelling (none/dry, or mild or greater), antivenom treatment, the amount of elevation (none, partial or full) and if pain or swelling reoccurred when elevation stopped or if pain or swelling was better when elevation was performed (a standard PCC assessment question).

Results: There were 1988 cases included; cases were excluded for not being a crotalid bite (n = 365), out of state exposure (n = 34), not followed (n = 32), drug seeking behavior (n = 29), trunk/neck envenomation (n = 11), or age less than or equal to 6 years (n = 108). There were 1659 (83.5%) copperhead/cottonmouth envenomations, 289 (14.5%) unknown crotalid and 40 (2.0%) rattlesnake bites. Elevation (full or partial) was reported in 1736 (87.3%) patients.

For patients with mild or greater swelling (n = 1750, 88.0%), there were 1331 (76.1%) cases where pain/swelling reoccurred when elevation stopped, or pain/swelling was better when elevation was performed; 196 cases (11.2%) did not have enough documentation to answer this question. For the subset of patients who received antivenom (n = 667, 33.6%) there were

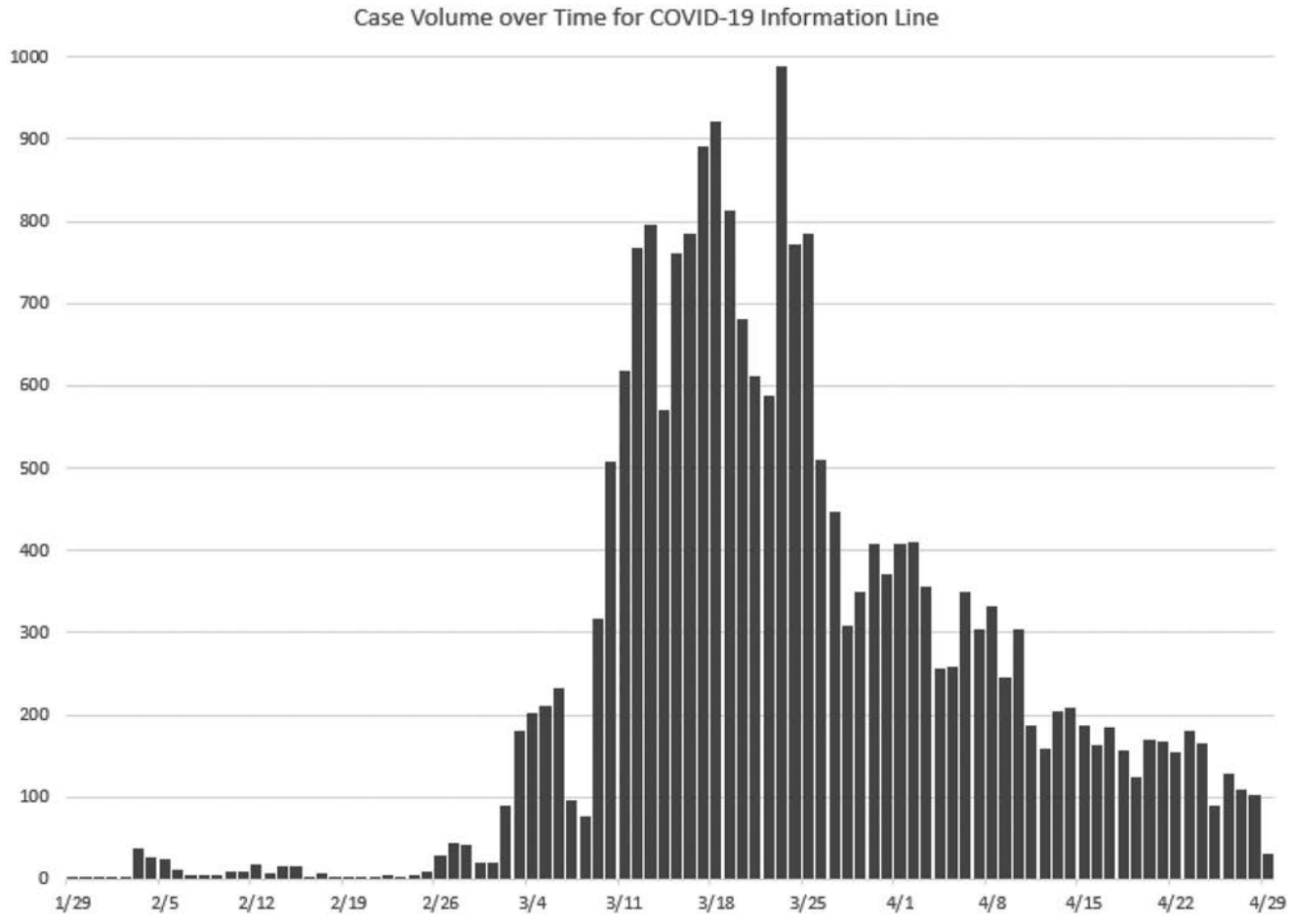

Figure (#35).

549 (82.3%) cases where pain/swelling reoccurred when elevation stopped, or pain/swelling was better when elevation was performed; 47 cases (7.0%) did not have enough documentation to answer this question.

Conclusions: In conjunction with standard care and assessment, limb elevation should be strongly considered for adolescent or adult patients with a crotalid envenomated extremity as it is associated with improvement in pain and/or swelling in the majority of patients. It remains to be seen if this holds true in children as their compliance with instruction and crotalid envenomation clinical course may be different.

KEYWORDS Snake bite, Analgesia, Copperhead

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37. Correlation Between Methamphetamine Seizures By State Police and Cases Reported to a Regional Poison Center by Geographic Region

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Background: Methamphetamine abuse and mortality are increasing in the United States. Monitoring and surveillance of different databases may assist in identifying patterns and emerging epidemics. Early detection of increasing use in communities may allow earlier intervention that can mitigate community harm.

This study is an analysis of state police laboratory data compared to regional poison center (RPC) methamphetamine cases, based on unique geographic regions of the state. The Department of Human Services (DHS) has divided the state into five regions ranging from urban (region 1), suburban (region 2), mixed large metropolitan/rural (region 3) and rural (regions 4 and 5) areas of the state. This study centered on analyzing regional variations in police seizures and methamphetamine cases in the RPC database on a population basis and evaluating for a correlation between the data sets.

Methods: We analyzed the amount of methamphetamine seized by state police and RPC methamphetamine cases, both organized by DHS region for the years 2009-2017. Both were corrected for population. Cases were excluded if drug intoxication/overdose was not confirmed by history or testing, cases did not present to a healthcare facility (HCF), the case originated outside the studied state, the case involved a methamphetamine lab or the case involved prescription methamphetamine.

Results: The data showed a major increase in methamphetamine cases in the RPC database starting in 2014-2015. This was present in all 5 DHS regions, but it was most prevalent in the most rural DHS regions: 4 and 5. The state police data showed a similar phenomenon. For these rural regions, there was a statistically significant correlation between RPC cases and methamphetamine seized.

Conclusion: Both presentations to a HCF reported to the RPC and seizures of methamphetamine by state police have increased over the past five years. There is significant variability between urban, suburban and rural populations in number cases reported to the RPC and in the amount of methamphetamine seized.

Rural populations have both larger amounts of RPC cases and amounts of methamphetamine seized on a population basis. There is a statistically significant correlation between the amount of methamphetamine seized and cases reported to the RPC in rural populations but not in urban, suburban or regions with large metropolitan areas.

KEYWORDS Methamphetamine, Law Enforcement, Epidemic

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38. Dosing Heat: Expected Core Temperature Change with Warmed or Cooled Intravenous Fluids

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Introduction: Emergent modification of a patient's body temperature is crucial in certain disease or injury states. Drug toxicity such as sympathomimetic toxidrome and malignant hyperthermia may require rapid cooling. Similarly, CNS depressants such as ethanol and barbiturates may lead to life-threatening hypothermia related to environmental exposure. Although advanced targeted temperature management techniques such as central venous catheter devices and forced air rewarming exist at some centers, they are not universally available. Virtually all medical centers have access to warmed or cooled intravenous fluids. This study approximates the change in body temperature for a given volume of room temperature, chilled, or heated isotonic crystalloid bolus.
Methods: Using thermodynamic principles, a mathematical model was created to approximate change in body core temperature in response to a given volume and temperature of intravenous fluid. The model assumes rapid fluid infusion and the previously published specific heat capacity of the human body of 3.47 J/kg·°C.
Values were calculated under conditions of varying body temperatures from profound hypothermia to hyperthermia (18–45 °C). Various crystalloid temperatures representing iced, room-temperature, and warmed (4 °C, 20 °C, 42 °C) were used in the calculations.
Results: Each 30 mL·kg^{-1} dose of 20 °C crystalloid is expected to cool a hyperthermic (38–45 °C) patient by 0.6–0.9 °C. Each 30 mL·kg^{-1} dose of 4 °C crystalloid is expected to cool a hyperthermic (38–45 °C) patient by 1.2–1.4 °C. Each dose of 42 °C crystalloid is expected to warm a mildly hypothermic (32–35 °C) patient by 0.2–0.3 °C, a moderately hypothermic (28–32 °C) patient by 0.3–0.5 °C, a severely hypothermic (24–28 °C) patient by 0.5–0.6 °C, and a profoundly hypothermic (18–24 °C) patient 0.6–0.8 °C.
Discussion: This study has several limitations in that all estimates of change in body temperature are based on mathematical models rather than clinical evidence. A controlled human trial assessing these results is unlikely because inducing dangerous temperature change in healthy subjects is unethical, and prospectively gathering patient data is subject to confounding by other temperature modifying therapies.
Using the results in this study, clinicians may roughly estimate the effect of temperature management with varying doses of intravenous fluids and thus assess the benefits of this technique. Risk should be evaluated based on inevitable co-administered volume and electrolytes. Individuals with volume-sensitive conditions such as heart, liver or kidney failure deserve particular attention.
The dose-response relationship described herein may imply situations where warmed or cooled fluids offer insubstantial therapeutic effect. For example, potentially dangerous volumes of warm fluid are required to make a clinically significant temperature difference in mildly or moderately hypothermic patients, or as solitary therapy for induced hypothermia. In other cases, hypothermic patients may require large fluid volumes due to cold diuresis and so the co-administration of intravenous heat and volume may be beneficial.
Conclusion: Clinicians should consider the relationship between intravenous fluid dose and temperature change on the human body.

KEYWORDS Hyperthermia, Hypothermia, Temperature

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39. A Toxic Who Done It - The Antidote for IPE?

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Background: Achieving the Accreditation Council for Pharmacy Education (ACPE) standard for IPE (standard 11, interprofessional education with physicians and their learners) has historically been difficult for our School of Pharmacy (SOP) due to the lack of a nearby medical school. After a poor turnout from the recruitment of local medical residents during the previous academic year, it was decided to instead create an authentic interprofessional experience that allowed for remote participation.
Knowing that participants would be pharmacy students, medical students, and residents at different stages of their training, patient cases were purposely designed in the field of toxicology as a way to even the playing field. Students are taught very little toxicology in their curriculum, whether it is pharmacy or medical school, so this offered the opportunity to deliver interprofessional education (IPE) in a meaningful way across professions, without being forced or unrealistic.
Methods: SOP faculty designed progressive patient cases in a format similar to the "Choose Your Own Adventure" book series. After a brief introduction, participants were separated into breakout rooms, with each small group having either a medical student or resident. Groups were then asked to work together through two different patient cases: an overdose of Tylenol PM^{O} and a combined opiate/benzodiazepine overdose. At each time point during the case, groups received new information about the patient and were asked to select an appropriate treatment from a handful of options provided. Each treatment option led the groups down a different "path," including immediate feedback on their selection and the option to try again.

Table (#37).

DHS Region	Population Density (persons/square mile, 2017 only)	Exposures/1,000,000 population (range)	Grams Methamphetamine seized/100,000 population (range)	Pearson Correlation for 9 year data points (and p value)
1	5,532	0.6 – 3.9	26.6 – 253.6	0.28 ($p = 0.4$)
2	439	0 – 2.9	3.4 - 103	0.41 ($p = 0.3$)
3	91	0.7 – 20.7	45.2 – 571.3	0.52 ($p = 0.2$)
4	60	3.3 – 35.5	89.4 – 498.3	0.82 ($p < 0.01$)
5	83	5.0 – 40.0	217.8 – 880.9	0.95 ($p < 0.01$)

Table 1(#38). Expected temperature change per 30 mL·kg^{-1} crystalloid bolus.

	Fluid Temperature (°C)		
Initial Temperature (°C)	4	20	42
18	−0.5	0.1	0.8
19	−0.5	0.0	0.8
20	−0.6	0.0	0.8
21	−0.6	0.0	0.7
22	−0.6	−0.1	0.7
23	−0.7	−0.1	0.7
24	−0.7	−0.1	0.6
25	−0.7	−0.2	0.6
26	−0.8	−0.2	0.6
27	−0.8	−0.2	0.5
28	−0.8	−0.3	0.5
29	−0.9	−0.3	0.5
30	−0.9	−0.3	0.4
31	−0.9	−0.4	0.4
32	−1.0	−0.4	0.3
33	−1.0	−0.5	0.3
34	−1.0	−0.5	0.3
35	−1.1	−0.5	0.2
36	−1.1	−0.6	0.2
37	−1.2	−0.6	0.2
38	−1.2	−0.6	0.1
39	−1.2	−0.7	0.1
40	−1.3	−0.7	0.1
41	−1.3	−0.7	0.0
42	−1.3	−0.8	0.0
43	−1.4	−0.8	0.0
44	−1.4	−0.8	−0.1
45	−1.4	−0.9	−0.1

All second-year pharmacy students were required to participate in the IPE as part of their coursework. Medical students and faculty were recruited from two nearby medical schools. Pharmacy faculty also recruited medical residents through their clinical practice sites and word of mouth. A financial incentive was offered to all medical students, residents, and faculty.

Due to COVID-19, the activity ended up taking place entirely online.

Results: Participants included 93 pharmacy students, 7 medical students, 2 physicians, 5 pharmacy faculty, and 4 staff members.

A survey of participants found that the top 3 most valuable aspects of the activity were (in order): working together as a team, the toxicology content, and getting to follow a patient over time. When asked to select a letter grade, the vast majority of participants rated their group as an A or A+.

A number of pharmacy students commented that they appreciated having either a medical student or physician in their group to read the ECG and interpret physical exam findings. Multiple medical students stated they were impressed by the speed with which pharmacy students were able to identify medications.

Conclusions: This activity shows that remote IPE can be done in an authentic way and that toxicology may be an ideal subject for naturally integrating students with different professional backgrounds.

KEYWORDS Interprofessional education, Online simulation, Toxicology

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40. Widespread Familial Elemental Mercury Exposure with the Poison Center Serving as the One Point of Continuity for All Exposed Persons

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Background: Managing multiple cases of elevated blood mercury levels from a widespread elemental mercury contamination is a labor intensive problem which involved the poison center coordinating multiple local, state and federal entities outside the poison center.

Case Presentation: The PCC received a call from Patient 5A*, indicating a four-ounce vial of elemental mercury broke on a hard surface 15 days prior (Day 1). It was reported that two children, Patients 1A and 2A, briefly played with the mercury while the other parent, Patient 4A, swept up the spill within a few minutes. 1A and 2A developed fever and rash on Day 8. Outpatient Clinic #1 called the PCC on Day 18 regarding Patient 1A's mercury exposure. It was now reported that one-fourth pound of Hg was spilled on a couch and carpet 10 days prior (Day 8). Patient 4A reported Hg was found in the family car and Patient 5A subsequently took car to a local car wash to vacuum.

On Day 20, Outpatient Clinic #2 called the PCC concerning a relative, Patient 6B, who was also exposed. On Day 21, the PCC received two separate calls regarding six additional patients (7B, 9B, 10B, 11C, 12C, 13C) linked to this same incident. As the incident continued to expand, one senior SPI was designated to be the PCC's point person for coordinating the care of all involved patients. On Day 23, the senior SPI reached out to original family and identified additional patients 3A, 4A, 5A, and 8B. In total, 13 individuals from 3 families, two houses, one car and one school were involved. Both houses and car were extensively contaminated with Hg.

Table 1 provides results of blood and urine Hg testing, and which patients received chelation.

The number and timing of Hg spills was uncertain because of different information provided to the various participating agencies. Due to the chronicity of exposures and the lack of data defining a toxic blood Hg level in children, six of the seven children were chelated. There was a delay in obtaining the DMSA for all patients due to retail pharmacies not stocking DMSA, the cost of the medication and, in some cases, medical insurance issues.

Case Discussion: What began as one call to the PCC on a Sunday afternoon resulted in a major response involving the local HazMat team, three local outpatient clinics, the local hospital, the county and state public health departments, the state department of environmental protection, the regional PEHSU and EPA, and several nationally recognized experts in Hg toxicology. The poison center's senior SPI was the UnityPoint for managing close follow-up on all 13 patients, 8 of who were treated with DMSA.

Conclusion: Utilizing one senior SPI facilitated the continuity of care with the three families and the numerous health care providers at the three outpatient clinics. Follow-up has continued for over 4 months with 338 total call backs to date.

*Each of the 13 individual patients are numbered consecutively, while the 3 households are denoted A, B, and C.

KEYWORDS Elemental mercury poisoning, Succimer chelation, Care Coordination UnityPoint

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41. Death from Chloroquine Diphosphate: How Much is a "Heaping" Teaspoon?

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Table (#40).

Patient (Number) and Household (Letter)	Age (years)	Day Test Obtained	Blood (ng Hg /mL)	24 hour Urine (mcg Hg/24 hrs)	Chelation with DMSA
1a	9	15	>200	>400	YES
		24	88	>244	Mid-chelation
		38	35		End chelation
		26	26		
		19	19		
2a	7	19	140		YES
					While on DMSA:
					AST 39 ->95 IU/L
					ALT 62 -> 188 IU/L
					Neutrophils 1.77 K/mcL (22.8%)
		47	21		End chelation
		89	9		
3a	15	19	102		YES
		47	20		End chelation
4a	32	19	162		YES
		47	20		End chelation
		69	11		
5a	35	Not known	7		No
6b	2	20	46	Spot UA 82 mcg Hg/g Cr	YES
		51	8		End chelation
		93	3		
7b	7	21	15	13	No
		55	2		
8b	9	20	60		YES
		51	7		End chelation
		93	2		
9b	11	21	35	32	YES
		67	3		
10b	29F	21	41	20	No DMSA due to risk of use in pregnancy
	20 week Preg	45	9		
		89	4		
11c	59	21	17	10	No
		45	4		
12c	63	21	39	39	No
13c	69	21	78	111	YES
		45	20	232	Mid-chelation
		54	12	392	End chelation

Introduction: In mid-March of 2020, chloroquine diphosphate (CQ-2P) was mentioned as a possible treatment for SARS-CoV-19. The ingestion of a "heaping" teaspoon of a CQ-2P aquarium product led to a fatal overdose in Arizona, USA. In trying to quantify the weight of a "heaping" teaspoon of CQ-2P, the density of CQ-2P could not be found, nor any consistent or scientific definition of the volume of a "heaping" teaspoon.

Methods: The non-compressed density of CQ-2P powder was measured by pouring 50 grams of CQ-2P powder into a 100 mL graduated cylinder. The compressed density was measured by vibrating the cylinder at 10,000 beats per minute until the powder was no longer visibly compacting.

Three differently shaped teaspoons were used. For a heaping teaspoon, as much non-compressed CQ-2P powder as could be loaded on the teaspoon without any sliding off was weighed. For a rounded teaspoon, two researchers agreed on an amount of non-compressed powder that formed a dome above the rim of the teaspoon that appeared to be equal to the depth of the teaspoon. For the level teaspoon, each teaspoon was filled with non-compressed powder and leveled off using a knife. To determine the weight of a level teaspoon of compressed powder, a rounded teaspoon of bulk powder was compressed into the spoon's bowl using a flat surface and a force of 150 N. Additional CQ-2P powder was compressed into the teaspoon two additional times before measurements were taken. The teaspoon's volume was leveled off during the third compression.The weights of a level, rounded and heaping teaspoon of non-compressed CQ-2P powder, and the weight of a level teaspoon of compressed CQ-2P powder were measured. Each measurement was repeated 10 times with each of the three teaspoons.

Results: The density of non-compressed and compressed CQ-2P powder were 0.756 g/mL and 0.929 g/mL respectively. The weight and corresponding volume of a level, rounded and heaping teaspoon of non-compressed CQ-2P powder were 3.53 g / 4.7 mL, 9.15 g / 12.1 mL, and 14.64 g / 19.4 mL, respectively. The weight and volume of a level teaspoon of compressed CQ-2P powder was 4.43 g and 4.8 mL.

Discussion: The assumption that one teaspoon is 5 mL or 5 g of a substance does not consider the density of the substance nor the load of material on the teaspoon. The results show there can be as much as a 2.5-fold difference in the weight of CQ-2P powder from a level to rounded teaspoon and a 4-fold difference from level to heaping teaspoon. This information may be helpful to PCC staff making triage decisions, as well as to health care providers when anticipating the severity of an ingestion.

Conclusions: The ingestion of very small volume of a CQ-2P aquarium product can be fatal. This is the first study to accurately quantify the amount of a powder in a level, rounded and heaping teaspoon.

KEYWORDS Chloroquine, CoVID-19, Heaping teaspoon

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42. Surprising decrease in the number of intentional self-harm cases among teenagers called to US poison centers early in the Coronavirus pandemic – April, 2020

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Background: Between 2010 and 2019 US poison control centers (PCCs) noted a 77.5% increase in the number of cases involving teenagers (aged 13-19 years) with exposures to xenobiotics for the purpose of intentional self-harm (ISH). The number of teenage ISH cases among females increased by a staggering 90.6% during that time. The SARS-CoV-19 pandemic has caused drastic social changes throughout the US, and world. Social upheaval, isolation and fear have caused significant physical and emotional stress for many. When global society will return to "normal" is unknown. In April of 2020, a PCC made the curious observation that there appeared to be much fewer ISH cases involving teenagers.
Methods: The American Association of Poison Control Center's National Poison Data System (NPDS) collects data in real time from all 55 US PCCs. This data base was searched (between 1/1/10 and 4/25/20) using the criteria: closed human exposures, intentional-suspect suicide (for reason of exposure), age range 13-19 years; results were divided by gender. Cases without gender data ($\leq$ 0.14% for any year) were excluded. For 2010 through 2019, the average weekly number of teen ISH cases was determine for 2010-2019; from 1/6/19 through 4/25/20 each week was individually searched for the number of teen ISH cases.
Results: The average number of ISH cases among teenagers called to US PCCs peaked at 1,601 in 2017, and remained essentially level through 2019. The weekly average number of teen ISH cases peaked for males at 374 in 2019 and for females at 1,257 in 2017. Overall cases continued to increase for the first 10 weeks of 2020. For weeks 11-16 of 2020, there was a significant decrease in total and female teenage ISH cases. These decreases were statistically significant compared to weeks 11-16 of 2019 and 1-10 of 2020 (Table 1).
Discussion: The decrease in teen ISH cases may be due to several factors including: sampling bias (cases not being called to PCCs), increased suicides among this age group without PCC involvement, or a true decrease in teenage ISH exposures. Possible causes for a true decrease in teenage ISH cases include less social trauma (e.g. at school), restructured social (home) support, and communal empathy concerning Coronavirus.
Conclusion: This trend should be tracked through (and after) this pandemic to better understand and prepare for similar events in the future.

KEYWORDS Teenager intentional self harm, CoVID-19, Poison Center NPDS Data

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Table 1(#42). Average weekly number of cases called to US poison centers involving teenagers exposed to xenobiotics with the intent of self-harm.

Time Period	Males	Females	Total
2019			
Weeks 11-16 3/17-4/27	390.0	1306.2	1698.3
2020			
Weeks 1-10 1/5-3/14	429.3	1404.9	1836.1
Weeks 11-16 3/15-4/25	336.0 † §	1041.7 † ¶	1379.7 † ¶

† P <0.0001 versus 2020 weeks 1-10.
§ P =0.0060 versus 2019 weeks 11-16.
¶ P <0.0001 versus 2019 weeks 11-16.

43. Rattlesnake Envenomation in the Setting of Disrupted Lymphatic Flow: A Case Series

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Background: Rattlesnake envenomation is a pathophysiologically complex process with a range of local effects including pain, erythema, local edema resembling compartment syndrome, ecchymosis that extends beyond the bitten extremity, tissue damage from the fang puncture as well as the development of blisters, bullae and tissue necrosis in severe cases. Central and systemic effects include nausea, emesis, hypotension, metallic taste, paresthesias, fasciculations, and a coagulopathy with laboratory values resembling a disseminated intravascular coagulation-like syndrome. Previous animal studies have suggested that lymphatic flow is a crucial part of dissemination of venom after initial injection to produce systemic effects. However, the effects of baseline lymphatic obstruction on local injury in humans have yet to be described clinically.
Case Reports: Three cases of patients that sustained rattlesnake bites with a history of lymphatic disruptions were reviewed, two with histories of mastectomies and one with chronic lower extremity lymphedema. All three patients experienced bites on the limb affected by lymphatic obstruction, yet their presentation varied.
Case Discussion: The first case describes a woman with a history of bilateral mastectomy and complete lymph node dissection who was bitten on her upper extremity and developed severe local cytotoxicity with hemorrhagic bullae and tissue necrosis despite standard antivenom administration protocols. Bearing this outcome in mind, providers in the second case treated the patient, who also had a history of mastectomy and complete lymph node dissection, more aggressively with repeat loading doses rather than maintenance dosing based on standard criteria of swelling progression greater than an inch an hour. In this instance, the patient had a favorable outcome with complete recovery of the local tissue and no evidence of necrosis. The final case, which involved a bite on an extremity with chronic lymphedema, resulted in delayed necrotic skin breakdown requiring two surgical debridements after initial standard antivenom dosing.
Conclusion: The clinical outcomes of these cases revealed a more severe local injury with lymphatic disruption, suggesting that either venom is unable to travel systemically and concentrates at the site of injection or that antivenom therapy is unable to reach the site of the bite. Future studies are needed to better understand this relationship as this case series suggests that lymphatic obstruction may be a risk factor for more severe local injury.

KEYWORDS rattlesnake, envenomation, antivenom

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44. Massive Propranolol Ingestion Successfully Treated with Very High Dose Insulin Euglycemic Therapy (18u/kg/hr)

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Background: Propranolol is a non-specific beta blocker that is highly lipophilic, which allows it to cross the blood brain barrier. Although still used to treat hypertension and to prevent acute cardiovascular events, it is often used for the treatment of situational anxiety. The lowest reported fatal dose of propranolol is 800mg.
Case Report: A 14-year-old female presented to the ED 30 minutes after ingesting 910 mg propranolol, 630 mg fluoxetine, and 8400 mg of quetiapine. Her mental status and vital signs were normal upon ED arrival. After 20 minutes in the ED, she became acutely obtunded and was intubated. Gastric lavage was performed, with return of pill fragments. A nasogastric tube was placed, 100 gm of activated charcoal was administered, and whole bowel irrigation was initiated. CBC and CMP were unremarkable. APAP/ASA/EtOH were non-detectable. Vital signs after intubation were HR 89, BP 89/59, RR 18, and O2 Sat 100%.
After transfer to a quaternary care center PICU, vital signs were: HR 82, BP 87/53 mm, RR 16 (mechanically ventilated), normothermic, and O2 Sat 100%. Whole bowel irrigation was stopped on account of absent bowel sounds and abdominal distention. She was hypotensive with a systolic BP in the 80's and an epinephrine infusion was started at 0.1 mcg/kg/min with good response. High dose insulin euglycemic therapy (HIET) was initiated with the goal to stave off cardiovascular collapse and wean pressor requirements. HIET dosing peaked on PICU day 5 at 18 units/kg/hr, with a 50% reduction in vasopressor requirement. HIET and vasopressors were discontinued on PICU day 6. She was extubated neurologically intact, and ultimately admitted to psychiatry. Her peak propranolol level was 803 ng/mL.
Case Discussion: We attribute the duration and intensity of our patient's propranolol toxicity to prolonged GI absorption, either from a pharmacobezoar or ileus. Oddly, her 12-hour serum propranolol level of 803 ng/mL is lower than the 2000 ng/mL level previously reported as a threshold for "probably toxicity." It is possible that her fluoxetine or quetiapine co-ingestions exacerbated the propranolol toxicity, or more likely, that 803 ng/ml does not reflect her true peak level. Although never severely bradycardic, her blood pressure was dependent upon HIET throughout her PICU stay, and would exhibit precipitous decline with increased vasopressor requirement whenever HIET weaning was attempted. Likewise, she exhibited almost no vasopressor requirement at HIET 18 u/kg/hr.
Conclusions: Propranolol can exert prolonged toxicity in large overdoses, and HIET is an effective antidote for propranolol toxicity, although higher than usual HIET dosing regimens may be required to manage severe poisonings.

KEYWORDS beta-blocker, anti-hypertensive, propranolol

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45. When the Researcher Becomes the Subject: Insights from a Severe Puff Adder (Bitis arietans) Envenomation in a Herpetologist

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Background: The clinical evolution and management of African snake envenomations are poorly known due to the challenges of obtaining accurate, detailed information throughout the course of the event. Some of the most valuable insights into snakebites have resulted from unfortunate situations where herpetologists found themselves on the receiving end of an envenomation. We present the case of a herpetologist who suffered a severe envenomation by a large puff adder (*Bitis arietans*) in rural Guinea and was evaluated and treated within minutes of the event.
Case Report: A 64-year-old male herpetologist with no prior envenomations presented to a snakebite clinic 5 minutes after a witnessed bite from a 1.5 meter captive adult puff adder to his left index finger. The bite occurred while he was picking up the snake to perform a venom extraction and one fang briefly penetrated the skin. An IV was placed 7 minutes after the bite, and a blood sample obtained for WBCT testing at this time already demonstrated delayed coagulopathy with an abnormal clot at 20 minutes that failed to stabilize until 30 minutes. Initial presentation was moderate tenderness to palpation to the wrist, local swelling and severe pain to the proximal interphalangeal joint, and persistent local bleeding from the site of the wound. A 1.5 cm blister was already visible at the puncture site. Inoserp Pan-Africa (500 LD50) antivenom was administered initially and 2 hours after the envenomation causing cessation of progression of local symptoms and improvement of the WBCT at both 20 and 30 minutes upon re-evaluation 2 hours after the bite. A recurrence of symptoms including progressing edema and tenderness to the elbow and local bleeding from the puncture site occurred 20 hours and 30 hours after the bite. At each interval the patient received 1 vial of antivenom which halted progression of symptoms and improved his pain. Pain management was achieved with low-dose intravenous ketamine and oral/intravenous acetaminophen. The authors obtained serial ECGs, blood samples, and ultrasound imaging to closely document the evolution of the envenomation and the response to antivenom therapy.
Discussion/Conclusions: This case offers insight into the clinical evolution of viper envenomations and raises a number of interesting questions about the impact of early treatment. First, the presence of a venom-induced coagulopathy (VIC) within 7 minutes of the envenomation represents the earliest documented onset of VIC. Second, the progression of blistering and necrosis were halted after the first dose of antivenom was given and never expanded beyond the borders of the initial lesion that was outlined 10 minutes after the bite. The efficacy of antivenom for neutralizing the cytotoxic effects of snake venoms is a matter of debate, but this case anecdotally suggests that early administration of antivenom may be sufficient to prevent disabling injury from occurring. Finally, the polyphasic exacerbation of local signs and symptoms offers insight into the phenomenon of recurrent envenomation and illustrates the value of pain and swelling as sensitive indicators to guide antivenom administration.

KEYWORDS Snakebite, Envenomation, Guinea

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46. Changing Patterns in Deliberate Self-Poisonings from Internet Promotion: Sodium Nitrite

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Background: There are few epidemiological studies of emerging trends in suicide methodology relating to Internet promotion of toxic substances. Rapid surveillance allows the introduction of public health control measures.
Objective: To investigate time trends and demographic characteristics of deliberate self-poisonings with sodium nitrite/nitrate.

Methods: This was a retrospective observational study using data from the National Coronial Information System (July 2000–April 2020), Poisons Information Centres (PIC), toxicology services (January 2014–April 2020) in Australia. Cases were included from coroner-referred deaths and patients who were the subject of a consultation to a PIC or hospital toxicology service involving deliberate self-poisoning with sodium nitrite/nitrate. The main outcome and measures were: Death, date, gender, age, setting of poisoning, geographical location, history of a terminal or psychiatric illness, product.
Results: We identified 56 deliberate self-poisonings, who were mostly male (71%) with a wide age distribution (median: 44 years; IQR: 23-62 years; range: 16-92 years; mode: 20-29 years). The majority had a fatal outcome (77%). A sudden and sustained step-increase in poisonings was seen in September 2017 (and the first death), the same month that euthanasia methodology was promoted on the Internet. Cases were identified across all of Australia, except the Northern Territory. State-based population rates varied between 2 and 8 per 1,000,000 persons. Home (66%) followed by hotel accommodation (19%) were the most common locations for ingestion. Only one case had a history of a terminal illness reported and the majority had a psychiatric illness. All cases with product information available reported use of 100% pure compounds and purchase via the Internet, however significant confusion was identified between sodium nitrite and nitrate in medicolegal records. The best available evidence and toxicity profile suggests sodium nitrite was used most commonly.
Conclusions: The publication of suicide and euthanasia methodology was associated with a dramatic change in harms from sodium nitrite/nitrate in the past two decades. The signal generated by poisons centre cases was confirmed using national coronial data and pooling data from state-based poisons centres and toxicology services. Public health actions in Australia have begun and focused on means restriction and improved antidote stocking and clinical education. National and international collaboration is needed for this and other promoted lethal substances.

KEYWORDS sodium nitrite, sodium nitrate, self-poisoning

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47. The Perils of Hydrogen Peroxide 35%: A Case Series Involving Multiple Imaging Modalities

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Background: Hydrogen Peroxide 35% has been promoted as a non-FDA approved treatment for multiple diseases including cancer and HIV and can liberate large amounts of oxygen (100cc per ml of solution). Data is limited on management and our poison center recently had 5 cases with 3 resulting in portal venous gas. Multiple imaging modalities were used to guide management.
Case series:
Case 1: 22 y/o man with h/o hepatitis C unintentionally ingested ~60-120 cc of hydrogen peroxide 35% and developed abdominal pain, nausea, and vomiting. CT abdomen/pelvis showed portal venous gas and patient was transferred to a hospital where he received hyperbaric oxygen for 6 hours. Repeat CT showed gastric thickening with no perforation and resolution of venous emboli. Endoscopy showed a minimal superficial grade burn (unknown location) and patient was discharged on hospital day (HD) 3.
Case 2: 3 y/o girl drank unknown amount of 35% hydrogen peroxide and vomited multiple times. She was seen at a community hospital where she had epigastric tenderness and a normal abdominal xray. She had red-stringed emesis which prompted transfer to a referral center. An abdominal CT showed trace portal venous gas in the periphery of the right lower lobe of the liver. An EGD found gastritis and an unremarkable esophagus. The patient's symptoms resolved and she was discharged HD 2.
Case 3: A 3 y/o boy unintentionally ingested "2 mouthfuls" of 35% hydrogen peroxide and then vomited twice and subsequently started vomiting blood. His abdominal xray at a community hospital was concerning for portal venous gas and he was transferred to a referral center. On arrival, family noted that he was non-verbal and therefore, CT head, chest, abdomen, and pelvis were performed and showed mild to moderate portal venous gas without intracranial gas. An ultrasound was performed which visualized the portal venous gas. Given an echocardiogram showed no PFO and the CT results, patient was observed in the PICU and not transferred for HBO. On hospital day 2, repeat ultrasound showed resolution of portal venous gas. Endoscopy showed normal esophagus and diffuse erythematous, edematous, and friable stomach lining without ulcers. Patient was discharged on HD 4.
Case 4: 76 y/o woman ingested between 2.5-5 ml of hydrogen peroxide 35% thinking it was her medication. She had vomiting and GI upset. She had a CT of head, chest, abdomen, and pelvis which showed no emboli. The following morning her symptoms related to ingestion resolved and the PCC closed the case.
Case 5: 44 y/o woman ingested a mouthful (~20-30cc) of hydrogen peroxide 35% and then ingested alkaline water and developed vomiting and diarrhea. CT abdomen/pelvis was negative. Her GI upset resolved and she was discharged from the ED.
Discussion: Low dose CT can determine the presence of gas emboli in the chest/abdomen/pelvis. Ultrasound can help avoid multiple CT scans to determine the resolution of portal venous gas.
Conclusion: Multiple imaging modalities including echocardiography can be used to identify and guide management of gas emboli from hydrogen peroxide 35% ingestions which are not uncommon.

KEYWORDS Hydrogen Peroxide, Gas Emboli, Radiology

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48. Delayed Carboxyhemoglobin Elevation in a Firefighter After An Explosion in a Cannabis Product Supply Facility

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Background: Carbon monoxide (CO) poisoning is commonly encountered after structure fires. Firefighters are at unique risk for inhalational CO exposure, especially when violation of protective gear occurs. Elevated levels of carboxyhemoglobin (COHgb) are present on arrival and decrease at a rate dependent on administration of supplemental oxygen. Delayed COHgb elevations from a structure fire have not been reported. We present a case of delayed COHgb elevations in a firefighter hours after exposure to an explosive fire at a cannabis product warehouse.
Case Report: A 46-year-old male firefighter responded to a structural fire at a facility that stored and distributed cannabis products and accessories, including butane canisters used in production of cannabis concentrates known as butane hash/honey oil. While descending a ladder from the roof, a massive explosion engulfed the firefighter in flames, igniting his protective gear. The flames on his person were extinguished after

descent. On presentation to the emergency department (ED), the patient's heart rate was 74 beats per minute, blood pressure was 106/64 mm Hg, respiratory rate was 16 breaths per minute and O_2 saturation was 95% on room air; mental status was normal. His only injury was full thickness burns to bilateral hands and partial thickness burns to his right arm covering 6% body surface area.
Serial blood gases were obtained, showing initial COHgb of 0.7%, which increased at hours 4 and 6. See Table 1. The patient reported nausea and vomiting at the time of the 6-hour sample.
Table 1: Serial blood gasesMedications administered in the ED included 1 mg oral hydromorphone, 350 mg IV ketamine, and oxygen 15L/min to facilitate bilateral distal upper extremity escharotomies. In the ICU he received ascorbic acid, zinc, docusate, intravenous morphine and gabapentin. He was on no home medications prior to his incident.
Upon result of COHgb 19.8%, the patient was placed on 100% oxygen nonrebreather mask. Repeat ABG 3 hours later showed resolution of COHgb elevation. See Table 1. Subsequent COHgb levels remained within normal limits and labs did not show evidence of hemolysis. Three other firefighters had delayed but mild elevations in COHgb levels (all <6%).
Case Discussion: Delayed COHgb elevations are not expected following inhalational exposure to CO. Delayed CO poisoning can occur after exposure to dimethyl halides such as methylene chloride, which is hepatically metabolized to CO. Methylene chloride is used as a solvent in paint strippers or in industrial settings. It is occasionally employed as a solvent in the extraction of cannabis concentrates, which are used for a variety of cannabis products. This case describes an unexplained delayed COHgb elevation following an explosion at a facility that stored and distributed cannabis products, including butane canisters for cannabis concentrates extraction. It is possible that methylene chloride or another dimethyl halide was present and contributed to the patient's toxicity.
Case Conclusions: Consider exposure to a wide variety of toxic chemicals after fires in structures producing or storing cannabis products.

KEYWORDS carboxyhemoglobin, fire inhalation, vape products

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49. Are Vape Juice Bottles Effective in Preventing Pediatric Deaths When "Sucked" On?

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Background: Since 2011, teenage vaping has increased over 1800%, with teenagers often using cartridge-based vape systems, with fruit-flavored cartridges, commonly referred to as "pods". In early 2020, the FDA attempted to curtail the epidemic of youth vaping by banning flavored cartridges, however, these restrictions were not placed on large volume refillable liquid nicotine. Bottles of flavored nicotine have a sweet smell and many bottles come in colors and designs that can be easily mistaken for children's candy. From 2013-2017, US Poison Centers recorded over 8,000 liquid nicotine exposures for children <6 years old while US emergency departments treated 4,745 children for liquid nicotine related poisonings. Nicotine product concentrations range from 0 to 60 mg/mL, and while reported fatal doses range from 6.5-13 mg/kg, small unintentional ingestions have exceeded these values resulting in pediatric fatalities.
While regulations require liquid nicotine bottles to have flow restrictors to limit the amount released when squeezed, there are no regulations governing the release of liquid nicotine if a child tries to drink from a bottle – even though ingestions account for 96.6% of exposures in young children reported by poison centers. In 2019, the American Society for Testing and Materials (ASTM) published flow restrictor testing standards (F3375-19) designed to mimic children sucking, squeezing, and shaking bottles. We sought to determine the amount of liquid nicotine released under ASTM negative pressure testing of flavored nicotine products.
Methods: Two predominant bottle and flow restrictor designs used on 30 mL bottles of fruit-flavored liquid nicotine were identified: cylindrical and conical. Three samples of a liquid nicotine brand representing each design were purchased. ASTM negative pressure testing was conducted when bottles were full, half-filled (15 mL removed), and quarter-filled (22.5 mL). The average weight of released liquid was converted to mL and compared to lethal dose rages for average 2-year-old males.
Results: On average, bottles with cylindrical flow restrictors released 0.6 mL (range 0.4-0.8 mL), 4.4 mL (range 4.2-4.6 mL), and 6.1 mL (range 5.9-6.2 mL) while bottles using conical flow restrictors released 1.1 mL (range 0.5-1.8 mL), 5.1 mL (range 4.7-5.3 mL), and 6.3 mL (range 6.0-6.6 mL) of liquid nicotine when entirely filled, half-filled, and quarter-filled, respectively (Table 1). The average amount of nicotine released by filled cylindrical (30 mg/mL) and conical (35 mg/mL) bottles (16.6 mg and 37.21mg) was not lethal for an average 12.7kg 2-year-old male (lethal range 6.5-13 mg/kg), however, the amounts released by half-filled (132.8 mg and 177.0 mg) and quarter-filled (181.9 mg and 221.3 mg) bottles were well within or above the lethal range (Figure 1).
Conclusions: This study tested the concentration equivalent to a low dose of the banned fruit-flavored nicotine cartridges. The more popular, higher concentrations (≥50 mg/mL) would be expected to have even greater risks of toxicity. To ensure the safety of liquid nicotine products, flow restrictor standards must account for when a child tries to suck from a bottle and when bottles are less than full.

KEYWORDS Liquid Nicotine, Pediatric Poisoning, Toxicity

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50. Identification of a Novel Synthetic Cathinone in a Patient Presenting After an Overdose

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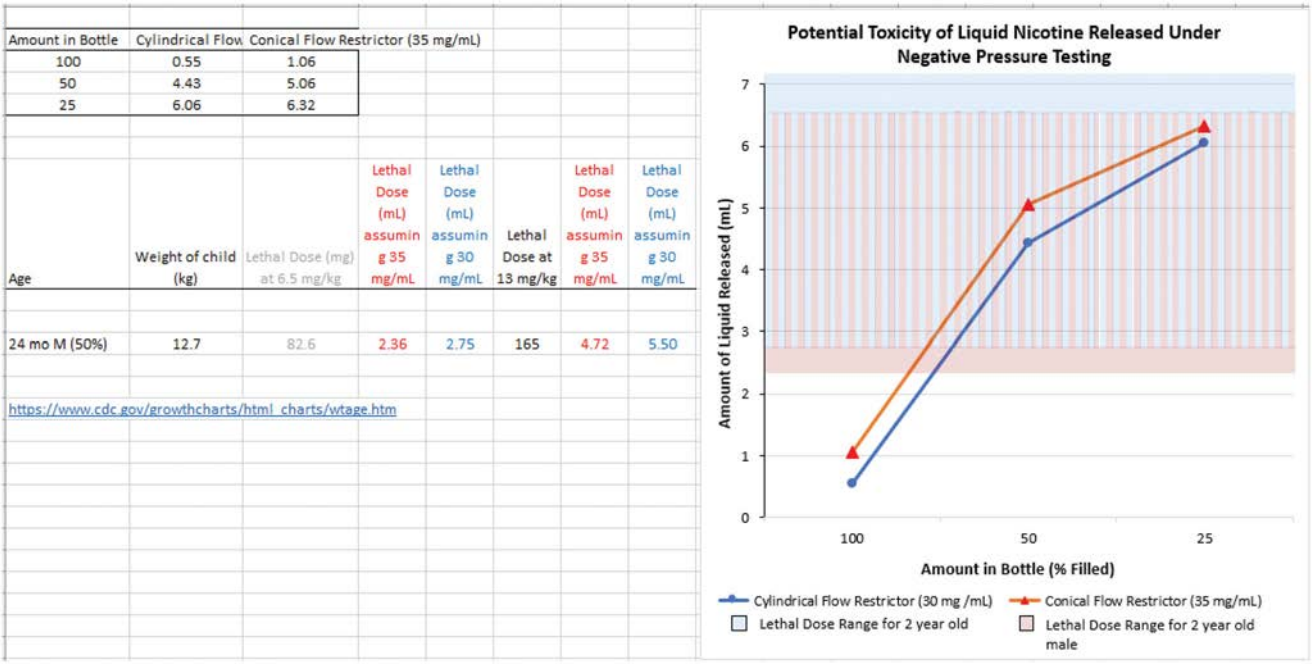
Table 1(#48). Serial blood gases.

Venous Blood Gas on Arrival (on room air)	Arterial Blood Gas at 4 hrs (on 1 L/min nasal canula)	Arterial Blood Gas at 6 hrs (on 1L/min nasal canula)	Arterial Blood Gas at 9 hrs (on NRB mask)
pH 7.38	pH 7.36	pH 7.36	pH 7.38
pCO_2 31 mmHg	pCO_2 38 mmHg	pCO_2 38 mmHg	pCO_2 36 mmHg
pO_2 39 mmHg	pO_2 86 mmHg	pO_2 89 mmHg	pO_2 227 mmHg
HCO_3 18 mmol/L	HCO_3 22 mmol/L	HCO_3 22 mmol/L	HCO_3 22 mmol/L
COHgb 0.7%	COHgb 12.7%	COHgb 19.8%	COHgb 0.7%
Lactate 6.4mmol/L	Lactate 1.7 mmol/L	Lactate 1.7 mmol/L	Lactate 1.7 mmol/L



Amount in Bottle	Cylindrical Flow	Conical Flow Restrictor (35 mg/mL)
100	0.55	1.06
50	4.43	5.06
25	6.06	6.32

Age	Weight of child (kg)	Lethal Dose (mg) at 6.5 mg/kg	Lethal Dose (mL) assuming 35 mg/mL	Lethal Dose (mL) assuming 30 mg/mL	Lethal Dose at 13 mg/kg	Lethal Dose (mL) assuming 35 mg/mL	Lethal Dose (mL) assuming 30 mg/mL
24 mo M (50%)	12.7	82.6	2.36	2.75	165	4.72	5.50

https://www.cdc.gov/growthcharts/html_charts/wtage.htm

Figure (#49).

Table 1(#49). Mean Product Released From Liquid Nicotine Bottles Under ASTM Negative Pressure Testing.

	Cylindrical Flow Restrictor		Conical Flow Restrictor	
	Liquid Nicotine Released, mL (Range)	Nicotine Released, mg (Range)	Nicotine Released, mL (Range)	Nicotine Released, mg (Range)
Filled (30 mL of Liquid Nicotine)	0.5 (0.5-0.9)	16.4 (12.9-23.3)	1.1 (0.4-1.6)	37.2 (15.1-54.3)
Half-filled (15 mL of Liquid Nicotine)	4.4 (4.2-4.6)	132.8 (126.7-137.1)	5.1 (4.7-5.3)	177.0 (166.0-184.1)
Quarter-filled (7.5 mL of Liquid Nicotine)	6.1 (5.9-6.2)	181.9 (178.5-186.2)	6.3 (6.0-6.6)	221.3 (211.2-229.3)

Background: Synthetic cathinones (commonly known as "bath salts") have been derived from cathinone, the stimulant found in khat (*Catha edulis*), a plant native to Africa and the Arabian Peninsula. Synthetic cathinones are categorized as sympathomimetic amines, similar in structure to amphetamines, and have emerged as recreational drugs of abuse. They can induce adrenergic and serotonergic effects, which may result in sympathomimetic or serotonergic toxidromes. Although many analogs are known, they are difficult to detect and are infrequently identified in patients presenting with overdose.
Case Report: This is a single patient case report. A 22-year-old male patient with history of depression and prior overdose complicated by cardiac arrest due to torsades de pointes presented to the emergency department after an out-of-hospital seizure. He was obtunded with hyperthermia, rhabdomyolysis, tachycardia, and sustained clonus suggesting serotonin syndrome. On initial EKG, neither QRS widening nor QTc prolongation was present. Comprehensive drug screen with gas chromatography-mass spectrometry (GC-MS) identified multiple medications present in the patient's urine including buprenorphine, bupropion, venlafaxine, chlorcyclizine, quetiapine, hydroxyzine, viloxazine, and dextromethorphan. Of particular interest, further analysis performed using liquid chromatography-mass spectrometry (LC-MS) identified a large signal for the synthetic cathinone 4-methyl-alpha-pyrrolidinobutiophenone (MPBP). The patient was admitted to the ICU for supportive care and gradually recovered over the course of six days.
Discussion: While MPBP has been identified in "bath salt" products, this is the first case report in the medical literature documenting the presence of MPBP in a patient. MPBP is structurally most similar to the synthetic cathinone pyrovalerone, for which there is more information regarding pharmacokinetics and pharmacodynamics. As a cathinone, MPBP is predicted to have sympathomimetic effects, primarily via inhibition of norepinephrine and dopamine reuptake. Pyrovalerone is thought to have minimal effect on the reuptake of serotonin, so contribution of MBPB to the development of serotonin syndrome in this patient is unclear. The patient was also prescribed a synthetic cathinone (bupropion) that was detected in his urine, with clinical effects in overdose that could be anticipated to be similar to those of MPBP. However, given the large peak for MPBP on LC-MS, we predict that MPBP likely contributed to this patient's toxicity. Use of LC-MS may identify the presence of synthetic cathinones not detectable by traditional GC-MS analysis.
Conclusion: We present a case report of a patient presenting with toxic encephalopathy, rhabdomyolysis, hyperthermia, and serotonin syndrome following a polypharmacy overdose. MPBP was detected via LC-MS in this patient's urine and is predicted to have contributed to his overall toxicity. This is the first case report in the medical literature that documents detection of MPBP in a patient.

KEYWORDS synthetic cathinone, 4-methyl-alpha-pyrrolidinobutiophenone (MPBP), liquid chromatography-mass spectrometry (LC-MS)

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51. Ocular Symptoms Reported with Vaccine Adverse Events

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Background: Vaccines are effective in the prevention of infectious diseases. However, adverse effects may occur after vaccination. Among these adverse effects are ocular effects. Information on the range of ocular symptoms reported with vaccine adverse events is limited. The objective of this study was to characterize ocular symptoms observed among vaccine adverse events reported to the United States Food and Drug Administration.
Methods: Data was obtained from the Vaccine Adverse Event Reporting System (VAERS). Reports are coded using the Medical Dictionary for Regulatory Activities (MedDRA). VAERS public data for the years 1991-2018 were downloaded and searched for all records that included a symptom affecting the eye. Symptoms involving tissue around the eye were excluded. The distribution of adverse events with ocular symptoms was determined for factors related to patient demographics, circumstances of the exposure, specific symptoms, and outcome.
Results: Among 533,113 total vaccine adverse events that were reported to have occurred during 1991-2018, 14,563 (2.7%) had one or more ocular symptoms. The most commonly reported specific ocular symptoms were 2,212 (15.2%) blurred vision, 1,927 (13.2%) ocular hyperemia, 1,271 (8.7%) eye pain, 1,189 (8.2%) eye movement disorder, 961 (6.6%) conjunctivitis, 941 (6.5%) visual impairment, 903 (6.2%) photophobia, 889 (6.1%) eye pruritis, 783 (5.4%) eye disorder, 736 (5.1%) visual disturbance, and 714 (4.9%) eye irritation. There were 1,727 vaccine adverse events with ocular symptoms during 1991-1997 (2.4% of 70,724 total vaccine adverse events), 2,512 during 1998-2004 (2.8% of 88,874 total vaccine adverse events), 5,040 during 2005-2011 (3.1% of 161,374 total vaccine adverse events), and 5,284 during 2012-2018 (2.5% of 212,141 total vaccine adverse events). Of the 14,151 patients with a known age, 2,973 (21.0%) were 0-9 years, 2,816 (19.9%) 10-19 years, 1,484 (10.5%) 20-29 years, 1,491 (10.5%) 30-39 years, 1,616 (11.4%) 40-49 years, 1,454 (10.3%) 50-59 years, and 2,317 (16.4%) 60 years or older; the mean age was 31.4 years (range 0-103 years). Of the 14,421 patients with a known sex, 9,247 (64.1%) were female and 5,174 (35.9%) male. The adverse event resulted in an emergency department or doctor visit in 6,460 (44.4%) cases. The adverse event was classified as serious in 2,574 (17.7%) cases: 1,745 (12.0%) hospitalized, 947 (6.5%) disability, 598 (4.1%) life threatening illness, 178 (1.2%) prolonged hospitalization, and 89 (0.6%) death. The most commonly reported vaccines were influenza (n = 5,461, 37.5%), diphtheria-pertussis-tetanus (n = 1,975, 13.6%), hepatitis B (n = 1,583, 10.9%), measles-mumps-rubella (n = 1,512, 10.4%), human papilloma virus (n = 1,452, 10.0%), and pneumococcal (n = 1,232, 8.5%).
Conclusion: Even though the number of vaccine adverse events with ocular symptoms increased over the time period, the proportion of total vaccine adverse events with ocular symptoms remained steady. Although 44% of the adverse events resulted in an emergency department or doctor visit, there were few (18%) serious adverse events. It should be noted that the vaccine may not have caused the reported ocular symptom. The ocular symptom may have been related to an underlying condition, another drug, or another reason.

KEYWORDS Ocular symptoms, Vaccine, Adverse events

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52. The Poison Center as Pandemic Response: Establishment and Characteristics of a COVID19 Hotline through the New Jersey Poison Center

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Background: Poison Centers are uniquely positioned to respond to an unprecedented public health threat such as the COVID19 pandemic, as fully operational 24-hour hotlines already staffed with healthcare professionals. While a temporary civilian call center can be set up to disseminate non-medical information to the public, a PCC can provide this service with very little lead time, providing up-to-date, unbiased, and factual information and expertise in a crisis.
Methods: On January 27, 2020 the New Jersey Poison Information and Education System (NJPIES) agreed to operate the NJ Coronavirus Hotline at the request of the NJ Department of Health, to provide 24-hour information regarding the state's evolving coronavirus response. Call patterns, subject matter, and staffing and infrastructure strategies that were implemented to meet this unprecedented demand are described.
Results: Since the inception of the hotline until May 27, 2020, NJPIES responded to over 30,000 calls for COVID19 information. Callers included the lay public, healthcare professionals, school systems, municipalities, business owners, and contacts within the New Jersey Department of Health and other departments. Call volume increased modestly in the first several weeks, then substantially in early March 2020, when COVID19 activity became severe in New Jersey. This resulted in a phone system overload requiring the addition of 40 phone trunks and a refined call triage protocol to prioritize poison calls. Staffing shortfalls were initially managed by increased hours by existing staff, but extreme demand required supplementation by health professions students on for-credit rotations, healthcare community volunteers, governmental staff, and ultimately permanent hiring through the University in the long-term. Temporary staff integration required an abbreviated on-boarding process as well as a training schedule, call escalation procedures and creation of a volunteer log. Telework was established for existing staff to allow for increased flexibility and to ensure adequate staffing in the event of the need for personal quarantine or isolation. On March 16th, 6 weeks into the hotline, NJPIES partnered with NJ-211, a national disaster hotline, to answer non-medical inquiries, as well as an interactive website launched through the NJ Office of Innovation, NJ.covid-19.gov. Several times the hotline number was inadvertently publicized on non-medical state webpages, prompting inappropriate calls requesting unemployment, tax application extensions, and small business complaints. These sites were modified at NJPIES request with a subsequent decrease in this volume. Call type categories are listed.
Conclusion: Although not the traditional role of a regional Poison Control Center, pandemic response synergizes with the workflow of this hotline because the infrastructure, staffing, and healthcare expertise are already present. While NJPIES faced significant challenges in ramping up to meet this demand, these were largely overcome with this multifaceted approach. Poison centers can rapidly adapt through scaling and process change to meet the needs of the public during times of public health threats. Lessons learned can be used to improve preparedness and response for future events.

KEYWORDS Poison Control Centers, Pandemic, Emergency Preparedness

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53. Severe Toxicity Associated with Confirmed Aconite Exposure

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Background: Aconite and its related alkaloids are extracted from the root of the Aconitum plant species. These substances are thought to cause toxicity by prolonging the opening of sodium channels. Common toxic findings include nausea and vomiting, paresthesias, neuromuscular weakness and cardiac dysrhythmias which can result in fatality.
Case Report: An otherwise healthy 33-year-old male presented to the Emergency Department (ED) with nausea and vomiting. Just prior to arrival, the patient reported intentionally ingesting aconite root which he had purchased online in an attempt at self-harm. Upon arrival to the ED, the patient had multiple episodes of vomiting, making him unable to tolerate oral activated charcoal (AC). The vomiting persisted despite 12mg of intravenous ondansetron. The initial vital signs were normal with the exception of a heart rate of 130 beats per minute. The laboratory results, including basic metabolic panel and magnesium, returned normal. An electrocardiogram (ECG) showed a QRS complex duration of 124ms and a QTc complex duration of 388ms. One hour after arrival, the patient developed non-sustained ventricular tachycardia that was treated successfully using amiodarone followed by a lidocaine infusion. Over the next few hours, the vomiting improved after treatment with metoclopramide. The patient remained hemodynamically stable, and was transferred to the intensive care unit (ICU) at a tertiary care center for further management; at that time, his blood pressure was 100/48 mmHg and his heart rate was 59 beats per minute. Shortly after arrival to the ICU, the patient was in atrial fibrillation and the lidocaine infusion was discontinued. During the course of his critical care stay, the patient developed bradycardia with heart rates between 47-56 beats per minute which improved to baseline within 36 hours after initial presentation. A remnant of the ingested substance was collected and sent to the Laboratory of Organic Analytical Chemistry of the Wadsworth Center, New York State Department of Health for analysis using gas chromatography/mass spectrometry; testing detected mesaconitine, aconitine and hypaconitine.
Case Discussion: Though infrequently encountered, aconite ingestions can be life threatening. After ingestion, patients should receive AC as soon as possible if it can be safely tolerated. Although there is no definitive treatment after ingestion, there is limited evidence to suggest that amiodarone is more effective than type 1 antidysrhythmics. Interestingly, this patient was given lidocaine after amiodarone and did not have any subsequent dysrhythmias. Magnesium has also been used to treat dysrhythmias from aconite poisoning. When aconite is suspected, definitive testing can be performed on available samples of the ingested material. Serum aconite levels can also be checked but were not obtained in our patient.
Conclusion: Aconite ingestion can cause severe toxicity with QRS prolongation and cardiac dysrhythmias, and laboratory confirmation can be performed if remnants of the ingested substance remain.

Table (#52).

Categories of Call Types	
1.	General Questions/Symptoms
2.	Housing Options Related to Isolation
3.	How to Obtain Test Results
4.	How and Where to Get Tested for COVID-19
5.	How to Obtain/Use PPE
6.	General Isolation
7.	Problems Reported at Nursing Home Facilities
8.	Risk Factors (Am I or Someone at Risk)
9.	What is Open in the State of New Jersey
10.	Travel Information (Intra- and Inter-state)
11.	Interpretation of My Antibody Results
12.	Antibody Test is Positive: Where to Donate Plasma
13.	Timing to Re-enter Work/School After Exposure/Symptoms/ Confirmed Diagnosis
14.	Complaint Regarding Social Distancing Measures
15.	Information Regarding Unemployment
16.	Renewing or Obtaining a Medical (MD, APN, PA, RN) License in the State of NJ During COVID 19 Pandemic
17.	Management After Testing Positive

KEYWORDS Aconite, Dysrhythmias, Management

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54. Serial Bicarbonate Monitoring in Toxic Alcohol Management

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Background: Suspicion of toxic alcohol exposure results in common calls to poison centers (PC) worldwide. The availability of diagnostic laboratory testing for toxic alcohol concentrations is highly variable and unavailable in many nonmetro areas. In lieu of this testing, methods used to inform the decision to treat with definitive therapy such 4-methylpyrazole, intravenous ethanol, and hemodialysis include serial bicarbonate evaluation and calculating osmolar gaps. The effectiveness of these methods are not well studied.
Objective: The purpose of this study was to determine the effectiveness of monitoring serial bicarbonate concentrations for suspected toxic alcohol poisoning at a large regional PC.
Methods: The National Poison Data System (NPDS) was queried for six generic codes (0031140, 0201001, 0051221, 0051222, 0031220, 0051260) between 1/1/2019 to 12/31/2019. Variables from case notes included age, gender, bicarbonate concentrations, outcomes, treatments administered, electrolytes, renal function, and toxic alcohol concentrations. Serial bicarbonate monitoring included obtaining serum bicarbonate concentrations for three measurements every four hours to identify developing acidosis. Descriptive statistics were utilized.
Results: There were 567 cases identified. Of these, 103 were both seen at a health-care facility and had laboratory evaluation performed. Table 1 depicts patient management. In group 1, 54 patients had serial serum bicarbonate measurements obtained every four hours for a 12-hour period to guide treatment. As demonstrated in Table 2, patients who did not develop a metabolic acidosis (defined as a measured serum bicarbonate <18) during this time period were interpreted to not have an ethylene glycol (EG) or methanol (MeOH) exposure and no treatment was administered ($n=46$). In patients who did develop a metabolic acidosis during this period, 4-MP was initiated ($n=8$). Four patients who were treated with 4-MP using the above criteria were found to have elevated EG or MeOH concentrations (>20 mg/dL). Confirmatory negative results in patients who did not meet criteria for 4-MP were obtained in six patients (Table 3). Notably, all patients who did not receive 4-MP using serial bicarbonate monitoring had clinical improvement and were discharged. In group 2, 17 patients presented with a metabolic acidosis and were empirically administered 4-MP. Of these, 9 patients had a confirmed positive test and one patient had a confirmed negative EG/MeOH test. In group 3, patients without metabolic acidosis were empirically treated by the primary healthcare providers. Four of these patients had elevated EG/MeOH and six had negative measurements. Lastly, in 11 cases EG and MeOH concentrations resulted so quickly that initial management was dictated by these results.
Conclusions: The management of EG and MeOH exposures is highly variable. While many healthcare facilities do not have EG and MeOH concentrations readily available, there are other reliable methods of detection. As seen in group 3, patients were administered 4-MP unnecessarily, which increased length of stay and hospital costs. Additional studies must be performed to

demonstrate that serial bicarbonate concentrations are sufficient in ruling out EG and/or MeOH ingestions.

KEYWORDS Toxico Alcohol, Ethylene Glycol, Methanol

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55. COSTCOverdose

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Background: Most over-the-counter (OTC) products sold at retail pharmacies and groceries do not contain a sufficient dose in a single container to cause significant toxicity. However, warehouse-style mass-quantity retailers have exploded in popularity and sell products with significantly more xenobiotic in a single container in order to minimize cost per xenobiotic unit. We explored whether OTC agents at these retailers contained enough product to cause significant toxicity if an individual was exposed to the entire contents of a single container.
Methods: On-site and online searches were performed at three major mass-quantity retailers: BJ's Wholesale Club, COSTCO, and Sam's Club. Analgesics, anti-inflammatories, anti-allergy products, cough-and-cold preparations, anti-diarrheals, sleep aids, smoking cessation agents, hair regrowth products, antiseptics, herbals, and vitamins were queried for substance(s) and quantity contained in a single bottle, box, or other non-blister package. "Significant toxicity" was determined by the authors' clinical experience along with the medical literature.
Results: Seventy (70) unique products containing enough xenobiotic to cause significant toxicity were found at the three major mass-quantity retailers queried. Highlights included oil of wintergreen, 100 g/10 fl oz; ferrous sulfate, 64 mg elemental iron/#365 tablets; nicotine, 4 mg/270 lozenges; hydrogen peroxide, 33%/64 fl oz; diphenhydramine, 25 mg/#600 tablets; twenty different acetaminophen products; and six unique products containing acetaminophen and aspirin.
Discussion: Mass-quantity retailers sell potentially dangerous xenobiotics in quantities sufficient to cause significant toxicity by exposure to one container. This is important for providers to consider for maximum exposure calculations from a single container.
Conclusion: Providers should maintain awareness of the potential for toxicity from exposure to a single container obtained from a mass-market retailer.

KEYWORDS Overdose, Massive, Mass-market

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Table 1(#54). Varying Methods of Evaluation.

	Group 1	Group 2	Group 3	Group 4	Group 5
Number of patients (N = 103)	54	17	14	11	7

Group 1= Serial bicarbonate measurements
Group 2= Prophylactic 4-MP with metabolic acidosis
Group 3= Prophylactic 4-MP without metabolic acidosis
Group 4= Laboratory EG and MeOH measurements
Group 5= Left AMA

Table 2(#54). Management of Patients with Serial Bicarbonate Measurements.

	Treated with 4-MP	Not Treated w 4-MP
Number of patients (N = 54)	8	46

Table 3(#54). Confirmatory Testing in Patients with Serial Bicarbonate Measurements.

	Treated, confirmed positive	Treated, confirmed negative	Not treated, confirmed negative	Not treated, confirmed positive
Group 1	4	0	6	0
Group 2	9	1	NA	NA
Group 3	4	6	NA	NA
Group 4	2	NA	9	NA

56. Naloxone Rescue Project

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Background: The opioid epidemic is one of the largest public health crisis the United States is currently facing. According to the Philadelphia Department of Public Health, there were 1,116 opioid overdose deaths in Philadelphia in 2018. Nationwide, there were over 40,000 deaths due to opioid overdoses. Additionally, it was determined that there was a gross domestic product loss of over 70 billion dollars in conjunction with lost productivity. Naloxone is a safe and effective opioid overdose reversal agent that is conveniently available as a portable intranasal atomizer. Naloxone is readily available at many pharmacies to anyone without a prescription in the Commonwealth of Pennsylvania due to a gubernatorial standing order. However, there are significant barriers preventing well-intentioned people from obtaining and carrying naloxone. We propose a program that would fund the training and distribution of naloxone to our providers to overcome those barriers.
Methods: In December 2019, we developed and distributed a questionnaire to physicians and advanced practice providers (APPs) within an Emergency Department at an urban tertiary care facility. The questionnaire was sent via a Redcap online form. The questionnaire was built to determine if they currently carry naloxone and, if not, what are the barriers to doing so. In addition, we collected information about previous use of naloxone and where the provider had obtained the medication in the past. We also inquired about primary mode of transportation for commuting to work and their residential zip codes for future use. This information will help us determine if we can increase the use of naloxone by circumventing perceived access barriers through our proposed program.
Results: We determined that 98 out of 109 responding physicians and APPs have not obtained the life-saving medication for one of the following reasons: 1) a naloxone kit costs close to $150 at retail value at most pharmacies making the out-of-pocket cost prohibitive, 2) approximately half of the respondents did not know about the standing order, and 3) although it can be billed to the purchaser's insurance, there is a fear that future employers and insurers will stigmatize the purchaser. As a result, we saw that only 11 out of the 109 respondents (10%) carry naloxone.
Conclusion: The number of physicians and APPs that currently carry naloxone is quite low due to reasons that we are able to mitigate. We propose that we should further promote our staff's ability to carry naloxone on their person outside of the Emergency Department. Our proposed project would provide training and distribution of opioid overdose reversal kits. This would increase the number of providers who carry life-saving naloxone dramatically in a way that circumvents the barriers revealed in our questionnaire. Our hope is to provide the tools for saving lives outside the hospital to our highly trained physicians and APPs, so that they can be health ambassadors to the surrounding community.

KEYWORDS public health, prevention, opioid crisis

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57. Disinfectant and Hand Sanitizer Product Exposures in Italy: a "side effect" of the COVID-19 Pandemic

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Background: During the first four months of 2020, Italy reported 205.463 COVID-19 exposures and 27.967 deaths. Public health messaging emphasized use of disinfectant and hand sanitizer products to reduce SARS-CoV-2 exposure, the agent responsible for COVID-19. Our aim was to analyse these exposures and compare to the same period in 2019.
Methods: We used descriptive statistics to analyse Milan Poison Centre toxicology-consultation-volumes for ethanol-based hand sanitizers, hypochlorite bleaches, denatured alcohols and unspecified disinfectants such as cationic and hydrogen peroxide disinfectants, for the period 1 January 2019–30 April 2019 to the same period in 2020.
Results: Milan PC Exposures 1 January 2019 -30 April 2019 and 2020. (Table 1)
During the 2020 study period an increase in exposures of 63.6% compared to 2019 was observed. In relation to the year 2020, the age group distribution was: <5 years (25%), 5 < 18 years (7%); ≥18 years (68%). The circumstance of exposure was unintentional for 57% of cases, intentional exposure occurred in 9% of cases (8% suicide attempted, 1% abuse) and misuse occurred in 34% of cases (17% mixing, 16% racking, 1% other).
The primary route of exposure was ingestion (60.1%), followed by inhalation (29.9%), ocular (5%) and other routes (5%). Symptoms were present in 48% of cases. The respiratory system was involved in 22% of cases and the gastrointestinal system in 12% of cases. The most frequently reported clinical effects were nausea, vomiting, coughing, choking and ocular inflammation.
Most exposures were managed at home (69.5%) and about 30.5% in hospital. Moderate symptoms were reported in 9.6% of total exposures and in 5.6% of accidental exposures. There were no deaths reported.
Conclusion: Public health messaging advocating the use of these products was necessary to mitigate CORVID-19 health effects. The Milan PC exposure increases were similar to those observed in the US. Exposure data from both countries demonstrated a temporal association with the pandemic. Based on these findings, messaging should emphasize proper use of these products.
In Italy the main problem appears to be linked to two high risk behaviors: transfer from the original container and the mixing of incompatible products. Our analysis reveals the role of poison control centre in the identification of risk factors for prevention and recommendations management to reduce ED use.

KEYWORDS disinfectants, hand sanitizers, Covid 19

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58. Trend of Toxic Alcohol Ingestions in the Setting of the COVID-19 Global Pandemic

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Background: The first cases of COVID-19 occurred in China in December 2019, declared an international emergency and by March 2020 the state of Pennsylvania declared a state of emergency. Transmissibility of COVID-19 led to mass purchases of alcohol-based sanitizers and closure of state-run liquor stores limited access to ethanol containing beverages.
Objectives: To determine if an association exists between the decreased access to ethanol, increased prevalence of hand sanitizers with an increase in toxic alcohol cases reported to the Philadelphia Poison Control Center (PHLPCC)
Methods: The National Poison Data System (NPDS) was queried for toxic alcohol calls taken by the PHLPCC between January 1st to April 30th 2019 and 2020 using the codes for methanol (0031140), ethylene glycol (0051260) and isopropyl alcohol (0025140, 0025143, 0025141). Total case numbers were obtained and trends by month, gender, intent, age, clinical effect were analyzed.
Results: Between the months of January and April, the PHLPCC took calls for 107 toxic alcohol cases in 2019 and 166 cases in 2020, representing a 55% increase in total cases. Females were involved in 52.4% of cases. Most cases involved ages 20-39 and 40-59 (35 and 36 cases, respectively), followed by children aged 1-5 years (28 cases). The vast majority of cases involved isopropyl alcohol with 92 cases in 2019 and 151 cases in 2020 with a noted uptick in exposures from February to March 2020 (20 to 55), persisting through April with 61 cases.
In 2020, 85% of the reported cases were associated with minimal or minor clinical effects, such as GI distress or dizziness. There were 136 unintentional exposures, an increase of 62% from 2019. Cases associated with intentional or misuse remained relatively constant with 13% methanol and 4% ethylene glycol.
Conclusions: The total number of toxic alcohol cases saw a year to year increase with a majority involving isopropyl alcohol. Surprisingly, despite closure of liquor stores, there was no increase in intentional exposures. Instead, the increase observed was due to unintentional exposures. The increased purchasing of alcohol-based sanitizers is likely a contributing factor. From 2019 to 2020, cases involving children less than 18 years increased 56%, with an uptick when schools were closed in March.
Several limitations exist. There is likely underreporting of cases of toxic alcohol exposures. The details of each of the cases is also limited in the query that was performed, such as the scenario involved in the exposure, with only 5% of cases in 2020 having a

Table 1(#57).

	2019	2020							
					Age (%)			Management Site (%)		
	N	N	Change (%)	Oral Route (%)	<5	5-18	≥ 18	Home	ED	Outcome Moderate (%)
Ethanol-Based Hand Sanitizers	53	153	188.7	96.3	71.3	8.1	20.6	96.6	3.4	1.4
Sodium Hypochlorite Bleach	535	651	21.7	49.2	17.7	7.7	75.1	58.4	41.6	12.1
Denatured Alcohols	73	156	113.7	72.9	40.0	8.6	51.4	80.4	19.6	4.7
Unspecified disinfectant	56	213	280.3	58.1	38.2	6.6	55.1	76.3	23.7	11.4
Total	**717**	**1173**	**63.6**							

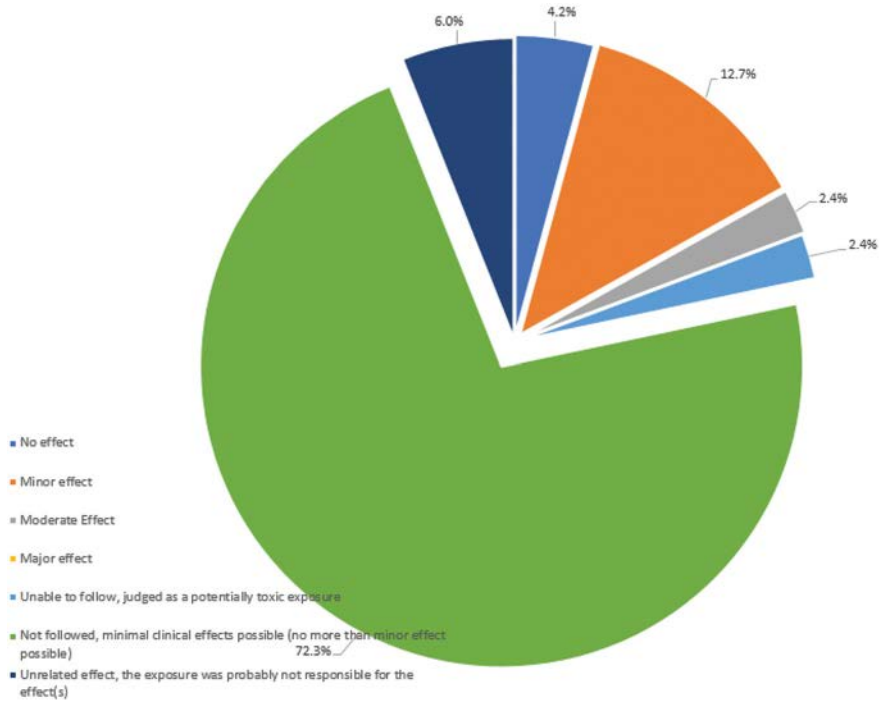

Figure 1(#58). Clinical effect after toxic alcohols January to April 2020.

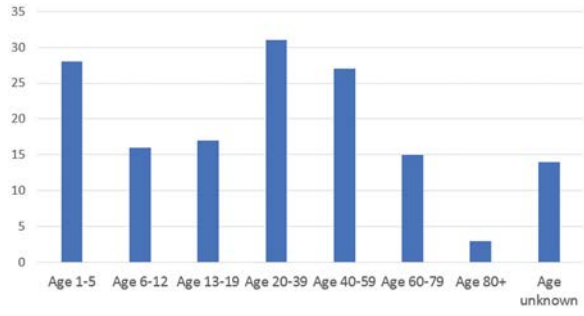

Figure 2(#58). Age distribution of isopropyl alcohol cases - January 2020 - April 2020.

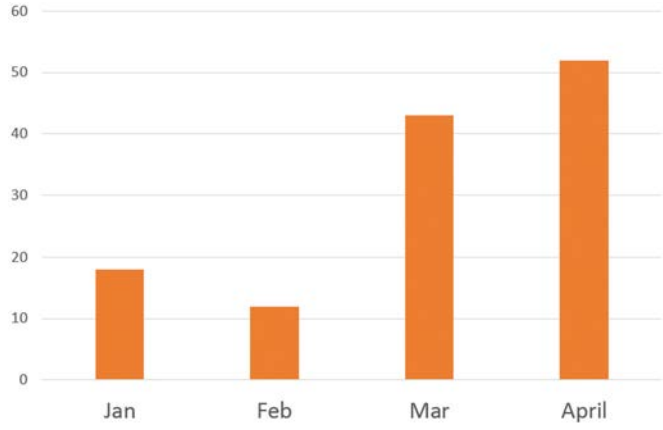

Figure 3(#58). Isopropanol exposures by month in 2020.

documented scenario. We used the common NPDS case codes associated with the various toxic alcohols, but this may miss incorrectly coded cases. Changes in coding practice may also result in missing cases, although we are not aware of recent changes in coding.

The data from our local poison center reveals a trend that appears to follow the timeline associated with COVID-19. The increase in unintentional exposures in children warrants further investigation and provide educational opportunities for the public about the dangers of toxic alcohols.

KEYWORDS toxic alcohol, covid-19, pandemic

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59. Don't Let Them Get Away: A Novel Method for Capturing Indirect Deaths

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Background: Poison centers are responsible for providing poisoning information, assisting in management of poisoned patients, and filling a critical niche in public health surveillance. However, this latter role is dependent on voluntarily submitted information from patients, caregivers, bystanders, and medical providers. In cases where the patient is found already deceased, this information is often incomplete or not available, or the death is never reported to a poison center at all. Common types of such cases include drug overdoses, house fires, or carbon monoxide leaks. Reporting in these cases is dependent on obtaining related reports from medical examiners or coroners, the requirements for which vary widely among states, or the media. We hypothesized that setting a search alert for news items would increase our capture of these cases and improve the value of poison center data for public health surveillance and statistics.
Methods: A news alert was created for the search phrases "[State] AND house fire AND (death or died)" and also "{State} AND (drug or poison) AND (death or died)". Boolean language was used to improve the relevance of search results and ensure that they contained only news items of interest from the poison center's reporting area. Alerts were set to be delivered on an "as it happens" basis, from any English-language source in the

United States. All alerts received were reviewed on a daily basis and indirect death cases were created in the National Poison Data System when appropriate.
Results: In the first year of this process, 150 fatality cases were reported, including 97 indirect cases and 52 direct cases. This is compared to the previous four years, during which there were reported 16 indirect cases out of 62 total deaths (2018), 2 indirect cases out of 50 total deaths (2017), 4 indirect cases out of 54 total deaths (2016), and 8 indirect cases out of 42 total deaths (2015). In addition, a variety of unexpected methods of fatalities caused by a toxic exposure were identified, including motor-vehicle accidents causing the vehicle(s) to burst into flames, drug and ethanol exposures causing drowning, and identification of victims from their illicit substance providers' felony reports.
Conclusions: Passive collection of news articles through the use of news alerts was found to be a low-cost, high-yield effort to more accurately record indirect poisonings resulting in death. These cases are often not reported to poison centers, particularly in states where death reporting mechanisms do not include poison centers as a required recipient.

KEYWORDS Indirect, Deaths, Search

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Table 1(#60). Number of times a therapy was given for all BZT exposures (n = 265), total number of cases requiring below therapy (n = 14; 5%).

TREATMENTS	OCCURRENCES
Seizure Medications	5
Antiarrhythmics	0
Vasopressors	5
Sodium Bicarbonate	5
IV Lipid Therapy	1

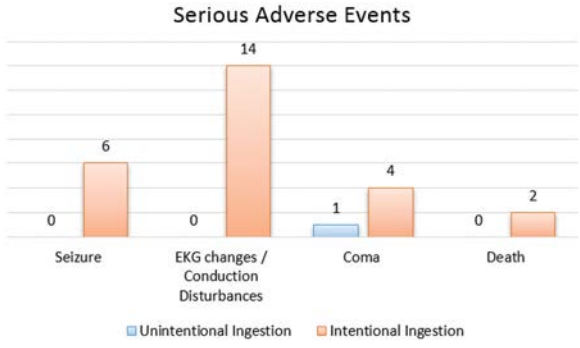

Figure 1(#60). – Serious adverse events for unintentional ingestions (n = 160) and intentional ingestions (n = 105).

60. Outcomes of Benzonatate Exposures Reported to a Single U.S. Poison Center: A 20-year Review

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Background: Benzonatate (BZT) resembles other topical anesthetics, and toxicity stems from its sodium channel blocking properties. Toxicity can lead to seizures, EKG changes, coma, and death. Few data exist describing medical outcomes of BZT ingestions, and no standard treatment guidelines exist. The purpose of this study is to characterize clinical outcomes and medical management of BZT ingestions over a 20-year period at a regional poison center (RPC).
Methods: This was an IRB-approved, retrospective case review of all BZT exposures reported to our RPC from January 1, 2000 through December 31, 2019. Cases were excluded if incomplete or irretrievable. Extracted case data included formulation, patient demographics, co-ingestants, adverse events, treatments, and outcome.
Results: A total of 265 BZT cases were included for analysis after one was excluded due to irretrievable data; 162 (61%) were female, and mean age was 25 years (range: 9 months to 95 years). Most cases (164 of 265; 62%) occurred in patients 13 years and older, 12 (5%) in patients 6 to 12 years, and 69 (26%) in children 5 years and under. BZT only exposures accounted for 173 (65%) of cases, and 92 (35%) were polysubstance exposures. Nearly half of all exposures (119 of 265; 45%) were managed at home. Of 48 patients referred to the ED, only 4 (8%) were admitted to a HCF. No adverse events occurred in 130 patients (49%), 135 (51%) experienced at least one adverse event, and 22 (8%) experienced serious adverse events. The incidence of therapies is listed in Table 1.
Most exposures were unintentional ingestions (160 of 265; 60%). Of these 160 patients, only one (0.6%) experienced at least one serious adverse event, and five (3%) were admitted to a HCF, with 155 (97%) not admitted (Figures 1 and 2). Of intentional ingestions (105 of 265; 40%), 21 patients (20%) experienced at least one serious adverse events, and 39 (37%) were admitted to a HCF (27 patients were admitted to an ICU), with 66 (63%) not admitted (Figures 1 and 2).

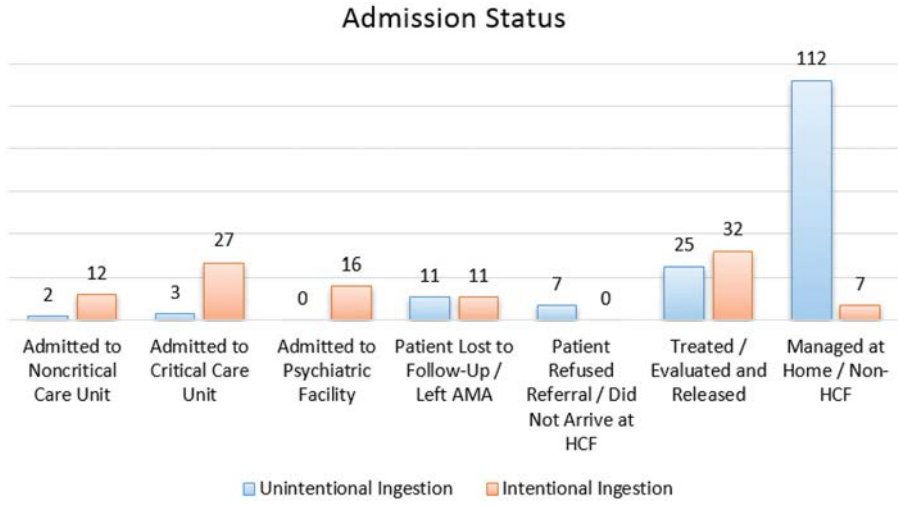

Figure 2(#60). – Admission status for unintentional ingestions (n = 160) and intentional ingestions (n = 105)

Two deaths (0.8%) occurred during the study period. One was an intentional ingestion of BZT, meclizine, and ethanol in a 17-year-old female. She presented in cardiac arrest with pulseless electrical activity which was followed by wide QRS complex tachycardia. She was intubated and during nine ICU days, therapies included vasopressor support, sodium bicarbonate, and lipid emulsion. Postmortem toxicological analysis showed 680 mcg/L BZT level in the urine and 150 mcg/L meclizine level in the blood. The second was an intentional ingestion of BZT, acetaminophen, metformin, and diphenhydramine in a 63-year-old female. She developed renal and liver failure during four ICU days. Therapies included hemodialysis, liver dialysis, N-acetylcysteine, and sodium bicarbonate.
Conclusions: During a 20-year study period at one RPC, BZT exposures involving significant therapeutic interventions and serious toxicity occurred more frequently in intentional ingestions. Unintentional ingestions did not result in significant adverse events and infrequently required hospital admission. Although BZT can result in serious toxicity, exposures are rare, and most cases can be managed at home.

KEYWORDS benzonatate, arrhythmia, seizure

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61. A Retrospective Review of Hospitalized Patients Receiving a Higher than Maximum Dose of Acetaminophen

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Background: Acetaminophen is a commonly used over the counter analgesic. Although the three to four gram per 24 hours dose recommended for daily use are generally safe, case reports and some series raise concerns about nonacute excessive doses in some individuals. Due to dosing errors, patients are occasionally administered doses of acetaminophen higher than generally recommended in the hospital setting. The result of this dosing has not been well studied. We looked at the effects of supratherapeutic dosing of acetaminophen in a hospitalized population.
Methods: We performed a retrospective chart review of all cases of supratherapeutic doses of acetaminophen administered at a tertiary care medical center over a 2-year period. The definition of supratherapeutic dose was more than four grams in a 24-hour period. Outcomes including death, liver transplant, liver test elevation (ALT or AST greater than 125 IU/L, or INR greater than 1.5) at 24-48 hours were reviewed. Abnormal liver tests found were compared to testing done prior to the supratherapeutic dose and testing 10-14 days after the supratherapeutic dose when available.
Results: A total of 152 cases met inclusion criteria for a supratherapeutic dose of acetaminophen during a 24-hour period, with doses between 4.2 and 5.85 grams. All doses were oral, and none were an acute ingestion. No cases of death related to liver failure or liver transplant were found in any of these patients. 56 of these patients had liver test performed within 24-72 hours after receiving the supratherapeutic dose of acetaminophen. Ten of these patients with evaluable liver tests were found to have abnormal liver tests within 24-72 hours after the dose of acetaminophen. Seven of these did not have follow up testing at 10-14 days, but all had abnormal liver tests documented prior to the supratherapeutic dose. Of the remaining 3 individuals, 2 had abnormal tests again 10-14 days after the dose, and both previously had abnormal tests prior to the dose of acetaminophen. The remaining individual had normalization of liver tests on testing at 10-14 days but had a history of alcohol abuse with previous abnormal liver tests.
Conclusion: Supratherapeutic dosing of acetaminophen from 4.2 to 5.85 grams in our cohort of hospitalized patients did not show serious outcomes of death or the need for liver transplant in any case. Abnormal liver tests were found in a few individuals, all of whom had preexisting liver test abnormalities on prior testing.

KEYWORDS acetaminophen, toxicity, overdose

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62. Pediatric Rhaphiolepis Indica Ingestions Reported to Poison Centers

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Background: *Rhaphiolepis indica* (Indian hawthorn) is a dense, broadleaf evergreen shrub in the family Rosaceae. *R. indica* can grow to 1.5 m tall and wide and has serrate, oblong-lanceolate leaves. The plant blooms in May-June, producing white to pale pink star-shaped flowers. Small, round, blue-black berries develop in August-September. The berries contain a single seed and have a tart, astringent taste and are considered inedible when raw but may be eaten once cooked. *R. indica* is grown as an ornamental plant in the southern United States. Information on potentially adverse effects from human *R. indica* ingestions is limited. The objective of this study was to describe *R. indica* ingestions among young children reported to poison centers.
Methods: Cases were all *R. indica* ingestions among patients age 5 years or less reported to a statewide poison center network during 2000-2018. *R. indica* ingestions were identified by review of records with Poisindex codes for *R. indica* or "Indian hawthorn" in the Substance Verbatim field. The distribution of *R. indica* pediatric ingestions was determined for various factors related to patient demographics, ingestion circumstances, management, and outcome.
Results: A total of 637 *R. indica* ingestions involving young children were identified. The part(s) of the plant ingested were the berry (n = 430, 67.5%), flower (n = 13, 2.0%), leaf (n = 13, 2.0%), and unknown (n = 182, 28.6%). Of the 317 cases with a reported number of berries ingested, 242 (76.3%) involved a single berry (mean 1.6, range 1-20). October-December accounted for 251 (39.4%) of the cases, January-March for 193 (30.3%), April-June for 92 (14.4%), and July-September for 101 (15.9%). The patient age distribution was 28 (4.4%) < 1 year, 275 (43.2%) 1 year, 200 (31.4%) 2 years, 57 (8.9%) 3 years, 40 (6.3%) 4 years, 30 (4.7%) 5 years, and 7 (1.1%) unknown exact age; 358 (56.2%) of the patients were male and 279 (43.8%) female. The ingestion site was 583 (91.5%) patient's own residence, 16 (2.5%) another residence, 28 (4.4%) school, 8 (1.3%) public area, and 2 (0.3%) at other sites. All of the ingestions were unintentional. Most (n = 624, 98.0%) of the patients were managed on-site, 9 (1.4%) were already at or en route to a healthcare facility, 2 (0.3%) were referred to a healthcare facility, and 2 (0.3%) were managed at an unspecified other location. The medical outcome was 180 (28.3%) no effect, 7 (1.1%) minor effect, 225 (35.3%) not followed-judged nontoxic, 213 (33.4%) not followed-minimal clinical effects possible, 3 (0.5%) unable to follow-potentially toxic, and 9 (1.4%) unrelated effect. A clinical effect was reported in 32 (5.0%) of the ingestions. The most frequent clinical effects were vomiting (n = 12, 1.9%), diarrhea (n = 8, 1.3%), and fever/hyperthermia (n = 4, 0.6%). The most frequent treatments were dilute/irrigate/wash (n = 433, 68.0%) and food/snack (n = 93, 14.6%).

Conclusion: Pediatric *R. indica* ingestions most often involved the berry, usually a single berry. The ingestions were seasonal, peaking in October-December. The majority (74.6%) involved children age 1-2 years. Most *R. indica* ingestions were managed outside of a healthcare facility and did not result in a serious outcome.

KEYWORDS Pediatric, Indian hawthorn, Rhaphiolepis indica

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63. Cholinergic Crisis Resulting from Acute Oral Pilocarpine Hydrochloride Overdose: Xerostomia be gone!

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Background: Oral muscarinic agents such as pilocarpine are increasingly used as second line agents for xerostomia. Mild cholinergic side-effects are common, but life-threatening complications of intentional overdoses are rare. Intentional overdose with ophthalmic pilocarpine is previously described, but intentional overdose with orally formulated pilocarpine hydrochloride is not. Here we present a case of respiratory failure from intentional overdose with pilocarpine hydrochloride.
Case Report: A 64-year-old female with xerostomia and past suicidality presented to the emergency department in respiratory distress after ingesting #60 5mg tablets of pilocarpine hydrochloride. Primary care, in coordination with otolaryngology, prescribed this three days earlier to treat xerostomia. Her spouse reported that she was in her normal state of health the evening before presentation; at the scene EMS identified an empty bottle consistent with the reported ingestion.
On arrival, the patient was in hypoxemic respiratory failure presumed secondary to bronchorrhea in light of copious secretions. Examination revealed an altered sensorium, a pulse of 86/minute, blood pressure of 174/116, respirations of 31/minute, rectal temperature of 34.6 °C and peripheral oxygen saturation of 90%; pupils were 2mm, round and nonreactive, and skin was warm and dry. After low dose atropine (0.5mg, then 2mg intravenously) failed to control suspected cholinergic crisis, she was uneventfully intubated. Subsequent toxicology consultation reported mild diaphoresis and trace wheezes. Presenting laboratory assessment revealed a modest lactic acidosis and moderate hypokalemia, undetectable acetaminophen and salicylates, and prescribed and emergently administered medications alone on comprehensive urine testing.
The patient cleared of her symptoms within 8 hours and was extubated on hospital day 1. She was discharged with close psychiatry follow-up after she was cleared by the inpatient psychiatric liaison service. Subsequent visits did not appear related to persistent or recrudescent symptoms of her exposure.
Case Discussion: Pilocarpine hydrochloride is an orally formulated non-specific muscarinic agent available since 1998 for the treatment of xerostomia resulting from radiation therapy or Sjögren syndrome. Intentional overdose of the oral formulation is not previously reported, but its mechanism of action and capacity to cross the blood:brain barrier suggests risk of cholinergic crisis, characterized by a hypersecretory state, bradycardia, and seizure - attributable to its tertiary amine structure - with overdose. This present patient developed neither seizure nor bradycardia with her exposure, but profound gastrointestinal and respiratory secretions with possible mild bronchospasm were evident, characteristic of the expected cholinergic crisis following significant pilocarpine overdose. Although emergency providers attempted to prevent intubation with a muscarinic antagonist, the patient's acuity on arrival forced emergent endotracheal intubation. Providers appropriately administered an antimuscarinic agent and took routine protective precautions, while the regional Poison Center specifically recommended against pralidoxime as it is not indicated if the poisoning is known to be secondary to a direct muscarinic agonist.
Conclusions: The case demonstrates the life-threatening characteristics of acute pilocarpine overdose and highlights exposure to a newer formulation not previously reported in intentional overdose. It highlights both the importance of judicious prescribing practices in patients with increased risks of self-harm, and the appropriate treatment of the critically ill patient in cholinergic crisis.

KEYWORDS pilocarpine, cholinergic crisis, atropine

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64. Implementation and Evaluation of a Naloxone Access Program Dispensing in the Emergency Department

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Increased access to naloxone, an opioid antagonist, is critical for reducing death rates from opioid overdose, yet community access to naloxone is limited. Patients with opioid use disorder (OUD) face additional barriers to access such as knowing how and where to obtain it, financial implications, and stigma from providers. In the midst of a national opioid epidemic, increased access to naloxone is imperative. Given these challenges, a pilot emergency department (ED) naloxone distribution process was implemented in September 2019. In the pilot process, physicians identified patients who had an opioid overdose and consulted pharmacy services to dispense, deliver and provide counseling on naloxone use at the bedside as processed by the outpatient pharmacy. The purpose of this study was to describe and evaluate the impact of this naloxone distribution program.
This retrospective chart review included ED adult patients presenting with opioid overdose from January 1, 2016 to December 31, 2019, identified via ICD-9/ICD-10 codes. Patients were excluded if <18-years-old, overdosed from a non-opioid substance, or incarcerated. The primary outcome was to determine the number of patients that received naloxone in the ED and institution direct naloxone cost. Secondary endpoints included: identifiers of opioid overdose, time in ED, percent of patients that received counseling from a pharmacist, and admissions from the ED.
A total of 281 patients presented to the ED with opioid overdose from January 1, 2016 to December 31, 2019. The average patient was 47-years-old (SD ±13), male 78.6% (n = 221), and Black 52.7% (n = 148). Heroin overdose comprised 87.5% (246/281) of overdoses. Prior to the implementation of the naloxone distribution program (n = 242), the most common overdose signs and symptoms included: pinpoint pupils (81.1%), unresponsiveness (78.3%), respiratory distress (65.8%), altered mental status (38.4%), and cyanosis (12.1%). Seven patients experienced a cardiac arrest after overdose, with 3 resulting in death. The average ED length of stay was 5 hours (SD ±4). About 20.2% (49/242) were admitted to the hospital for further observation and management. Forty patients presented during the naloxone distribution program. The common overdose signs and symptoms

included: pinpoint pupils (77.5%), unresponsiveness (65.0%), respiratory distress (60.0%), altered mental status (52.5%), and cyanosis (7.5%). The average ED length of stay was 4 hours (SD ±3). Two patients (5.0%) were admitted for further treatment. A total of 19 patients received take-home intranasal naloxone via the program (47.5%). All 19 patients received pharmacist counseling on opioid overdose and naloxone use. Five of 19 patients were uninsured, the cost to the institution was $353.80. Of the 21 that presented during the naloxone distribution period, but were not consulted to the program, 5 (23.8%) were given a naloxone prescription and zero received pharmacist counseling.
A naloxone take-home program is an imperative step to increasing access to a life-saving medication in high-risk patients. Implementation of the program was feasible with low institution costs. Additional provider education is needed to ensure eligible patients are captured. Further data is needed to evaluate the impact the naloxone distribution program has on reducing opioid overdose mortality rates.

KEYWORDS overdose, opioid reversal, emergency medicine

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65. Regional Poison Center (RPC) Post-Marketing Surveillance Pilot Study: Safety and Effectiveness of Antivenom for the Treatment of Crotalid Envenomation

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Background: Regional poison center (RPC) data have been used to study and describe antivenom treatment for crotalid envenomation, however, they are limited as they typically capture only the early antivenom treatment phase and usually include data from a single RPC. We sought to perform a multicenter systematic surveillance of antivenom treatment for snakebite envenomation for key safety and effectiveness outcomes, including a 10-day post-discharge follow up of outcomes.
Methods: We conducted a prospective observational study of crotalid envenomations at Rocky Mountain Poison Center (RMPC), Oklahoma Poison Control Center (OPCC), and Louisiana Poison Control Center (LPCC). Data collected during routine medical management were captured during the subject's hospitalization and through direct subject and clinician follow up 10 days post-discharge. Criteria for inclusion were: suspected crotaline envenomation, age 1 to 89 years, start date of 01 January 2019 through 31 October 2019 and call placed from a healthcare facility. Subjects were eligible for post-discharge follow up if they were age 18-89 years, received antivenom, and spoke English. Subjects were consented for 10-day follow up. Data were abstracted by trained researchers and adjudicated by a clinician investigator.
Results: Ninety five cases were eligible for data collection (RMPC: n = 52; 55%; LPCC: n = 38; 40%; OPCC: n = 5; 5%). Nearly half (n = 43, 45%) were bitten by rattlesnakes; copperhead (n = 22, 23%) and cottonmouth (n = 8, 8%) bites were also reported. 72 (76%) cases were treated with antivenom; 66 (92%) were treated with FabAv, 5 (7%) were treated with Fab2Av, and 1 (1%) was treated with both FabAv and Fab2Av. All 5 Fab2Av treatments were due to rattlesnake envenomation. No subjects reported acute hypersensitivity reactions to antivenom treatment. Thirty-two (32; 44%) were eligible for post discharge follow up, of which 24 subjects (75%) and 10 clinicians (31%) successfully completed follow up. Follow up was not completed in any Fab2Av patients, and therefore insufficient data was available for comparison to FabAv. No subjects treated with FabAv experienced recurrence of early or delayed onset HVEs (Table 1).

Table 1(#65). Key Safety and Effectiveness Outcomes in FabAv-Treated Patients.

	All Cases n (%)	FabAv Cases n (%)	FabAv Cases (Rattlesnake Only) n (%)
Acute hypersensitivity reaction	0 (0.0%)	0 (0%)	0 (0.0%)
Initial control			
After 1st dose	45 (62.5%)	41 (62.1%)	15 (53.6%)
After 2nd dose	16 (22.2%)	16 (24.2%)	7 (25.0%)
After 1st or 2nd dose	61 (84.7%)	57 (86.4%)	22 (78.6%)
Serum sickness	2 (8.3%)	2 (8.7%)	2 (20.0%)

(*continued*)

Initial control was achieved after the first dose of antivenom in the majority of FabAv (n = 41, 62%) cases (Table 1). The average amount of FabAv used to achieve initial control was 7.5 vials. Two patients treated with FabAv (8.3%) experienced serum sickness symptoms (reported symptoms included; muscle aches, fever, chills and rash). Average length of hospital stay for FabAv-treated patients was 46.0 hours. Three (4.2%) FabAv treated patients were readmitted to a healthcare facility.
Conclusion: This pilot study demonstrated the feasibility of using RPC data to evaluate the safety and effectiveness of antivenom in the treatment of crotalid envenomation. The pilot data have several limitations including the volume of data completed and limited Fab2AV cases. We were also unable to control for confounding (e.g., snakebite severity, preexisting medical conditions). Additional data should be collected to systematically evaluate key outcomes and to compare the safety and effectiveness of antivenom treatments.

KEYWORDS Antivenom, Surviellance, Regional Poison Center

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66. PoisonHelp – It's More Than a Telephone Call

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Background: Research performed by the American Association of Poison Control Centers (AAPCC) has indicated that many patients in the digital age prefer to use online resources instead of contacting a poison center. In response, AAPCC created PoisonHelp.org in 2017 to allow these users to provide self-care for minor exposures. The strategy was to ask simple questions, allowing users to perform home care when appropriate and encourage users exposed to more dangerous products or

medicines to contact their regional poison center. This is the first report of PoisonHelp.org performance.
Methods: The website (www.poisonhelp.org) is designed to provide a triage recommendation to the user within 15-30 seconds. Early testing in a variety of age groups indicated that this goal had been achieved. The site asks a short series of questions in lay terms to determine the substance, patient age, route of exposure, presence of symptoms and pregnancy status. The exposure substance is coded to the appropriate AAPCC generic code for proper identification and case management. A standard response was written by the AAPCC PoisonHelp.org committee for each AAPCC generic code. Peer review of each response was performed within the committee and by outside reviewers. The final guideline was approved by the AAPCC Board of Directors. Each completed case is uploaded into a unique section of NPDS (data are not commingled with traditional data from regional poison centers).
Results: In April 2020, PoisonHelp.org was accessed 6,789 times; 3104 (45.7%) were users in the United States. The most common sources of referral were Medline and the AAPCC website (aapcc.org). Only two poison centers had users referred from their site. Patient age spanned all age groups (Figure). The most common substance categories involved were "Unknown Substance Unlikely to be Drug Products followed by Other Antihistamines Alone (Table); over 380 generic product guidelines were utilized by users in total. Over 100,000 complete cases have been received since inception.
Conclusions: PoisonHelp.org is an easy-to-use, fast and responsible channel for individuals to address their poisoning concerns. Instructions for self-care are provided when appropriate, but referral to their regional poison center is essential if the exposure is more complicated or involves a dangerous substance. Future enhancements include enhanced substance identification, refinements of the recommendations, continued product database growth and accessibility, and improvements in reporting functions.

KEYWORDS PoisonHelp, Poison management, Online Information Syste

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67. What to Do with Manganese Neurotoxicity due to Liver Dysfunction?

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Background: Manganese (Mn) neurotoxicity or Manganism, manifests as an extrapyramidal (EPS) movement disorder. Although it is most commonly associated with chronic occupational Mn exposures, chronic liver disease is also known to predispose to neurotoxicity due to decreased biliary excretion of Mn.
Case Report: 15-year-old M with ulcerative colitis, primary sclerosing cholangitis, autoimmune hepatitis, cirrhosis with portal hypertension, on liver transplant list, was admitted for abdominal pain. During hospitalization he was noted to have episodes of upper extremity rigidity and tremors. EEG was negative for seizures. Brain MRI demonstrated bilateral increased T1 signal changes in the basal ganglia, especially in the globus pallidi, consistent with possible Mn deposition related to patient's liver failure.
Neurologic exam demonstrated hand tremor and mild cogwheel rigidity of upper extremities, which was intermittent and did not progress on repeat examinations.
Laboratory results revealed a serum Mn level of 2.8 mcg/L (normal <2.5); 24-hour urine heavy metals (As, Cd, Hg & Mn) were negative (< 1.0 mcg/L). Hgb was 12.0 g/dL, serum Fe 114 mcg/dl (50-212), TIBC 229 mcg/dl (250-450), Ferritin 29 ng/mL (24-336).
Chelation with CaNa2EDTA was not recommended at the time because the patient had mild EPS findings and there is little data that chelation has a beneficial effect on Mn-induced neurotoxic symptoms. It was felt that liver transplantation would be a preferred management choice.
Three weeks later, the patient received an Orthotopic Liver Transplant. Follow up 10 weeks post-transplant revealed an improved liver and nutritional status, and the persistent hand tremor had resolved. There was no repeat MRI.
Discussion: Biliary excretion accounts for the majority of Mn elimination and thus, chronic liver dysfunction could predispose to elevated Mn levels.
MRI findings of bilateral T1 weighted signal hyperintensity in the basal ganglia, particularly in the globus pallidi, seen in patients with manganism, have also been observed in patients with cirrhosis and parkinsonian-like clinical features. However, it is unknown to what extent these findings correlate with reversible or irreversible Mn- induced neurologic damage. Serum Mn levels do not correlate well with toxicity either.
The sparse literature on chelation of Mn using CaNa2 EDTA suggests that, although it can enhance renal excretion of Mn, there is inconsistent support for a beneficial effect on Mn neurotoxicity and thus, the benefits of chelation are unclear. Perhaps, chelation may be a bridge to liver transplantation, especially in young patients. Case reports of patients who had a liver transplant suggest potential improvement of neurologic and MRI abnormalities, and our patient demonstrated post-transplant improvement of tremor.
Conclusion: This case presents unique management issues of a young patient with cirrhosis, EPS symptoms, and MRI findings supportive of Mn neurotoxicity. Patient age and duration of neurologic symptoms may affect efficacy of chelation. The ultimate therapy may be a liver transplant with consideration of chelation as a bridge to transplantation. Long-term surveillance of EPS and MRI findings following chelation or transplant are required to further current knowledge.

KEYWORDS Manganese, Parkinsonism, Neurotoxicity

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68. Adolescent Marijuana Exposures Reported to the Rocky Mountain Poison Center

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Background: Surveillance research has demonstrated self-reported use of marijuana by adolescents in Colorado, which initiated the sale of recreational marijuana in retail establishments in 2014, has not increased. The objective of this study is to describe annual trends and characteristics of adolescent

marijuana exposures reported to the Rocky Mountain Poison Center (RMPC) from 2010 through 2019.

Methods: The National Poison Data System was queried for exposures involving a generic marijuana code in adolescents 13 to 17 years old reported to the RMPC from 01 January 2010 to 31 December 2019. Confirmed non-exposures and synthetic cannabinoid product exposures were excluded. Products were categorized into different types of marijuana products by two trained researchers. Descriptive statistics were used to evaluate medical outcome, level of care, and product type over time.

Results: A total of 573 adolescent exposures to marijuana products were reported to the RMPC from 2010 through 2019. Adolescent exposures increased 13.0% from 2010 to 2014, with larger increases in the number of exposures following sales of recreational marijuana in retail establishments (76.9% increase in exposures from 2014 to 2019). The mean age of adolescent exposures was 15.4 years (SD 1.25), and the majority of exposures involved males (58.6%). Adolescent marijuana exposures were most often treated and evaluated without being admitted to a healthcare facility (58.2%) and most often involved a minor (52.2%) or moderate (25.3%) effect. Plant products were most commonly involved in adolescent marijuana exposures (68.4%); however, exposures involving plant products have continued to decrease since the initiation of recreational marijuana sales in retail establishments (31.8% decrease from 2014 to 2019). Adolescent exposures to edible marijuana products were reported beginning in 2013 and increased through 2018, followed by a slight decrease 2019. Adolescent exposures to vaping marijuana products were reported beginning in 2017; however, very few exposures have been reported (2017: n = 1; 2018: n = 2; 2019: n = 8). Exposures involving an unknown marijuana product type increased from 2015 (n = 4) to 2019 (n = 30). Very few exposures to capsule/pill products and pharmaceutical preparations were reported over the time period (Figure).

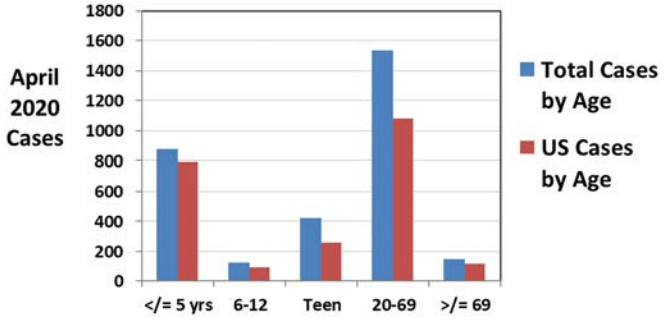

Figure (#66).

Table (#66). Rank Order of Generic Codes Utilized in PoisonHelp.org and National NPDS, April 2020.

Rank	PoisonHelp.org	NPDS
1	Unknown Substance Unlikely to be Drug Product	Melatonin
2	Other Antihistamines Alone (Excl. Cough/Cold)	Bleaches: Hypochlorite
3	Diphenhydramine alone	Ibuprofen
4	Bleaches: Hypochlorite	Acetaminophen Alone, Adult
5	Sertraline	Other Types of Foreign Body, etc.
6	Ibuprofen	Hand Sanitizers: Ethanol Based
7	Systemic Antibiotic Preparations	Multiple Vitamin Tabs: Ped Form w/o iron/fluoride
8	Disinfectants	Diaper Care and Rash Products
9	Benzodiazepines	Other Non-Drug Substances
10	Other Types of Miscellaneous Rx or OTC drug	Disinfectants: Other or Unknown

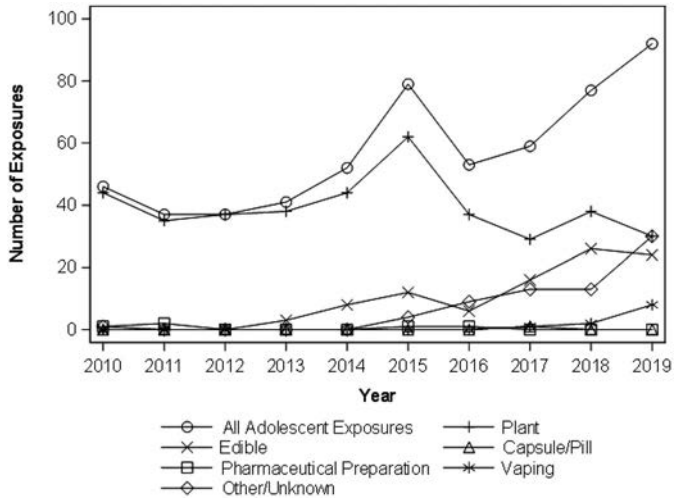

Figure (#68). Adolescent Marijuana Exposures Reported to the Rocky Mountain Poison Center by Product Type.

Conclusions: Adolescent marijuana exposures reported to RMPC continue to increase following the initiation of sales of recreational marijuana in retail establishments. While plant marijuana products remain the most common type of product involved in exposures, edible product exposures increased following the legalization of recreational marijuana and were reported almost as frequently as plant products in 2019. Adolescent exposures to marijuana vaping products were uncommon. Adolescent exposures continue to increase, and the type of marijuana product involved in the exposure changed over the study period. More studies evaluating exposure characteristics, specifically product type, among adolescent marijuana exposures may help guide the development of targeted education and intervention strategies. As exposures with unknown product types have increased annually, improving poison center education around marijuana product identification may aid in this effort.

KEYWORDS adolescent, marijuana, poison center

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69. Unintentional Pediatric Marijuana Exposures Reported to the Rocky Mountain Poison Center

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Background: Since Colorado initiated the sale of recreational marijuana in retail establishments in 2014, unintentional pediatric exposures to marijuana products have increased. Colorado has implemented interventions to prevent or reduce toxicity from unintentional pediatric exposures to marijuana products. The

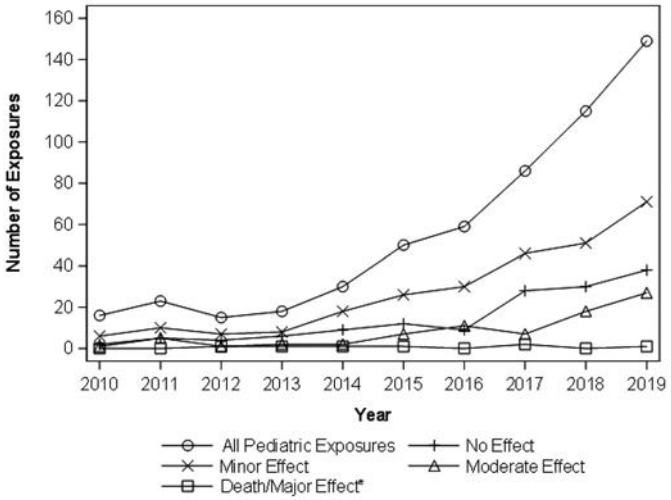

Figure (#69). Unintentional Pediatric Marijuana Exposures Reported to the Rocky Mountain Poison Center by Medical Outcome.

impact of these public health interventions remains unclear. The objective of this study was to evaluate trends in medical outcome and the level of care following unintentional pediatric exposures to marijuana products reported to the Rocky Mountain Poison Center (RMPC) from 2010 through 2019.

Methods: The National Poison Data System was queried for unintentional general exposures in children <6 years old involving a generic marijuana code reported to the RMPC from 01 January 2010 to 31 December 2019. Confirmed non-exposures and synthetic cannabinoid product exposures were excluded. Products were categorized into different types of marijuana products by two trained researchers. Descriptive statistics were used to evaluate medical outcome, level of care, and product type over time.

Results: A total of 561 unintentional exposures to marijuana products in children <6 years old were reported to the RMPC from 2010 through 2019. Unintentional exposures increased from 16 (2.9%) in 2010 to 149 (26.6%) in 2019. Sixty-four percent (64.3%) of exposures had at least a minor effect (minor effect: 48.7%; moderate effect: 14.4%; major effect: 1.1%; death: 0.2%), but exposures rarely resulted in a severe outcome (Figure). The majority of exposures were treated and evaluated at a healthcare facility (HCF) without being admitted (54.9%); exposures resulting in HCF admission fluctuated from 2014 through 2019 (range 20.2% to 29.3%). No exposures to an edible product were reported from 2010 through 2012. Exposures to edible products increased from 2013 (27.8%) to 2014 (53.3%) followed by a decrease in 2015 (44.0%) and then remained consistent from 2016 to 2019 (range 59.4% to 64.4%). In contrast, plant product exposures decreased from 2013 (66.7%) to 2019 (17.5%).

Conclusions: Unintentional pediatric marijuana exposures reported to the RMPC continue to increase despite public health interventions implemented in Colorado to prevent exposures. Severe medical outcomes are rarely reported following unintentional pediatric marijuana exposures; however, the majority of exposures had at least a minor effect on the child. Unintentional pediatric marijuana exposures involving edible products began increasing the year prior to recreational marijuana retail establishments opening in Colorado and have remained the most common products involved in unintentional pediatric marijuana exposures. Interventions previously implemented on marijuana products may not have been enough to reduce unintentional pediatric marijuana exposures, and more studies evaluating the root cause of these exposures should be performed to aid in the development of more effective intervention strategies.

KEYWORDS pediatric, marijuana, poison center

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70. A Valuable Toxicology Education: Emergency Medicine Residents' Experiences At A Regional Poison Center

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Background: An accredited medical toxicology fellowship and clinical consulting service, in conjunction with its affiliate Regional Poison Center (RPC), offers a month-long toxicology rotation for emergency medicine (EM) residents. This rotation includes didactic case conferences, journal club, and backup call with medical toxicologists. Additionally, residents spend 20 hours over one week onsite in the RPC precepted by a clinical pharmacist who is a Certified Specialist in Poison Information. They perform health care facility follow-up via telephone.

Methods: All EM residents who completed the RPC rotation were sent a survey link via email which asked 3 questions regarding the rotation (see results). Each question had 5 answer choices: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree. Survey responses were anonymous. The study period was 16 months.

Results: 103 residents completed the experiential rotation during the study; 52 surveys were returned (50% response rate). All 52 agreed that after the rotation they were more aware of the scope of RPC services, the variety of cases managed, and the expertise of RPC staff (85% Strongly Agree, 15% Agree). 94% felt that they gained additional knowledge regarding the clinical course and treatment of various overdose and poisoning exposures (63% Strongly Agree, 31% Agree, 6% Neutral). 94% of residents felt their RPC experience was educational and valuable (52% Strongly Agree, 42% Agree, 4% Neutral, 2% Disagree).

Conclusion: The vast majority of EM residents who completed an experiential RPC rotation felt the experience was educational and valuable. Future study may include RPC staff perceptions of training and educating rotating residents, as well as the benefits and quality of their health care facility follow-up calls.

KEYWORDS poison center, emergency medicine residents, teaching

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71. Comparison of the Extracorporeal Treatments in Poisoning (EXTRIP) and Paris Criteria for Lithium Poisoned Patients

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Background: The EXtracorporeal TReatments in Poisoning (EXTRIP) workgroup made "recommendations" and "suggestions"

for hemodialysis in lithium poisoning based on consensus and low-level evidence without prospective validation. Subsequently, one single-center retrospective analysis proposed their criteria (Paris) asserting it could reduce hemodialysis use without worsening neurological outcomes. We designed our study to assess neurological outcomes in lithium poisoning and compare EXTRIP and Paris criteria. The primary outcome was worsening of neurological symptoms in patients where EXTRIP and Paris criteria were discordant.

Methods: Our poison control center maintains a database from 1/1/2000-present. To limit the data to the sickest patients we performed a Structured Query Language search of all human lithium poisoned patients where hemodialysis was either recommended or performed and neurological symptoms were reported. Patients were reviewed by two authors and clinical information was extracted using a predetermined form. Patients were identified by the availability of reported data to apply either one of the two EXTRIP or Paris criteria and excluded if the peak lithium concentration was less than 1.2 mEq/L or if neurological follow-up was unavailable. Patients were included in comparative analyses only when data were sufficient to assess both Paris and EXTRIP criteria. Descriptive statistics were reported. Direct comparisons were performed by Fisher's exact test and odd ratios were calculated.

Results: 3541 lithium cases originated from health care facilities, 347 had hemodialysis recommended or performed, and 298 recorded both a supratherapeutic lithium concentration and neurological symptoms. Following exclusion for incomplete data, 219 patients were analyzed (Table). The Paris criteria could be applied to 70 patients, while the EXTRIP criteria could be applied to 178 patients (78 "recommended"; 146 "suggested"). 42 patients were excluded from the comparison because data were insufficient to determine whether Paris criteria could be applied. When both Paris and EXTRIP agreed that hemodialysis was indicated, 50/57 (88%) of patients who received hemodialysis improved, as did all 3 who did not receive hemodialysis. There were no deteriorations in the non-dialyzed group. Similarly, when both Paris and EXTRIP agreed that hemodialysis was not indicated, the outcome without hemodialysis was universally favorable. However, among the 86 patients for whom hemodialysis was indicated by either EXTRIP criteria but not by Paris criteria, 4/19 (21%) patients who did not receive hemodialysis deteriorated ($p = 0.02$; OR =8.7, 95%CI =1.5-51.8), one of whom died. This finding was consistent when only the EXTRIP "suggested" criteria were compared to the Paris criteria ($p = 0.022$; OR =8.7 95%CI 1.4-53) but did not reach statistical significance for the EXTRIP "recommended" criteria vs the Paris criteria. In only 8 patients Paris criteria indicated hemodialysis while EXTRIP did not. All patients received hemodialysis and improved.

Conclusion: When the EXTRIP and Paris criteria are both in favor of hemodialysis, dialyzed patients do well. When the two criteria are against hemodialysis, non-dialyzed patients do well. When the criteria are discordant, EXTRIP criteria outperforms the Paris criteria at identifying potentially ill patients who might benefit from hemodialysis.

KEYWORDS Lithium, Dialysis, EXTRIP

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72. How Quickly Do Lithium Concentrations Fall in Chronic Overdoses: A Validation of a Proposed Lithium Nomogram

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Background: More than 40 years ago, Hansen, et al suggested that patients whose lithium concentration [Li+] remained above 1mEq/L after 30 hours of therapy should receive hemodialysis. The EXtracorporeal TReatments in Poisoning (EXTRIP) workgroup included this concept in its "suggested" criteria for hemodialysis for patients with lithium toxicity. A recent study derived a nomogram to predict patients whose [Li+] would remain >1mEq/L after 36 hours of treatment.(1) The present study was designed to perform an external validation of that nomogram.

Methods: Our Poison Control Center maintains a database from 1/1/2000-present. We performed two Structured Query Language searches: 1) all lithium poisoned patients from 1/1/2000-present for whom hemodialysis was either recommended or performed; 2) all lithium poisoned patients from 1/1/2000-present not included in search 1. The first search was to maximize inclusion of the sickest patients. Patients were reviewed by two authors and clinical information was extracted using a predetermined

Table 1(#71). Comparison of outcomes.

	Hemodialysis							
	done			not done				
	Clinically Improved	No change	Worsened (death)	Clinically Improved	No change	Worsened (death)	P value	OR (95% CI)
EXTRIP Criteria								
Recommend or Suggest								
FOR HD	135	11	5 (3)	18	5	4(1)	0.031	5.1 (1.3 - 20.3)
AGAINST HD	31	5	0	5	0	0	ND	ND
PARIS								
FOR HD	55	7	3(3)	3	2	0	ND	ND
AGAINST HD	75	6	2	18	2	4(1)	0.022	8.1 (1.4 - 47.4)
Any EXTRIP + PARIS								
BOTH FOR HD	50	4	3 (3)	3	2	0	ND	ND
Any EXTRIP + PARIS								
BOTH AGAINST HD	14	2	0	5	0	0	ND	ND
Any EXTRIP FOR HD + PARIS AGAINST HD	61	4	2	13	2	4(1)	0.019	8.7 (1.5-51.8)
Any EXTRIP AGAINST HD + PARIS FOR HD	5	3	0	0	0	0	ND	ND

ND: no comparison done because of empty cells; HD: hemodialysis.

Table(#72). Two-by-two analysis of the data.

Characteristics	Actual post-36 hour $[Li^+] \geq 1$ mEq/L	Actual pre-36 hour $[Li^+] < 1$ mEq/L	Total Subjects	
Buckley Nomogram Predicted a 36 hour $[Li^+] \geq 1$ mEq/L	10	6	16	PPV =63%
Buckley Nomogram Predicted a 36 hour $[Li^+] < 1$ mEq/L	1	7	8	NPV =88%
Total Subjects	11	13	24	
	Sensitivity =91%	Specificity =54%		Accuracy =71%

form. Inclusion criteria were: chronic lithium toxicity, peak [Li+] ≥ 1.2mEq/L, initial creatinine recorded, timed [Li+] available to assess the 36 hour [Li+], and hemodialysis not performed. At least one documented [Li+] < 1mEq/L before 36 hours or a [Li+] ≥ 1mEq/L after 36 hours was sufficient for analysis. The predicted 36 hour [Li+] was calculated using Buckley's method with the exception that there was no adjustment of eGFR for race, because race is not documented in our database. This produced a more conservative estimate of lithium clearance. Sensitivity, specificity, positive and negative predictive values (PPV, NPV), and accuracy were calculated with standard formulas.

Results: Twenty-four cases (Table 1) met inclusion criteria: six from search 1 and eight from a convenience sample search 2 (cases from 1/1/2019-present). An additional 3005 lithium cases from search 1 (1/1/2000-12/31/2018) are still being evaluated. The nomogram correctly identified 10/11 patients whose [Li+] failed to to drop below 1.0mEq/L by 36 hours. The remaining patient's [Li+] notably increased from 1.6mEq/L on presentation to 1.8mEq/L before downtrending; the patient's neurological symptoms improved. The nomogram correctly identified 7/13 patients whose [Li+] fell below 1.0mEq/L before 36 hours. This would have increased to 9/13 if all the eGFRs were assumed to require race adjustment. The test characteristics of the nomogram (without race adjustment) are shown in the Table.

Conclusion: Predicting patients with chronic lithium poisoning who are at risk of failing conservative therapy based on their initial [Li+] and creatinine may be of benefit by prompting earlier hemodialysis. Likewise, correctly identifying patients likely to rapidly eliminate lithium would obviate the need for hemodialysis. Based on these preliminary findings, the low PPV of the nomogram prevents using the nomogram to select patients for hemodialysis, but the strong NPV might help identify patients for whom hemodialysis is unnecessary. Prospective validation in a larger cohort is required and underway.

KEYWORDS Lithium, Nomogram, EXTRIP

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73. Fentanyl-contaminated Cocaine Poisonings: A Case Series with Laboratory Confirmation

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Table 1(#73). Blood fentanyl concentrations and naloxone doses.

Patient	Blood [Fentanyl]	Naloxone Received
1	5.0 ng/mL	1mg IN
2	4.8 ng/mL	none
3	3.4 ng/mL	4mg IN, 2mg IN, 2mg IV
4	3.0 ng/mL	4mg IV
5	2.7 ng/mL	4mg IN, 0.5mg IV
6	2.6 ng/mL	4mg IN, 2mg IN, 2mg IV
7	1.5 ng/mL	1mg IN, 1mg IV
8	1.1 ng/mL	2mg IV

Background: The opioid epidemic remains a significant public health problem in the United States. Illicitly manufactured fentanyl and fentanyl analogues (IMFs) are being increasingly identified in overdose deaths. Fentanyl is approximately 100 times more potent than morphine, and IMFs have become an economical way to adulterate or replace heroin among illicit drug distributors and patients with opioid use disorder (OUD). While adulteration by IMFs is increasingly recognized among patients with OUD, what has received less attention is the contamination of non-opioid illicit substances, such as cocaine, with IMFs. There are few prior outbreaks that have been reported thus far of patients with laboratory-confirmed IMF toxicity after reporting intent to use only nonopioid substances.

Herein we report a case series of nine patients without OUD who presented to two urban emergency departments (EDs) with opioid toxicity after insufflating a substance they believed to be cocaine.

Case Reports: Over a period of under three hours, nine patients from five discrete locations were brought to two affiliated urban academic EDs. All patients were in their third decade of life and denied prior illicit opioid use. Two patients reported prior opioid exposure in the form of prescribed analgesics only, both more than one year prior. One patient reported a remote history of deep venous thrombosis; all others denied any significant past medical history. All patients endorsed insufflating cocaine shortly prior to ED presentation. Over the seconds to minutes following insufflation, all patients developed lightheadedness, and seven patients lost consciousness. In all cases of loss of consciousness, Emergency Medical Services responded and found the patients to have varying degrees of respiratory depression. These seven patients received naloxone en route to the hospital (Table 1) and all had improvement in respiratory function by arrival to the ED. None of the patients required any additional naloxone administration in the ED. All nine patients reported nausea and/or emesis which resolved with symptomatic treatment. All nine patients were discharged to home after an observation period.

Blood samples were obtained from eight patients, and urine samples from six of these. One patient declined laboratory testing. All patients who provided specimens tested positive for cocaine metabolites and had quantifiable IMF concentrations, as well as several detectable fentanyl derivatives, analogues, and synthetic opioid manufacturing intermediates. (Table 2)

Discussion: The geographic and temporal proximity of our patients' presentations, combined with the overlap in fentanyl precursors and analogues found on laboratory testing strongly suggests a common source, though sample product was not

Table 2. Additional exogenous compounds detected.

		Substance/Patient		1	2	3	4	5	6	7	8
Fentanyl metabolites		Norfentanyl (ng/mL)	Blood	1.1	0.84	0.66	0.42	0.37	0.48	0.37	0.54
			Urine	D	NA	D	NA	D	D	D	D
		N-methyl norfentanyl	Urine	D	NA	D	NA				D
	Opioid manufacturing precursor	4-ANPP	Blood	D		D		D	D		
			Urine	D	NA	D	NA	D	D	D	D
	Active Analogues	Beta-hydroxyfentanyl	Blood	D	D					D	
			Urine	D	NA	D	NA	D	D	D	D
		Acetylfentanyl	Urine	D	NA	D	NA	D	D	D	
Cocaine Adulterants		Levamisole	Urine	D	NA	D	NA	D	D	D	D
		Lidocaine/metabolites	Urine	D	NA	D	NA	D	D	D	
Cocaine metabolites		Benzoylecgonine (ng/mL)	Blood				242	326	105	100	
			Urine	D	NA	D	NA	D	D	D	D
	Cocaine/Ethanol metabolite	Ethylbenzoylecgonine	Urine	D	NA	D	NA	D	D	D	D
Prescription medications		Gabapentin /pregabalin	Urine					D			D
		Ondansetron	Urine					D		D	D
Drugs of Abuse		MDMA/MDA	Urine								D
		Cocaine	Urine	D	NA	D	NA	D	D	D	D
		Ethanol (g%)	Blood	0.01	0.06		0.15			0.11	
			Urine	0.03	NA	0.17	NA	0.04	0.22	0.16	0.13
		Cannabinoids	Blood				D				
			Urine		NA		NA	D	D		D
		Nicotine	Urine	D	NA		NA				D
Nicotine metabolite		Cotinine	Blood				D				
			Urine	D	NA		NA	D	D		D

4-ANPP: 4-anilino-N-phenethylpiperidine; D: positive qualitative detection; MDA: Methylenedioxyamphetamine; MDMA: Methylenedioxymethamphetamine; NA: no urine available for analysis.

available for confirmation. Interpretation of this data is subject to a number of limitations, including variations in time between exposure and lab collection limiting interpatient comparability.
Conclusion: IMF-contamination of illicit drugs remains a public health concern that does not appear to be restricted to heroin. Increasing prevalence implies that providers should elevate their level of suspicion for concomitant IMF exposure even in cases of non-opioid drug intoxication. Responsive public health apparatuses need to prepare for future IMF-contamination outbreaks.

KEYWORDS Fentanyl, Cocaine, Contamination

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74. Severe Lactic Acidosis in Patients Using Traditional Herbal Therapy

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Introduction: Herbal antidiabetic products are popular in Vietnam. Many cases have presented to hospitals with severe lactic acidosis, shock, and were ultimately fatal. We reviewed the clinical findings of these patients for factors that contributed to their illness and death, and analyzed the ingredients contained in these herbal products sold for diabetic treatment.
Method: This was a single-center, retrospective, observational case series. Data were collected on all cases who presented with severe lactic acidosis after use of traditional herbal anti-diabetic pills, over the two-year time period 2018–2019. Past medical histories and clinical findings were reviewed. Samples of the herbal anti-diabetic products,and patient blood and urine were analyzed.
Results: A total of 18 cases of severe lactic acidosis with use of herbal anti-diabetic pills were reviewed. These patients had a diagnosis of diabetes for an average of 9 years (9.4 +/-4.6 years). The use of these herbals for blood glucose control ranged from one month to 8 years; approximately 50% of these patients consumed these products over a year's time. Only two cases had combined herbal products and metformin 500 mg. The total mean of herbal pills consumed was 9 (SD ±8); patients commonly took combinations of two different colored tablets. Major manifestations included gastrointestinal disorders, severe metabolic acidosis (pH $=6.85 \pm 0.22$, HCO3- $= 4.4 \pm 2.6$), with multi-organ failure and shock on admission. Hyperlactatemia was present in all cases (195 ± 74 mg/dL). For lactate removal and acidosis correction, IHD/CRRT was performed, ranging from 2 hours to 72 hours depending on the severity of lactic acidosis and patient need. The mortality rate was 33.3% and all patients became hypoglycemic, either at initial presentation or during treatment. There were 22 samples of herbal pills available for testing that contained biguanides metformin and phenformin, with a higher concentration of phenformin than metformin if both were present. Phenformin was detected in all samples. Arsenic was also found in two samples.
Conclusion: Biguanides are an effective treatment for diabetes and were added to traditional herbal pills sold and used for blood glucose control. Many users of these products are doing so because of the cost and perception of the safety of natural remedies. Biguanide poisoning may still occur even in patients without renal impairment.

KEYWORDS Herbal pills, Metformin, Phenformin

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75. Hypercalcemia and Pseudohypercalcemia from Strontium Chloride Supplementation

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Background: Strontium (Sr) is a chemical element and alkaline earth metal. It has been purported to improve bone density and is taken by some as an over-the-counter supplement. Sr is chemically similar to calcium and is nominally incorporated into newly formed bone in its place. Strontium appears to decrease bone resorption by suppressing osteoblast differentiation and shift the

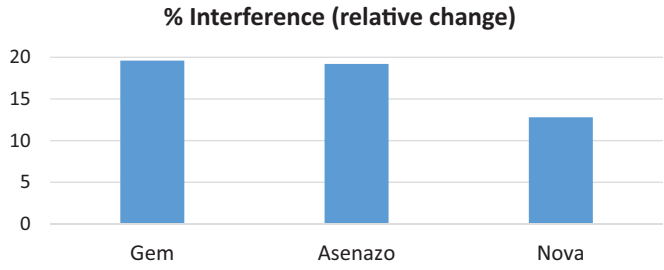

Figure 1(#75). Relative change in calcium levels with increasing strontium using three different devices.

balance of bone remodeling to the bone-building osteoblasts. It is not known how chronic strontium supplementation could potentially interfere with clinical calcium testing and affect the diagnosis of hypercalcemia. We present a case of hypercalcemia associated with strontium supplementation and confirmed interference with clinical laboratory calcium assays.

Case Report: A physician contacted the Central Virginia Poison Control Center regarding a 75-year-old female who presented to the emergency department with progressive weakness. On-site point-of-care ionized calcium testing was performed on a GEM5000 blood gas analyzer with a result of 7.8 mg/dL (normal ~4-5). Referral laboratory studies utilizing an arsenazo-dye mediated method revealed a total serum calcium of 14.9 mg/dL (normal ~8-10). The patient reported taking strontium chloride for bone health. This prompted the question: could strontium supplementation interfere with the calcium assay and lead to pseudohypercalcemia?

In preliminary experiments, pooled remnant patient plasma was fortified with six different concentrations of strontium. In three unique pools of plasma, Sr was found to positively interfere with the Abbott™ arsenazo-dye calcium assay. A clinically significant increase in calcium was detected at Sr concentrations of 2.5 mg/dL and above. A plasma sample fortified with 5.0 mg/dL was analyzed on the GEM5000 and results indicated a clinically significant increase in calcium compared to control. Less Sr interference was observed with the ionized calcium assay on the NOVA blood gas instrument (figure). Some recommended Sr supplement doses are in gram quantities and given the relatively long biological half-life of Sr in humans; therefore, high Sr concentrations are physiologically possible and relevant.

Case Discussion: Strontium positively interferes with the arsenazo-dye mediated calcium assay used in some laboratories and potentially other calcium assays. This indicates that patients taking strontium containing supplements are at risk for pseudohypercalcemia, especially if using the arsenazo-dye mediated method for quantitating plasma calcium.

Conclusion: Supplementation with strontium can result in an inaccurate interpretation of serum calcium. Measurement of ionized calcium on a NOVA blood gas instrument may provide a more accurate evaluation of calcemic status in the presence of Sr.

KEYWORDS Strontium, Calcium, Pseudohypercalcemia

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76. Negligible Nux Vomica: Do homeopathic remedies contain any strychnine?

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Background: A 55 year-old female reported to an emergency department with severe vomiting following ingestion of the "St. Ignatius bean" for treatment of constipation. This "bean" is the seed of the Strychnos ignatii tree reportedly containing the toxic alkaloids, strychnine and brucine, akin to the Strychnos nux-vomica tree. No typical neuromuscular findings of strychnine poisoning developed, and the gastrointestinal upset resolved over 8 hours. The St. Ignatius bean and the homeopathic "Nux Vomica" extract have been advocated in alternative medicine circles as treatments for gastrointestinal distress. Both are readily available for purchase from herbal or homeopathy shops. Given their name, it could be presumed that these products were derived from Strychnos trees and contained small amounts of strychnine in accordance with homeopathic principles. Human poisonings of strychnine resulting in serious toxicity or death occur at doses of 1-2 mg/kg, but as little as 15-20 mg has caused severe clinical effects. The aim of this study was to analyze commercially available Nux Vomica products and a sample of purchased St. Ignatius beans to determine their strychnine and brucine content; and whether use or overdose of them could be expected to result in clinically significant toxicity.

Methods: Strychnine and brucine detection limits were set at 0.1 ng/g. Using ultra-performance liquid chromatography tandem mass spectroscopy, various formulations of Nux Vomica products and St. Ignatius beans were analyzed. Product labeling varied between preparations and included: Boiron® Nux vomica 6c, 200ck, and ColdCalm® (3c HPUS); and Hyland's® Nux vomica 30x. Nux Vomica products were analyzed using the product's labeled entire first day of use dose. St. Ignatius beans were analyzed following a 1-hour steep (either whole-bean in very hot water, or macerated bean in ethanol).

Results: None of the analyzed Nux Vomica products contained any detectable strychnine or brucine (limit of detection, 0.1 ng/g). The hot water steeped St. Ignatius bean extract contained 550 ng strychnine. The macerated ethanol steeped St. Ignatius bean extract contained 560 ng strychnine. Expected strychnine dose from a St. Ignatius bean would be <0.001 mg. Brucine was not detected in either bean.

Conclusions: Our study reveals that the quantifiable amount of strychnine in homeopathic Nux Vomica products or St. Ignatius beans are not likely to result in clinically significant strychnine toxicity.

KEYWORDS strychnine, St. Ignatius bean, Nux Vomica

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77. Clinical outcomes of "massive" APAP overdose treated with standard-dose N-acetylcysteine

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Background: Traditionally, patients presenting after a single acute overdose of acetaminophen (APAP) have been risk stratified using the Rumack-Matthew nomogram. Prophylactic treatment with N-acetylcysteine (NAC) with standard dosing was historically derived for treatment of roughly 16-gram ingestion. Recently, greater attention has been paid to so-called "massive" APAP overdoses, variably defined as over 30-40 grams of APAP, and whether standard dosing of NAC is adequate in this setting. Some authors have suggested that doses of NAC beyond standard dosing may improve outcomes following massive APAP ingestions. The primary aim of this study was to evaluate the clinical outcome for patients meeting massive APAP overdose

criteria who were treated with a standard intravenous NAC dosing of 300 mg/kg in the first 21 hours. The secondary aim was to determine the incidence of acute liver injury (AST/ALT >150 U/L, but <1000 U/L) and hepatotoxicity (AST/ALT >1000 U/L) among these patients.
Methods: This was a single-center retrospective cohort study conducted by chart review of massive APAP overdoses reported to a regional poison center from 1 January 2010 to 31 December 2019. Cases of massive APAP overdose were defined by an APAP concentration exceeding an adjusted massive nomogram starting at 300, 450, or 600 mcg/mL at 4 hours post-ingestion. Cases were excluded from analysis if a time of ingestion was not available, if intravenous NAC dosing greater than 300mg/kg in 21 hours was utilized, or if oral NAC was used in treatment. Standard univariate statistical analysis was conducted to describe the cohort, and a multivariate logistic model was utilized to calculate adjusted odds ratios for risk of hepatoxicity.
Results: 1425 cases of APAP overdose were initially reviewed. 105 cases met the inclusion criteria of massive APAP overdose for analysis. No deaths or liver transplants were noted among these cases. Overall, 74 cases (70%) had no acute liver injury or hepatotoxicity, 6 (6%) had acute liver injury, and 25 (24%) developed hepatoxicity. Nine percent of cases receiving NAC within 8 hours developed hepatotoxicity. Crude odds for hepatoxicity was 5.5-fold higher for cases who received NAC later than 8 hours. Using a multivariate analysis that controlled for both APAP serum concentrations by adjusted nomogram line (as a surrogate for dose) and administration of activated charcoal, we found an approximately 11% increase in risk for hepatotoxicity for every hour delay in NAC administration.
Conclusions: Standard dosing of NAC will adequately prevent hepatoxicity in the majority of massive APAP overdoses that receive NAC within 8 hours. No deaths or hepatic transplants occurred in this cohort with standard NAC dosing. Hepatoxicity due to massive APAP overdose is more likely due to delay in treatment. Further study is needed to determine the efficacy of higher NAC dosing for massive overdose.

KEYWORDS acetaminophen, N-acetylcysteine, massive

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78. Unintentional Administration of Intra-Articular Hydromorphone

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Background: There are many strategies for obtaining appropriate postoperative analgesia following complete and partial knee arthroplasty. One strategy that has been described is the post-operative administration of intra-articular morphine, typically between 5-15 mg. This is typically well tolerated, though data on the total reduction in post-operative oral and parenteral opiate administration following this approach is equivocal. One agreed-upon feature of intra-articular morphine is the delayed response, with studies suggesting the peak effect is 2-3 hours after administration with a total duration of local analgesia of up to 72 hours. There also tends to be minimal systemic effects, as the proposed mechanism is via intra-articular opiate receptors and systemic absorption is theoretically minimal at these doses.
Case Report: The patient is a 64-year-old female presenting from an outpatient surgical center for inability to arouse the patient after right knee hemiarthroplasty. The patient received 4 mg of midazolam and 100 mcg fentanyl pre-operatively. The patient was supposed to receive 10 mg intra-articular morphine at the end of the procedure, however the patient erroneously received 10 mg intra-articular hydromorphone. On arrival to the ER the patient was approximately 6 hours post-op. She was somnolent, though she was minimally responsive to painful stimuli. Vitals on arrival were HR 78, BP 112/64, RR 12, O2 97% on 2L nasal cannula. Initial exam revealed a comatose patient with 1mm pupils bilaterally. She responded briskly to 0.4 mg IV naloxone, though she quickly became somnolent again over the course of one hour. Her respiratory rate remained stable and she did not have an increasing oxygen requirement, so she was admitted to the hospital for observation. She did not require any further naloxone and quickly returned to her baseline mental status over the course of several hours following admission. She was subsequently discharged without further complication.
Case Discussion: Opiate overdose is a common cause of altered/depressed mental status in patients that present to emergency departments in the United States. This case highlights a typical presentation of opiate intoxication, with depressed mental status and depressed respiratory rate, but with a unique route of administration. The benefit of intra-articular morphine in post-operative patients is a delayed onset and prolonged duration of action; it is these features that led to the clinicians in this case pursuing admission for observation of recrudescence of opiate intoxication. Ultimately this patient did not require further naloxone, which suggests that in future patients with this presentation could theoretically be observed in the emergency department and discharged if they do not show worsening respiratory depression.
Conclusion: This case demonstrates a common clinical presentation, opiate intoxication, but with a unique route of administration. Ultimately this patient did well with one dose of IV naloxone, suggesting that, despite the theoretically delayed peak and prolonged duration of intra-articular narcotic administrations, these patients can be treated in a similar manner to other patients with opiate intoxication.

KEYWORDS Hydromorphone, Naloxone, Medication Error

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79. Assessing E-cigarette and Other Nicotine-related Regulations and Exposures from 2012-2018

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Background: As e-cigarette use increased in the United States (US), the number of e-cigarette cases reported to poison control centers increased as well. To date, no studies have assessed the impact of the US Food and Drug Administration's August 2017 Compliance Policy on nicotine exposures. We hypothesized that e-cigarette exposures increased after this policy, given that it extended the period in which e-cigarette producers could sell largely unregulated products, and that these effects exceeded the anticipated reduction in poisonings achieved after the implementation of the Child Nicotine Poisoning Prevention Act of 2015.
Methods: We conducted a retrospective review of all suspected nicotine toxicity cases reported to a statewide poison center network from September 1, 2012 to December 31, 2018. Detailed phone records were reviewed for characteristics and outcomes. Nicotine toxicity was measured as the primary outcome, and was stratified by nicotine product use (e-cigarette, combustible cigarette, and other) and by time-range: before and after implementation of the Child Nicotine Poisoning Prevention Act of 2015, and before and after the 2017 Compliance Policy. Secondary analysis included clinical outcome and age of the patient.

Table 1(#79). Number of nicotine exposures reported to a statewide poison center network, 2012-2018.

	Before Child Nicotine Poisoning Prevention Act of 2015 Dates: 9/1/2012 - 1/27/2016		After Child Nicotine Poisoning Prevention Act of 2015 Dates: 1/28/2016 - 12/31/2018	
	Total exposures	Average number of monthly exposures	Total exposures	Average number of monthly exposures
Combustible tobacco products	1672	40.8	1364	39.0
E-cigarettes*	745	18.2	741	21.2
Other nicotine-containing products	433	10.6	377	10.8
	Before August 2017 Compliance Policy Dates: 9/1/2012 - 8/9/2017		**After August 2017 Compliance Policy** Dates: 8/10/2017 - 12/31/2018	
	Total exposures	Average number of monthly exposures	Total exposures	Average number of monthly exposures
Combustible tobacco products	2489	41.5	547	34.2
E-cigarettes*	1103	18.4	383	24.0
Other nicotine-containing products	639	10.7	171	10.7

*Includes liquid nicotine exposures.

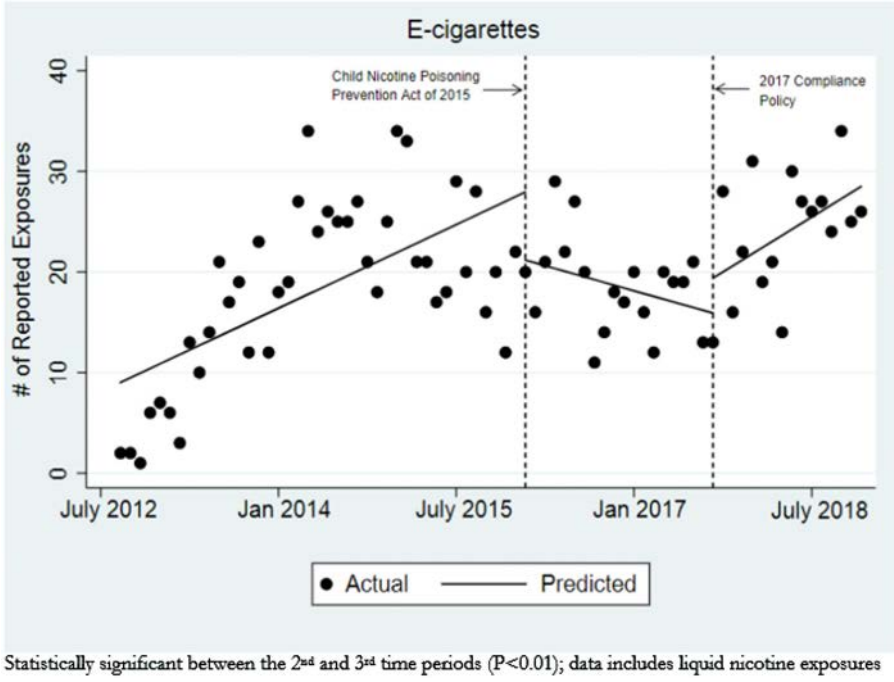

Figure 1(#79). E-cigarette exposures reported to a statewide poison center network, 2012-2018
Statistically significant between the 2nd and 3rd time periods ($P < 0.01$); data includes liquid nicotine exposures

Results: A total of 5,277 cases met inclusion criteria; 28.2% involving e-cigarette exposures. The median age was 1.33 years. Our analysis found that there was no significant change in e-cigarette exposures after the implementation of the Child Nicotine Poisoning Prevention Act despite previous studies suggesting a reduction. However, exposures for e-cigarettes increased significantly after the August 2017 Compliance Policy ($p < 0.01$). The shift in e-cigarette exposures was substantial enough in scope that the total exposures containing all types of tobacco and nicotine products increased significantly after the policy change ($p < 0.05$). Children accounted for the majority of nicotine-related exposures during this time period; 76.1% of all exposures were in individuals under 5 years of age, and 4.5% were in individuals between 5 and 18 years of age. Children under 5 years of age accounted for 70.8% of all e-cigarette exposures; this proportion is larger than that in previous nationwide poison control center studies. Specifically for symptomatic e-cigarette exposures in all age groups, only 5% had serious adverse outcomes (4.8% moderate, 0.2% major), and no deaths. We found that the majority of exposures were potentially due to the following problem categories: product design, labeling, and the appeal of flavors.

Conclusions: These findings suggest that existing efforts to regulate e-cigarettes have failed to prevent poisonings and that young children are particularly at risk. Additional regulations, specifically ones that target product design, labeling, and flavorings, are needed to reduce future nicotine toxicities due to e-cigarette use.

KEYWORDS Electronic Nicotine Delivery Systems, Poisons, Nicotine

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80. Bupropion Overdose Mimicking Brain Death

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Introduction: Bupropion, or Wellbutrin, is a commonly prescribed antidepressant that is particularly dangerous when taken

in excess. Overdoses of bupropion have been documented in the literature to cause cardiovascular collapse as well as seizures with persistent loss of neurologic function. This case highlights a massive bupropion ingestion with subsequent loss of neurologic activity to the point of apparent brainstem death.
Case Report: A 48-year-old male presented to outside hospital after ingesting 90 tablets of 300 mg extended-release bupropion (2700 mg total) in a suicide attempt. The patient called emergency medical services (EMS) approximately 10 minutes after ingestion complaining of chest discomfort. On arrival to the emergency department (ED) the patient required intubation secondary to refractory seizures. He was also given activated charcoal, polyethylene glycol and initiated on propofol infusion as well as norepinephrine due to fluid refractory hypotension. Patient was then transferred to tertiary care facility. On arrival he had no brainstem reflexes. Pupils were 6 mm and non-reactive. Patient exhibited reflexes in upper extremities but had no response to noxious stimuli. EEG demonstrated continuing seizure activity that responded to lorazepam and continued propofol. Patient also exhibited intermittent junctional rhythm with a QTc as prolonged as 611 ms. Comprehensive drug screen noted no other drugs ingested. Patient was admitted to the hospital for monitoring and supportive care. Approximately 36 hours after ingestion, the neurological exam showed intact brainstem reflexes. Neurologic function gradually improved throughout duration of stay. On discharge he was able to stand and take steps with assistance. He was transferred to a rehabilitation facility.
Discussion: Bupropion is an atypical antidepressant that is increasing in popularity. With a particularly dangerous overdose profile, understanding the presentation and stabilization of bupropion toxicity is critical for critical care physicians. This case describes an intentional overdose of approximately 27 grams of bupropion resulting in status epilepticus, QTc prolongation, and the appearance of brainstem death. Electroencephalography can play an important role in the management of bupropion overdoses, as in the case presented. It is a common diagnostic modality when an overdose presentation includes a seizure, but also has practical utilization in brain death and coma. With supportive care, this patient ultimately made a full recovery emphasizing the necessity of educating providers to keep neurologic prognoses extremely guarded.
Conclusions: High levels of bupropion may completely shut down the brain (including an iso-electric video EEG and lack of brainstem reflexes). Clinically these patients will appear as if they're brain dead (e.g. with fixed and dilated pupils) leading to inappropriate withdrawal of life-sustaining therapy. Conclusion of brain death should be deferred until enough time has elapsed for the medication to be fully systemically eliminated.

KEYWORDS Bupropion, Overdose, Brain Death

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81. Outcomes of Hyperbaric Oxygen Treatment Following Hydrogen Peroxide Ingestion: A Systematic Review

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Background: When ingested, hydrogen peroxide (H_20_2) can cause significant morbidity and mortality due to right- and left-sided air emboli that damage vital organs and/or cause cardiovascular collapse in addition to locally caustic effects. Hyperbaric oxygen therapy (HBOT) is a recommended treatment for left-sided symptoms (e.g., stroke, seizure, myocardial infarction (MI)). Clinical efficacy of HBOT in this setting remains largely undocumented.
Objective: The purpose of this systematic review was to evaluate effect of HBO treatment on left sided embolic symptoms after H_2O_2 ingestion using cases described in the literature and reported to US Poison Centers (USPCs).
Methods: Literature searches using terms related to H_20_2 and embolism were performed in PubMed, EMBASE, CINAHL Complete, Web of Science, Scopus, and Google Scholar from database conception to May 29, 2019. Articles were screened by two independent reviewers based on *a priori* inclusion and exclusion criteria.
Demographics, volume and concentration of H202, timing of embolic symptom onset, and type(s) of embolic event were extracted from literature cases and published poison center records. Repeat cases were eliminated. Potentially reversible embolic phenomena (altered mental status, stroke, seizures, MI), hemodynamic instability, and gas emboli in either ventricle, pulmonary arteries or coronary arteries were defined as clinical effects of interest (CEOI). Outcomes (full recovery versus residual deficits/death) and timing of HBOT treatments in relation to onset of CEOI(s) were recorded and analyzed with Chi-Squared and Mann-Whitney U. Cases where timing of CEOI(s), HBOT, and unknown outcome were excluded.
Results: 126 cases were included for analysis: 85 from the database search and 41 from 2017 USPC study. 78 patients had at least one CEOI. 23/78 (29%) CEOI patients received HBOT:13 had full recovery and 10 had residual deficits/died. 55/78 (71%) CEOI did not receive HBOT: 23 had full recovery and 32 had residual deficits/died. Chi squared: 1.4; p-value 0.23.
Mean time from CEOI onset and HBO treatment in full recovery group was 9 h while mean time for partial recovery/death group was 18.2 h. Two-sided Mann-Whitney U was not significant ($p = 0.40$)
Discussion: HBOT was not associated with higher proportion of full recovery in CEOI cases and time to HBOT did not differ between full recovery and partial recovery/death. However, disease heterogeneity, disease recognition, clinical stability, large range in timing to HBOT, and small sample size may have affected results. HBOT remains the logical treatment for oxygen emboli and should be considered first-line treatment until further evidence emerges. Prospective cluster trial of USPCs after concentrated H2O2 ingestion (i.e. USPCs recommend immediate HBOT, observation then HBOT if embolic event occurs, or no HBOT) is suggested.
Conclusion: Based on current literature and USPC cases, there are no measurable differences in outcome with HBOT or in timing of HBOT for serious embolic phenomena. This lack of significance is likely multifactorial and should not dissuade HBOT in appropriate cases. A coordinated research effort among USPCs could help define effectiveness of HBOT.

KEYWORDS Hydrogen Peroxide, Hyperbaric Oxygen Therapy, Embolism

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82. A Scoping Review of Inhaled Vitamin E Acetate, Vitamin E (tocopherol), and Pyrolyzed Acetate

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Background: Vitamin E Acetate (VEA) has come under significant scrutiny due to its association with e-cigarette and vaping associated lung injury (EVALI). Theoretical mechanisms have been

proposed for toxicity including tocopherol (Vitamin E) mediated surfactant damage, or pyrolysis of acetate to ketene. No summarized data to evaluate the toxicity of VEA or its proposed mechanisms exist. The objective of this study is to characterize the current state of literature in mammals or humans evaluating inhaled VEA, tocopherol or analogues, or pyrolyzed acetate and the subsequent effect on the lung.
Methods: A protocol was developed using Preferred Reporting Items for Reviews and Meta-Analyses (PRISMA) guidelines to conduct a scoping review on inhaled VEA, tocopherol or analogues, and pyrolyzed acetate. Ovid/MEDLINE, Scopus, and Web of Science Core Collection were searched for original research articles in all languages from time of inception to 2/26/2020. Included studies evaluated pulmonary effects in mammals (human or animal) after exposure to inhaled tocopherol or analogues, or any compound containing acetate administered via inhalation after pyrolysis. Two blinded independent reviewers screened articles for inclusion by title and abstract using the Rayyan application. Relevant included articles were read in full to determine if they met inclusion criteria. References from included studies were then screened for additional articles. Any disagreement on inclusion was resolved via third party review. Key outcomes were collected independently by two separate reviewers in a predefined data collection sheet. The first 14% of studies were collected in duplicate to ensure abstracter congruence.
Results: The initial search resulted in 783 unique articles. After abstract and title screening 15 articles were included for full text review. Two were excluded due to incorrect route of exposure, and one additional study was included from reference screening. In total 14 original research articles were included. Alpha tocopherol, gamma tocopherol, or a combination were evaluated in 78.6% (11/14) of studies. Only 21.4% (3/14) evaluated VEA. No studies evaluated acetate after pyrolysis. Tocopherol was studied for a protective effect against a known toxicant in 81.8% (9/11). All studies of tocopherol without acetate demonstrated pulmonary protective effects against toxicants. Two trials evaluated the protective effects of VEA against a known toxicant. VEA did not demonstrate a lung protective effect. One trial examined the effects of VEA on the lung alone. The trial demonstrated increased markers of lung injury compared to control. Markers of lung injury evaluated in studies were heterogeneous.
Conclusions: Tocopherol has primarily been evaluated as a protective antioxidant in lung injury. Only one trial has evaluated the effect of VEA alone on lung tissue. No identified trials have evaluated pyrolyzed VEA, tochoperol, or any form of acetate. Trials evaluating VEA without co-exposed toxicants, as well as trials utilizing the route of pyrolysis would aid in our understanding of the potential role of VEA in lung injury.

KEYWORDS EVALI, Vitamin E, E-Cigarette

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83. Forty Years of Poison Control Center Research: Does Pollyanna Still Live?

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Background: The "Pollyanna Phenomenon," an optimism for useful interventions appearing as efficacious as useless ones, was first described in 1992[1]. An editorial written in 1997 highlighted this phenomenon regarding passive data collection from Poison Control Centers (PCCs) and its limitations related to minimally symptomatic or asymptomatic patients[2]. PCCs continue to collect data passively with an immense data pool. Despite these "big data," limitations to PCC research persist. The term toxicovigilance was borne from this editorial and suggestions were made to improve PCC data fidelity and to overcome the "Pollyanna Phenomenon." We investigated PCC research over the past 40+ years to determine the impact of this editorial on toxicovigilance[2].
Methods: We searched PubMed and EMBASE for PCC research from 1978 to 2020 using these search terms: "Poison Center", "Poison Control Center", "Poison Centre", "Poison Control Centre." Research articles before 1997 established a baseline for research quality[2]. Research articles from 1997 to April 2020, served as the intervention group assessing for changes in the quality of research and were examined for evidence of toxicovigilance. Articles were included in this study based on the following criteria: written in English; classified as original research; performed in a PCC setting, and the study objective was focused on an identifiable xenobiotic or xenobiotics. Each article was assessed for toxicovigilance based on the following criteria: confirmation of said xenobiotic(s) either qualitatively or quantitatively, study methodology (retrospective or prospective), and clinical recommendations made "beyond the scope of study methodology." If a study did not confirm xenobiotics' presence analytically, the study was considered to make recommendations beyond the scope of the study methodology.
Results: Our search initially identified 1614 articles. A random sample of 400 articles was chosen for review. From 1978-1997, 88 articles were initially identified. Twenty-five studies met inclusion criteria. Fifteen were retrospective and ten were prospective. Two studies confirmed exposure confirmation analytically in each group. Ten retrospective studies made clinical recommendations based on their conclusions, none of which confirmed the analytical presence of xenobiotic(s). Ten prospective studies made clinical recommendations with only two analytically confirming the presence of the xenobiotic. From 1998-2020, 138 research studies

Table 1(#83). Summary of results in each category evaluated with corresponding percentages.

	n = 25			
1978-1997	Retrospective	%	Prospective	%
	15	60%	10	40%
Analytically Confirmed Exposure	2	13%	2	20%
Clinical Recommendations	10	67%	9	90%
Recommendations Beyond the Scope of Methodology	9	60%	7	70%
	n = 138			
1998-2020	Retrospective	%	Prospective	%
	117	85%	19	14%
Analytically Confirmed Exposure	19	16%	7	37%
Clinical Recommendations	87	74%	17	89%
Recommendations Beyond the Scope of Methodology	68	58%	10	53%

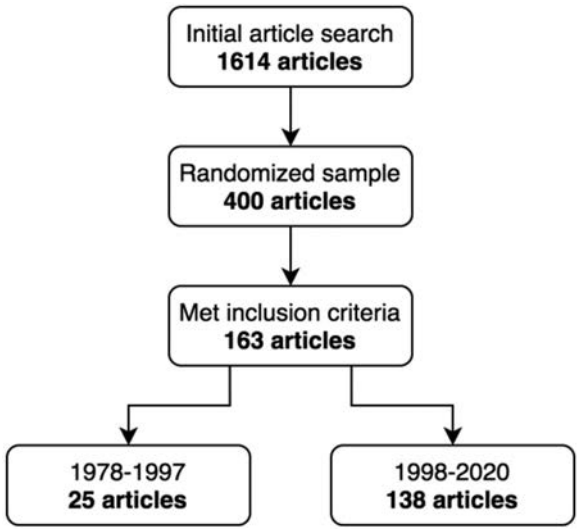

Figure 1(#83). Resulting articles after screening based on inclusion criteria and further categorization based on publication year.

met inclusion criteria of which 117 were retrospective and 19 were prospective. Of these two groups, 19 and 7 had analytically confirmed xenobiotic presence in the retrospective and prospective studies, respectively. Sixty-eight retrospective studies and ten prospective studies made clinical recommendations without analytically confirming xenobiotic exposures. Comparing the baseline and intervention groups, we observed an increase in the frequency of retrospective studies with a similar proportion making clinical recommendations while lacking confirmation of exposures. There was an increase in rates of xenobiotic confirmation by 2% in the intervention period. **Conclusion:** Toxicovigilance appears to be lacking in many PCC studies. Despite vast advancements in analytical techniques and the ability to gather and record data, the "Pollyanna Phenomenon" remains vibrant in PCC research. Efforts towards improving the frequency of analytical testing and confirmation of xenobiotic exposure are essential to improve PCC data collection and research and must be considered prerequisites for journal publication.

KEYWORDS Pollyanna, Poison Center based research, Poison Center Data quality and analysis

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84. The Amish Community and Poisonings, are they at Higher Risk of Adverse Outcomes?

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Background/objectives: Amish lifestyle differs from that of the general non-Amish population due to not using electricity or modern technology; they depend on alternate power sources to survive, gasoline and kerosene to run generators and farming equipment, and manufacturing household products like lye soap. Due to these circumstances, the Amish have many substances around their homes that are not found in the average non-Amish household. The primary objective of this study was to determine if Amish individuals have more severe outcomes and require higher levels of care when exposed to toxins, compared to the general state population managed by the poison center.
Methods: This was a retrospective study of Amish patients managed by three regional Poison Centers over a twenty-year period. Cases were identified by searching the notes for "Amish" in the text. All cases involving an Amish patient were included. Cases were excluded if the patient was not noted to be an Amish individual, Amish made products but not Amish patients, non-poison center cases (i.e. public health), and cases that were transferred to another poison center. Data, free text and coding, were reviewed by two authors for agreement and the third author served as deciding vote on inclusion if necessary. Statistics for this study were primarily descriptive, with the use of Mann-Whitney/Wilcoxon two-sample tests and Chi square (Fisher-Exact) to evaluate differences between Amish exposures and the general population for both medical outcomes and management sites. Odds ratios with 95% confidence intervals were calculated.
Results: From 2000 to 2019 there were 224 Amish patient cases identified. There were 118 males (53%) and 106 females (47%). Mean and median ages were 6.79 years (SD 12.67, 28 days - 86 years) and 2.00 years, respectively; 86% ($n = 193$) were pediatric patients (0-19 years). Majority (53%) were seen in the hospital, of which 24% were admitted for medical care. Compared to the general state population managed by the poison centers the Amish were: three times more likely to receive treatment at a healthcare facility (OR 3.90, 95% CI 2.99-5.07) and twice as likely to be admitted and admitted to critical care unit (OR 2.49 [1.84-3.39] and OR 2.41 [1.59-3.56]), respectively; all $p < 0.001$. Fifty-eight (26%) patients experienced severe medical outcomes: 50 (22%) moderate, 7 (3%) major, and one (0.4%) death. Compared with the general pediatric and total population, the Amish were ten times and five times more likely to experience severe outcomes (OR 5.42 [4.02-7.30] and OR 10.61 [7.58-14.85]), respectively; both $p < 0.001$. Amish exposures most commonly involved hydrocarbons (39%), pharmaceuticals (19%), carbon monoxide (6%) and pesticides (5%). Top substances for the general population included pharmaceuticals (58%), household cleaning products (8%), cosmetic/personal care products (8%), foreign bodies (4%) and pesticides (3%).
Conclusions: The Amish community are more likely to be exposed to harmful substances that result in more severe medical outcomes requiring higher levels of care when compared to the general population.

KEYWORDS Amish, Amish Poisonings, Severe outcomes

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85. Drug-Induced Hyperthermia: A Tale of Two Temperatures

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Background: Rapidly recognizing and treating hyperthermia is essential to prevent devastating consequences. We describe two patients with apparent MDMA-associated hyperthermia with significantly different cooling initiation times and outcomes.

Table (#85).

Maximum temperature	107.8 °F (42.1 °C)	106.4 °F (41.3 °C)
Time to ice bath after measured temp >105 °F	<30min	2 hours
Initial neurological examination	Responsive to pain	Unresponsive to verbal or painful stimuli
Initial (peak) lactate (reference range 1.00-1.90 mmol/L)	9.6 (9.6)	16.5 (16.5)
Initial (peak) CPK (reference range 35-155 U/L)	1,733 (8,360)	1008 (>78,000)
Initial (peak) creatinine (reference range 0.1-1.1 mg/dL)	1.3 (1.3)	2.15 (15.4)
Initial (peak) AST (reference range 11-35 U/L)	65 (612)	54 (3480)
Initial (peak) ALT (reference range 25-100 U/L)	36 (579)	74 (3147)
Hospital days of ventilator dependence	2 days	49 days
Hospital discharge neurological examination	At baseline	Unable to ambulate, lower extremity weakness, and dysmetria
Hospital days to discharge	3 days	60 days

Case Reports:
Case 1: A 27-year-old previously healthy woman was found unresponsive in a nightclub after using "MDMA." Upon ED arrival by ambulance, vital signs were: BP, 92/58mmHg; HR, 162 beats/minute; RR, 31 breaths/minute; T, 107.6 °F (rectal); O_2 Sat, 99% (RA). Rapid ice water bath immersion cooled her to 100.4°F within 27 minutes of arrival (0.15 °C/min). During cooling she received 3L of intravenous (IV) 0.9% saline and lorazepam 2mg IV. After removal from the ice bath, her core temperature decreased to 98.4°F. Subsequently, she was endotracheally intubated with rocuronium 100mg IV and etomidate 20mg IV and sedated with IV midazolam (5mg/hr). She required a phenylephrine IV infusion (100mcg/min) for hypotension and was given cyproheptadine 8mg via nasogastric tube for presumed serotonin toxicity. She was extubated on day two and discharged to home on day three with complete clinical recovery.
Case 2: A 25-year-old previously healthy man was found confused and agitated at a dance club after using "MDMA." Initial vital signs were: BP, 117/68 mmHg; HR, 94 beats/minute; RR, 11 breaths/minute; T, 102.6 °F; O_2 Sat, 94%. Upon ED arrival, he was endotracheally intubated with rocuronium 50mg IV and etomidate 20mg IV and sedated with a midazolam infusion (0.4mcg/kg/min). His core temperature increased to 106.4°F three hours later and cooling was initiated with ice packs to the axillae and groin. After Poison Control Center consultation, ice water immersion was initiated five hours after presentation. Although his core temperature decreased to 98°F seven hours after arrival, the duration of immersion was incompletely documented. His urine drug screen was positive for "amphetamines." Twenty-four hours after presentation, he developed disseminated intravascular coagulopathy and rhabdomyolysis. His course was further complicated by acute kidney injury, aspiration pneumonia, hepatic failure, bone marrow suppression, and posterior reversible encephalopathy syndrome. He remained hospitalized for 60 days, followed by 15 days of acute inpatient rehabilitation.**Case Discussion:** These two patients with suspected MDMA ingestions were of similar age, had no prior medical histories, and presented with similar clinical findings, but had significantly different times to effective cooling. Severe hyperthermia is defined as a core temperature ≧ 105°F and requires aggressive cooling in ice water immersion. The first patient was cooled within 27 minutes of arrival and was discharged 3 days after presentation without any long-term sequelae. The second patient had a significant delay to effective cooling and spent 60 days in the hospital with likely permanent disability.
Conclusion: Drug-induced hyperthermia is a life-threatening emergency that can lead to multisystem organ failure and possibly death if not treated aggressively. Clinicians should rapidly identify hyperthermia and initiate rapid cooling with ice water immersion. The use of ineffective techniques that lead to delayed cooling may result in severe complications, debilitating long-term sequelae, or death.

KEYWORDS Hyperthermia, MDMA, Drug-Induced

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86. A Prospective Observational Study Characterizing Lurasidone Toxicity

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Background: Lurasidone is a novel antipsychotic approved by the FDA in 2010 to treat schizophrenia and in 2013 to treat bipolar depression. Despite being around for almost a full decade, toxicity associated with acute lurasidone has not been well delineated. The primary objective of this study is to describe the clinical effects associated with singe acute lurasidone ingestions as reported to a single statewide poison center.
Methods: In this IRB approved study, all lurasidone ingestions reported to a single state-wide poison center (approximately 35,000 human exposures a year) were prospectively reviewed to increase accuracy of information. Cases were collected from March 1, 2017-March 1, 2019. Variables recorded include age, gender, site of treatment, vital signs, physical exam findings, cardiac intervals, electrolytes. Cases were excluded for coingestants, subacute or chronic ingestion, or for lack of follow-up.
Results: In the two-year study period, 47 patients with acute lurasidone ingestion were identified. Thirty-one cases were excluded (26 cases excluded for polypharmacy ingestion and 5 cases were excluded for lack of follow-up). Of the 16 cases included in the analysis, 6 were less than 20 years and 10 were adults over 19 years. Age ranged from 2 years to 63 years old and 10/16 (62.5%) were female. 9/16 patients were admitted for medical monitoring. No patients required ventilator support or advanced airway management. 6/16 patients were noted to be sedated. 14/16 patients had vital signs all within normal reference values; the other two patients with abnormal vitals only had tachycardia. Hypotension was not seen in any of the cohort. No patients had creatinine kinase values > or =500 units/L. One patient reportedly had a seizure prior to arrival in the emergency department that was not witnessed by any health care provider. He did not have any further neurological symptoms after arrival at health care facility. No patients had muscle spasms or dystonic reactions. Per American Association of Poison Control Centers definitions, 4/16 had no effect, 2/16 had minor outcome, 9/16 had moderate outcome, 1/16 had major outcome, and 0/16 had death.
Conclusion: In this cohort, acute single ingestion of lurasidone was generally well tolerated. The most common symptom appeared to be mild sedation and was seen in less than half of the patients. While one patient was recorded as having a seizure, it was not witnessed by any health care provider and none of the other 15 patients had severe neurological effects. Except for this patient, no one else was reported as having a major effect. No patients developed cardiac arrhythmias, cardiac interval prolongation, or severe respiratory depression. While further research is needed, acute single ingestions of lurasidone were generally well tolerated.

KEYWORDS Lurasidone, Poison Center, antipsychotic

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87. The Role of the Poison Center and the Use of an Intradepartmental Data Repository During the Novel Coronavirus Outbreak

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Background: The novel coronavirus pandemic created an unprecedented public health emergency. Quick and efficient communication of the most current information became a primary goal and necessity for our state. Poison centers historically have been and remain today one of the best methods for critical information dissemination in a public health emergency. The Tennessee Poison Center (TPC) was activated to provide this service for our state on March 5, 2020.
Methods: The TN State Department of Health (TNDOH) partnered with the TPC to open an information line dedicated to coronavirus questions originating from the public. In its inception, the coronavirus hotline was intentionally kept separate from the poison control hotline with the concerns that inundating the poison line with coronavirus questions could unintentionally create a second public health crisis. It was imperative that call center staff and multitude of rotating volunteers including medical students and pharmacy students from four institutions could quickly access the most current clinical recommendations, testing triage guidelines, and isolation timelines. The types of caller questions varied widely as the pandemic reached a variety of communities and created a multitude of difficult scenarios. New and unanswered questions were compiled by the coronavirus hotline specialists and were reported back to the state health department on a biweekly basis for clarification and further instruction.
The TPC created an internal Google Site to use as a centralized data repository for public health information and resources. The novel nature of the outbreak required frequent guideline updates as new information became available. The TNDOH provided the call center with the answers to frequently asked questions as they became available. The internal Google Site was kept up to date in real time as statewide guidelines, CDC recommendations, and testing capabilities changed. All guidance and new information was managed on this single site – including links to important CDC and TN State Department of Health documents and recommendations by a Poison Information Provider and the Managing Director.
Results: By using this data repository tool, the coronavirus hotline has answered over 16,000 questions in seven weeks, roughly a third of our typical annual call volume, with consistent, quick, and thorough information. The TPC has provided roughly 5,000 hours of service to the TNDOH through staffing of the coronavirus hotline in this timeframe.
Conclusion: Poison centers are uniquely positioned to assist state and local health departments in a public health crisis. The communication of everchanging public health guidance presents a time sensitive and quality control challenge when managing a hotline with multiple specialists. These challenges can be overcome with motivated partners and centralized resources such as Google Sites.

KEYWORDS coronavirus, public health, poison center
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88. Intractable Vomiting and Sedation Requiring Intubation in a Child Exposed to Varenicline

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Background: Varenicline (Chantix®) is a partial agonist at subtype $\alpha4\beta2$ nicotinic acetylcholine receptors and is prescribed to aid in smoking cessation. It is also an agonist at 5-HT_{3A} receptors, commonly causing nausea and vomiting, and in overdose these can the predominant symptoms on initial evaluation. Reports of significant symptoms in pediatric patients are rare. Here we present a pediatric exposure to varenicline led to significant major effects.
Case Report: A 16-month-old, 10.3 kg female child presented to the emergency department (ED) with vomiting. Her initial vital signs were as follows: HR 99 bpm, RR 28/min, BP 125/70 mmHg, and temperature 98.1 °F. The mother stated that she been prescribed varenicline months ago but stopped taking it and had forgotten she had left it in her purse. This morning she found her child had gotten into her belongings and found her with the open bottle of her varenicline and surrounded by pills, which she quickly cleaned up and threw away. There was no witnessed ingestion and no other medications were in the home except acetaminophen. They report the family has not had any visitors who could have led to other potential exposures. Six hours later (and twenty minutes prior to ED presentation), the patient developed sudden and continuous vomiting. On exam, ED staff noted that she was repeatedly retching and appeared lethargic. Vascular access was placed, and she was given ondansetron and intravenous fluids. However, it was noted she was becoming progressively more sedate and was intubated for airway protection, one hour after symptom onset. She was then transferred to the children's hospital intensive care unit (ICU). Laboratory testing was significant for hypokalemia of 3.0 mmol/L (reference 3.5-5.5 mmol/L). Electrocardiogram was unremarkable. She arrived to the ICU three hours after ED presentation and sedation was discontinued. Physical exam was significant for 3-4 beats of ankle clonus and mild hyperreflexia. After one hour, she was fully awake and subsequently extubated. The remainder of her hospital course was uncomplicated, and she was discharged the following morning. On repeat exam, ankle clonus had resolved.
Case Discussion: Varenicline has agonist effects on both nicotinic and serotonergic receptors, however in this exposed patient, it appears the effects at the 5-HT_{3A} receptor predominated. Her nausea and vomiting did not stop despite receiving multiple doses of ondansetron which is a highly selective antagonist at the 5-HT_{3A}receptor. It was felt that this patient was intubated due to airway protection and anticipatory course rather than from direct effects from her ingestion, with total time of intubation about three hours. In a review of the literature, medical outcomes are minor and gastrointestinal effects are also the most commonly reported. To our knowledge this is the youngest case reported in the literature, resulting in significant effects and ultimately resulted in an intubation.
Conclusion: Pediatric varenicline exposure can result in significant clinical effects, including intractable vomiting and sedation.

KEYWORDS Varenicline, Pediatric, Exploratory Ingestion
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89. Systematic Review of the Effect of N-acetylcysteine Treatment For Amatoxin Poisoning

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Introduction: Amatoxin is accountable for most death cases of mushroom poisoning around the world, which would mainly cause *gastrointestinal disturbances and* multiple organ dysfunctions, including liver and renal failure. As a potential antidote for amatoxin, N-acetylcysteine is used in treatment for decades but the benefit is still controversial.
Objectives: We undertook a systematic review to evaluate the effectiveness of N-acetylcysteine on patients with amatoxin intoxication.
Methods: We searched Pubmed, EMBASE, CENTRAL and SinoMed database, from database inception to Aug 2019. Articles were eligible if there were five or more patients with amatoxin intoxication, and N-acetylcysteine was included in the therapeutic regimen. Mortality rate including liver transplant cases (MRLTi) was the primary outcome. Liver function, renal function, and other complications were the secondary outcomes.
Results: Twelve studies with a total of 463 patients were included. The mortality rate including liver transplant cases (MRLTi) of amatoxin-poisoning patients with NAC treatment is calculated to be 10.6% (49 cases/463 cases), with the mortality rate excluding liver transplant cases (MRLTe) to be 7.34% (34 deaths/463 cases) and liver transplantation (LT) rate to be 3.89% (18 LTs/463 cases). The peak value of transaminase was attained at around 48-72 hours after admission, while the time to peak of creatine varies from the first day to the fourth day after start of treatment. The coagulation function was still getting worse during the first 48-72h after the start of treatment and get back to normal at around the 5th day based on the test of PT, and the international normalized ratio (INR) was recorded to descend to normal range at around 72 hours after admission.
Conclusions: The mortality rate of amatoxin-poisoning patients with NAC treatment is relatively low compared with patients that didn't accept NAC treatment, and NAC could be safely used in both adults and children. However, the effectiveness of NAC for amatoxin intoxication still needs to be confirmed by future researches, especially randomized controlled trials.

KEYWORDS amatoxin poisoning, N-acetylcysteine, liver function

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90. Comparison of Characteristics of Kratom, Buprenorphine and Methadone in National Poison Data System Exposures (2011-2019)

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Background: Kratom is popularly known as a "natural" alternative to prescription opioids and an aid for opioid withdrawal. It became readily available in the United States in the early 2010s and reported use and exposures have risen exponentially since 2016. The purpose of this investigation is to compare exposure characteristics of kratom to current pharmaceutical opioid use disorder treatments.
Methods: Single product exposures for kratom, buprenorphine and methadone were obtained from National Poison Data System (NPDS) from 2011 to 2019. Reason for exposure, level of care, and medical outcome were examined for adult (age ≥12 years) exposures. Medical outcomes categorized as 'clinically significant' experienced a medical outcome of moderate effect, major effect, or death. Descriptive statistics were used to compare exposure characteristics across products.
Results: A total of 35,865 single product exposures were included in the analysis (buprenorphine (57.8%), methadone (33.8%), and kratom (8.4%)). From 2011 to 2019, kratom exposures increased from 8 to 943 (11,687.5%), buprenorphine exposures increased 16.5%, and methadone exposures decreased 48.5%. Males accounted for 66.3% of kratom exposures, 51.7% of buprenorphine exposures, and 53.4% of methadone exposures. Average age was highest in methadone (35.0 years), followed by kratom (32.8 years), and then buprenorphine (19.3 years).
Among adults (age ≥12 years), Intentional – Abuse was the most common reason for exposure reported. 49.0% of kratom, 26.4% of buprenorphine and 22.7% of methadone exposures were identified as Intentional – Abuse (Table 1). Kratom exposures experienced the highest proportion of clinically significant outcomes (45.1%), followed by methadone (40.8%), and buprenorphine (22.3%). Deaths were infrequent; methadone exposures experienced the highest proportion of deaths (0.5%; n = 54), followed by kratom (0.3%; n = 8), and buprenorphine (0.1%; n = 9). Kratom exposures most frequently required evaluation in a healthcare facility (HCF) (84.4%), followed by methadone (78.4%) and buprenorphine (67.0%). Among those who received care in a HCF, 35.9% of kratom, 41.2% of buprenorphine, and 65.9% of methadone exposures required admission.
Conclusions: Calls to US poison centers from 2011-2019 showed differences in exposure characteristics between kratom, methadone, and buprenorphine. Poison center calls for kratom reported higher rates of intentional abuse than for the other

Table 1(#90). Adult (Ages ≥ 12) Exposure Reasons by Product (2011-2019).

	Kratom (n = 2,770)	Buprenorphine (n = 10,653)	Methadone (n = 9,890)
Unintentional - Therapeutic error	28 (1.0%)	1,736 (16.3%)	2,212 (22.4%)
Unintentional - General	129 (4.7%)	556 (5.2%)	287 (2.9%)
Unintentional - Misuse	45 (1.6%)	227 (2.1%)	85 (0.9%)
Unintentional - Other	34 (1.2%)	76 (0.7%)	66 (0.7%)
Intentional - Misuse	319 (11.5%)	1,423 (13.4%)	902 (9.1%)
Intentional - Abuse	1,356 (49.0%)	2,812 (26.4%)	2,249 (22.7%)
Intentional - Suspected suicide	116 (4.2%)	899 (8.4%)	1,804 (18.2%)
Intentional - Other	131 (4.7%)	554 (5.2%)	727 (7.4%)
Adverse reaction	359 (13.0%)	1,448 (13.6%)	700 (7.1%)
Other	171 (6.2%)	604 (5.7%)	363 (3.7%)
Unknown reason	82 (3.0%)	318 (3.0%)	495 (5.0%)

drugs studied. Understanding the specific reasons for kratom use may provide additional information about its safety relative to other opioid use disorder treatments. Though the number of kratom exposures limits the comparison of the 3 products in this abstract, our analysis highlights the need for further research in order to ensure the safety and efficacy of this perceived "natural" opioid treatment alternative.

KEYWORDS kratom, opioid treatment, poison system exposures

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91. Severe Vitamin D Toxicity and Hypercalcemia Requiring Dialysis in Family Intentionally Poisoned with Concentrated Vitamin D Oil

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Introduction: We discuss a case of severe vitamin D toxicity and hypercalcemia requiring dialysis following a chronic intentional poisoning of a family (a mother, her 3-year-old son, 4-year old daughter, her brother, and her parents) with concentrated vitamin D3 oil.
Case: The 3 year-old and 4 year-old siblings presented to the emergency room with nausea and vomiting. The children were previously treated and discharged a month prior for elevated vitamin D levels and hypercalcemia. On exam, bloodwork showed elevated serum 25—hydroxyvitamin D levels of 786ng/ml and 1215ng/ml and increased serum calcium levels as high as 17mg/dl. Both children were re-admitted for emergent dialysis and forced diuresis.
The mother also disclosed that the children's grandparents and uncle had recently received medical care for similar symptoms. After multiple bouts of recurrent nausea and vomiting, the children's uncle began to suspect that his estranged wife was poisoning his family. When he was released from the hospital he searched her home and found a white plastic jug with a manufacturer's label that read "Vitamin D3 1.0 MIU/gram." It was discovered that his estranged wife brought the oil home from her workplace and siphoned the oil into another container to give the grandparents to use as a cooking oil. The grandparents did most of the cooking for the entire family. This particular brand of vitamin D oil is designed for use in oil dispersions, encapsulated products, and fortified foods.
Discussion: Vitamin D is a fat soluble vitamin and is available in two forms, D2 (ergocalciferol) and D3 (cholecalciferol). It is commonly used to treat hypoparathyroidism, osteoporosis, osteomalacia, and in the prevention of rickets. Research and evidence suggest that it may also play a role in the prevention of multiple types of cancer including colon, prostate, and breast cancer. Vitamin D is widely available in single dietary supplements, multivitamins, and fortified foods like bread, milk, and cereal. Vitamin D is metabolized by vitamin D-25-hydroxylase into 25-hydroxyvitamin D. It acts via specific interactions that occur within the gastrointestinal and skeletal systems to promote calcium absorption. It also helps regulate serum calcium and phosphate levels to maintain homeostasis. It is said that vitamin D acts like a hormone due to our innate ability to naturally produce vitamin D, its systemic circulation in the blood, and the initiation of reactions by binding to receptors. Most exposures are minor and only cause mild symptoms such as nausea, vomiting, diarrhea, and abdominal discomfort. Severe toxicity is rare and seen with chronic exposures of large amounts of overly fortified foods or aggressive use of supplements. Severe toxicity can cause seizures, confusion, renal failure and cardiac dysrhythmias. This case illustrates the severe sequalae that can be seen after a chronic exposure to a concentrated vitamin D liquid.

KEYWORDS vitamin D, hypercalcemia, intentionally poisoned

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92. Spanish Speaking Staff Increased the Utilization of the Poison Center for Spanish Speaking Callers

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Objective: There are over 300 languages spoken in the United States. Spanish is the second most spoken language in the United States, and is spoken as the first language in millions of American households. As a healthcare resource, the Poison Center provides up-to-date information on toxic exposures. The Specialists in Poison Information (CSPI) answers calls from the public, emergency medical services, and healthcare providers. Depending on the service population calls from the public may linguistically diverse. Studies show language barriers prevent people from seeking medical care, when patients and providers speak the same language patients report less confusion and better health care quality. The aim of this study is to determine if the number of Spanish speaking Specialists in Poison Information staffing the poison center makes a difference in the number of Spanish speaking calls managed.
Methods: Data collected from the surveyed 2019 Poison Center archived cases were reviewed. The study compared two time periods in 2019 where a Poison Center serving a predominantly Hispanic population was staffed with three and five Spanish speaking CSPIs over 157 days. Group A had five Spanish speaking CSPI and managed cases for 157 days from January 1st to June 7th. Group B had three Spanish speaking CSPI and managed cases for 185 days from June 8th to December the 10th. To have an equal representation of group A and groups B twenty-eight days and the average number of calls managed by group B in that twenty-eight-day time frame was corrected by removing them.
Results: The average number of Spanish calls managed by the Poison Center under review is 787 per year. Group A, managed 291 calls with 5 CSPI's, and group B managed 160 calls with 3 CPSI's during the designated time. Each CSPI managed a similar number of cases during the designated study period. CSPI's in group A, on the average managed 58 cases in the 157 days, and CSPI's in group B, on the averaged managed 53 cases in 157 days. The Poison Center after June 7th only had three Spanish speaking CSPI's. The total number of Spanish language calls managed by the poison center in 2019 was 476. There was a 39 percent decrease in Spanish language calls managed by the Poison Center which supports the hypothesis that the more Spanish Speaking CSPI's will manage more Spanish language calls.
Conclusion: The number of calls managed by CSPI's in group A and B, were similar. More Spanish speaking calls were managed when the Poison Center was staffed with more Spanish speaking CSPI's. It would be prudent to assess the community to be served and staff according to the needs of the community. Decreasing language barriers improves access to health information and expands reach for those who may otherwise not be served.

KEYWORDS Spanish speaking, language, language barrier

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93. The Top Ten Medications Most often taken by Preteens to Commit Suicide

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Objective: According to the Center for Disease Control and Prevention (CDC) the number of suicides has increased in the United States by 25% over the last two decades. Suicide is carried out by different methods which include hanging, firearms, suffocation, and strangulation. Less common methods include railway suicide, jumping from heights, and drug overdose. Children attempt suicide daily and every 5 days a child succumbs to suicide. Some drug overdoses exhibit characteristic symptoms/toxidromes. Toxidromes can help healthcare professionals identify what the person might have taken, even if the person is a poor historian, uncooperative or incapacitated. The primary toxidromes encountered are: anticholinergic: *atropine, diphenhydramine, and quetiapine*; cholinergic: *pesticides;* opioids: *heroin, hydrocodone*; sedative/hypnotics: *benzodiazepines* and sympathomimetics: *amphetamines, caffeine, cocaine*. The objective of this research is to identify the 10 most common medications used by preteens between the ages of 6 to 12 years of age to commit suicide by drug overdose.
Methods: A retrospective review of the 2019 database from six regional poison centers in the United States to determine the top 10 most commonly used medications by children between the ages of six to twelve years of age who attempted or committed suicide by drug overdose.
Results: The data from 6 regional Poison Center documented 404 attempts or suicides by drug overdose in 2019. The top 10 medications most frequently taken by children attempting suicide, in descending order of frequency are as follows: ibuprofen (20%), acetaminophen adult formulation(16%), atypical antipsychotics (11.6%), sertraline (10.6%), antihistamines alone (9%), diphenhydramine-alone (7.9%), fluoxetine (7.9%), trazodone (5.4%), antibiotics (5.4%), and melatonin (5.4%).
Conclusion: Over 58 percent of the time children in the study took over-the-counter medications to commit suicide. These medications are readily available to children but are not innocuous. Overdosing on medications such as *acetaminophen, antihistamines, and ibuprofen* can cause hepatic, renal, neurological, and cardiac toxicity, leading to the child's injury and/or untimely death. Prescribed medications such as *fluoxetine, sertraline, trazodone, atypical antipsychotics and antibiotics* are less accessible but usually remain readily available. Medications, like firearms, should be kept secured and be accounted for. Medication availability combined with the child's Impulsive behavior can contribute to children's increased frequency in suicide by overdose.

KEYWORDS preteen, suicide, top ten

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94. Answering the Call During COVID-19

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Background: Coronaviruses are a group of viruses that cause illnesses like the common cold, severe acute respiratory syndrome, Middle East respiratory syndrome, and COVID-19. COVID-19 originated in China in 2019; by March 2020 it was declared a pandemic by the World Health Organization. The Centers for Disease Control suggest the virus is highly contagious. The virus spread is still under investigation, it is spread mainly from person to person through respiratory droplets and by touching surfaces or objects that are contaminated with the virus. Auto inoculation can occur by touching these surfaces and then touching the mouth, nose, or eyes. In the United States the virus has infected over 1.5 million people and over 100 thousand have succumb to the disease. In an effort to contain the spread of the virus, in March 2020 Federal and State governments issued guidelines to provide flexible and remote work options to employees.
There are 55 Poison Centers (PC's) in the United States operating 24/7 to provide expert medical advice on managing poison emergencies, response to public health crises and emerging hazards. In an effort to comply with Federal and State recommendations 6 regional PC's coordinated with their information technologies teams, host institutions, and the State administrator of the poison control program to implement remote agent (RA) workstations. The object of this study is to determine if the remote agent workstations were effective in delivering the poison center's services efficiently avoiding covid-19 cross contamination, while maintaining staff satisfaction.
Methods: We performed a telephone survey on participants with remote access. Questions were asked related to their ability to work successfully at home, productivity, support from leadership, and satisfaction with the efforts to protect their health and safety. We utilized data from the Toxic Exposure Surveillance System to determine if there was a difference in call volume before and after remote workstations were employed.
Results: There are 50 SPI's working in the six participating PC's of which 38 were interested in remote working, satisfied technical requirements, passed the computer set-up test, received institutional authorization, and signed remote agent agreements. The number of cases managed by the participating poison centers in March and April were 15,922 and 14,827 respectively. Calls were recorded as required and there were no major technical problems. From the participating group to date none contracted COVID-19. Respondents to the survey answered affirmatively that leadership showed concern for their health and safety and expressed a positive remote experience.
Conclusion: The COVID-19 pandemic was declared on March 11th 2020, and by March 31st the first RA went remote. Extensive planning and coordination between venders and stakeholders ensued to develop policies and procedures to include information security, quality improvement standards, and privacy protection of callers. A paradigm shift has occurred in the manner in which the PC service is delivered. The deployment of RA's has proven to be effective and a success in the current crisis while maintaining staff satisfaction and safety.

KEYWORDS remote agent, COVID-19, paradigm shift

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95. Acetaminophen Overdose in a 720-Gram, 25-Week-Gestation, Five-Day-Old, Micro-Preemie

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Background: Acetaminophen (APAP) is a commonly used antipyretic and analgesic medication used for adults and children. APAP can be dispensed alone or in combination with other products (opioids, analgesics, sedatives, decongestants, expectorants, and antihistamines), and can be administered by intravenous, oral, and rectal routes. APAP has a wide therapeutic index and a

wide margin of safety yet it is the drug overdose most frequently reported to the poison centers. APAP overdose is the most common identifiable cause of acute liver failure in children. Neonatal APAP toxicity, however, is rare. We present a case of a premature 5-day-old, 25-week gestation, 720-gram neonate with an APAP level of 297mcg/mL (drawn 3 hours post ingestion of the 3rd supratherapeutic dose) successfully treated with N-acetylcysteine.
Case Reports:
A 25-week gestation, 720-gram, 5-day-old micro-preemie male was admitted to the Pediatric Intensive Care Unit for a patent ductus arteriosus (PDA). APAP was ordered for treating the PDA. The prescribed APAP dose was 9.0 mg (12.5 mg/kg) every six hours. Inadvertently the patient was given 90.0 mg every 6 hours 3 times before the miscalculated dose was realized. Laboratory findings post supratherapeutic dosing were as follows: APAP level 297 mcg/mL, AST 17 IU/L, ALT <9 IU/L, BUN 49 mg/dL, T Bili 6.3 mg/dL.
The poison center was consulted; the medical toxicologist recommended the standard Intravenous N-acetylcysteine protocol: 150mg/kg/hr. loading dose, followed by 50 mg/kg/over 4 hrs. followed by 100 mg/kg over 16 hrs. until there was no measurable serum APAP detected, AST/ALT normalized, and the INR was <2. The patient received treatment for 45 hours. Post treatment lab results were as follows: APAP 8.9 mcg/mL, AST/ALT 22/9, T Bili 5, BUN/Cre 36/0.7, PT 21.4, INR 1.79, and PTT 45.6.
Case Discussion: Although nonsteroidal anti-inflammatory drugs are the standard therapy for PDA treatment, the physician selected APAP, which is an effective alternative and offers fewer side effects. Hepatotoxicity is theoretically possible in micro-preemie neonates after APAP overdose, but there are no guidelines on how to dose NAC. The NAC package insert makes recommendations for 10 kg or greater. Neonates and infants less than 1 year of age typically have immature enzyme systems, including the sulfation and glucuronidation pathways, and CYP isoforms used in APAP metabolism. After APAP overdose young children's metabolic pathways preferentially select sulfation over glucuronidation, when these pathways are exhausted, APAP metabolism proceeds via CYP 2E1 to the toxic metabolite N-a-etyl-p-benzoquinone-imine (NAPQI), responsible for hepatic injury and toxicity. APAP toxicity appears to be low in micro-preemies, possibly due to the neonate's slow oxidative metabolism and rapid glutathione synthesis, both of which lead to a slower production of NAPQI. Prompt NAC administration may further decrease hepatotoxicity and liver injury.
Conclusion: There is limited information on toxicity, biochemical effects, and treatment that occur in micro-preemies after acetaminophen overdose. Hepatotoxicity was mitigated in this case with the administration of N-acetylcysteine and possibly the micro-preemie physiological development state.

KEYWORDS micro-preemie, neonate, N-acetylcysteine

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96. An Increase in Preteen Suicide Attempts by Drug Overdose in the Past Decade

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Objective: According to Centers for Disease Control and Prevention (CDC) the number of suicides in the United States has risen by 25% over the last two decades. Suicide is the 10th leading cause of death in the United States with approximately 123 suicides a day. One national survey estimated that 0.5% of adults aged 18 or older made at least one suicide attempt. Rates of suicide attempts vary depending on demographic characteristics such as gender, ethnicity, race, and age. Every year 12,000 children aged 5-14 years old are admitted to psychiatric hospitals for suicidal behavior. Children as young as six years of age have attempted suicide by overdose. There are many reasons why teens and preteens attempt and commit suicide; mental illness as well as environmental causes. Environmental causes include: bullying, cyber bulling, sexual & physical abuse. Mental causes include: depression, bipolar disorder, borderline personality, eating disorders, feelings of worthlessness and hopelessness. Preteens are impacted by family conflict while teenagers are affected by relationship conflicts. The purpose of this research is to determine if there has been an increase in suicide attempts by preteens by overdosing between the ages of 6 and 12 years of age over the last decade.
Method:
Poison centers collect demographical data on individuals who attempt or commit suicide. A review research data from the last ten years was conducted on suicide attempts from 6 regional poison centers (10%) of the poison centers in the United States. The survey included suicide attempts between the ages of 6-12 years of age. The study will document the percent increase or decrease of suicide attempts in pre-teens for the last decade.
Results: Statistical data collected from 6 regional poison centers from 2009-2019 show a percentage increase in suicide attempts in our surveyed research age category of 6-12 years of age. The percentage increase by each year of age are as follows: 6 y/o: 21.7%, 7 y/o: 28.3%, 8 y/o: 17.8%, 9 y/o: 55.1%, 10 y/o: 21.3%, 11 y/o: 18.9% and 12 y/o: 18.6%.
Conclusion: The data reviewed from six regional poison centers over the past decade showed an increase in suicide attempts by overdose in children between the ages of six and twelve years of age. The findings are consistent with the statistics published by the CDC for the national statistics on suicide. Data presented support the hypothesis of increased rate of preteen suicide attempts during the past decade.

KEYWORDS preteen, suicide attempt, teens

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97. Large False Elevation of Ethylene Glycol in a Patient with DKA

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Background: We report a case of a patient with diabetic ketoacidosis who was incidentally found to have an elevated ethylene glycol concentration which prompted additional workup and nearly resulted in unnecessary fomepizole administration.
Case Report: A 55-year-old male presented to the Emergency Department with a dislodged tracheostomy, altered mental status, and a severe anion gap metabolic acidosis. His initial BMP revealed: Na 138 mmol/L, K 5.1 mmol/L, Cl 84 mmol/L, CO2 < 7 mmol/L, BUN 14 mg/dL, Cr 1.53 mg/dL (baseline 0.6 - 0.9 mg/dL), glucose 245 mg/dL. Venous lactate was 17.2 mmol/L, and anion gap was 47. A venous blood gas revealed pH 7.04, pCO2 16 mmHg, pO2 50 mmHg, bicarbonate 4 mmol/L, Base Excess -24 mmol/L. Beta hydroxybutyrate was 11.21 mmol/L. The patient had a past medical history notable for alcohol abuse, poorly controlled Type 1 Diabetes Mellitus, and multiple hospital admissions for diabetic ketoacidosis (DKA). Toxic alcohol levels were ordered as part of the workup for the acidosis. An enzymatic ethylene glycol (EG) resulted 149 mg/dL. Methanol, ethanol, and isopropanol were not detected. Venous lactate at the time the EG was drawn was 9.4 mmol/L. The patient and his roommate denied access to or ingestion of any toxic alcohols. The

toxicology service was consulted and opted not to treat with fomepizole based on the likely falsely elevated enzymatic assay. A second EG level was ordered, which was 101 mg/dL. Microscopic examination of the patient's urine revealed no calcium oxalate crystals. A confirmation of the EG, performed by GCMS, was drawn at the same time as the second level and sent to a reference laboratory. The result returned six days later, and EG was not detected.

Case Discussion: The test used to measure the initial EG level was the Catachem *VetSpec*ä Ethylene Glycol Kit. This assay utilizes glycerol dehydrogenase as the reagent to convert EG to glycoaldehyde, with the concomitant reduction of NAD + to NADH. The formation of NADH, measured spectrophotometrically, correlates with the EG level, which is reported as the result. There are a number of known interferences with this assay. Elevated serum lactate can falsely elevate EG because the oxidation of lactate to pyruvate by lactate dehydrogenase also produces NADH. Propylene glycol is a common excipient in medications is also known to cause false elevations of EG by this method. The patient described above had not received any medication containing propylene glycol. Although a number of case reports describe the effect of lactate on this assay, the EG level in those cases is rarely >40 mg/dL. This case identifies that a falsely elevated level can be much higher than previously reported.

Conclusion: A false elevation of EG can lead to unnecessary workup, inappropriate antidotal administration or even dialysis. We report a very high EG level via enzymatic assay confirmed negative by GCMS. It was most likely due to interference from the elevated serum lactate. Clinicians should be aware of the methodology of toxic alcohol assays at their home institutions and their associated limitations prior to instituting interventions.

KEYWORDS ethylene glycol, false, lactate

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98. Incidence of recurrent and delayed coagulopathies in North American rattlesnake envenomation patients treated with crotalidae polyvalent immune Fab, an update of the Arizona Poison and Drug Information Center experience

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Background/Objectives: The purpose of this study was to better characterize the incidence and severity of late coagulopathies (recurrent and delayed) for rattlesnake envenomated patients treated with Crotalidae Polyvalent Immune Fab antivenom (FabAV).

Methods: This retrospective poison center chart review included all rattlesnake envenomations from 2013-2016 treated with FabAV. Inclusion criteria were rattlesnake envenomation in a human, initial control of venom effects achieved with FabAV with or without maintenance dosing, and laboratory follow up after antivenom discontinuation. Exclusion criteria were no antivenom administered, past medical history resulting in any coagulation abnormalities, and no laboratory follow up. Patients with "persistent" coagulopathy, those that developed coagulopathy and never returned to normal after antivenom administration, were also excluded. "Late" coagulopathies are defined as developing after

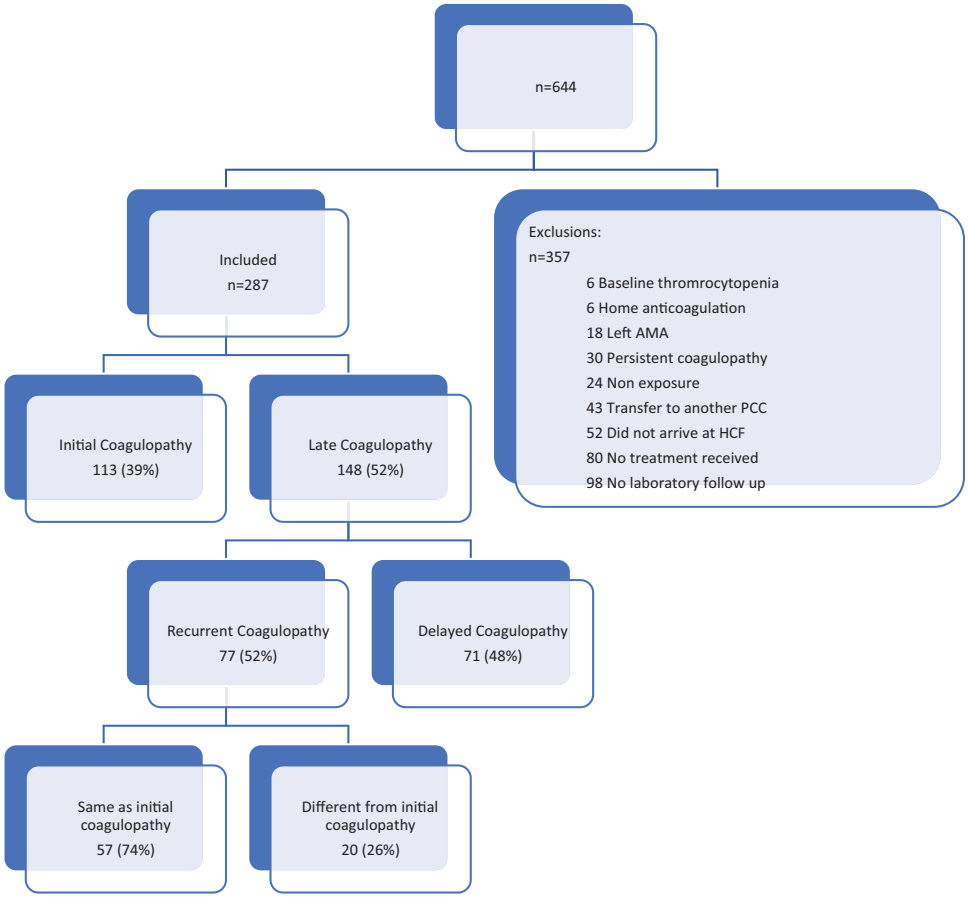

Figure 1 (#98).

completion of antivenom administration with or without maintenance doses. Late coagulopathies they were classified as either "recurrent" (initial coagulopathy occurred and resolved) or "delayed" (no initial coagulopathy). Coagulopathy was defined as an INR >1.5, plasma fibrinogen <150 mg/dL, and/or platelets <150,000/mm^3.

Results: Out of 644 reports identified, 287 patients were included in the analysis (Figure 1). During the initial hospitalization, 113 patients (39%) had an initial coagulopathy prior to the completion of antivenom. Late coagulopathy occurred in 148 (52%) of all patients. Of the late coagulopathies, 77 (52%) had a recurrence and 71 (48%) had delayed. (Table 1). Sixty-eight percent (68%) of patients with an initial coagulopathy had a recurrence. Of those patients with recurrent coagulopathy, 57 (74%) had the same coagulopathy as the initial and 20 (26%) had a coagulopathy different from the initial. A total of 9 patients had a late coagulopathy consisting of a platelet count <50,000 mm^3 (recurrent, delayed). Of these, 6 patients did not experience an initial thrombocytopenia during hospitalization. Thirty patients (9%) were retreated with FabAV post-discharge.

Conclusions: Late coagulopathy can be expected in at least 50% of patients treated with FabAV after a rattlesnake envenomation. Recurrent coagulopathy is expected to be seen 5 days, on average, and can present as late as 11 days after treatment. These data suggest delayed coagulopathy is expected to present at a later time, on average between 6-7 days, and can present as late as 14 days after treatment. Most recurrent coagulopathy is the same as the initial coagulopathy, however it does not always predict the findings in the outpatient setting. While retreatment rates were low, the risk of bleeding exists, as evidenced by patients developing severe thrombocytopenia without prior history of such coagulopathy. Based on this data, when treating rattlesnake envenomations with FabAV, we recommend laboratory follow up from 5 to 14 days to ensure late coagulopathy is assessed.

KEYWORDS envenomation, coagulopathy, recurrence

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Table 1(#98). Laboratory Characteristics of Late Coagulopathy.

	Recurrent (n = 77)	Delayed (n = 71)
Fibrinogen 50 - 150 mg/dL	21 (27%)	25 (35%)
Fibrinogen <50	34 (44%)	18 (25%)
Platelets 100 - 150,000 mm^3	31 (40%)	30 (42%)
Platelets 50-100,000 mm^3	13 (17%)	8 (11%)
Platelets <50, 000 mm^3	5 (6%)	4 (6%)
INR >1.5	38 (49%)	20 (28%)
Mixed coagulopathy	29 (38%)	15 (21%)
Onset of hypofibrinogenemia	Average =5.1 days	Average =6.5 days
	Min= 1 day	Min =1 days
	Max =10 days	Max =14 days
Onset of thrombocytopenia	Average =5.4 days	Average =7.2 days
	Min =1 day	Min =1 day
	Max =11 days	Max =12 days

99. Epidemiology, Clinical Features, and Management of Texas Coral Snake (*Micrurus tener*) Envenomations Reported to the North American Snakebite Registry

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Background: There are 5,000–8,000 snakebites reported to poison control centers (PCCs) annually in the United States (U.S.), but very few are attributed to coral snakes. Clinical manifestations following a coral snake bite may vary depending on the species involved. This study describes the epidemiology, clinical effects, and management of Texas coral snake envenomations using prospective data reported to the North American Snakebite Registry (NASBR), administered by the American College of Medical Toxicology (ACMT).

Methods: Data collected in the NASBR include details on the snakebite encounter, patient demographics, circumstances of the envenomation, clinical presentation, diagnostic or laboratory tests, treatment, and any outpatient follow-up or re-admissions post-discharge. For this report, all Texas coral snake (*Micrurus tener*) envenomation cases reported to NASBR were identified for the period from January 1, 2015 through December 31, 2019. Data reviewed for this study included details regarding the snake encounter, patient demographics, local and systemic signs and symptoms, treatment, and outcomes. Descriptive statistics were used to report results.

Results: Fourteen Texas coral snake bites were reported to the NASBR. Ten men and four non-pregnant women reported coral snake bites. Nine (64%) patients were younger than 18 years old, with ages ranging from 5–72 years old (median 15.5 years old). There were 12 patients with upper extremity bites and two with bites to the lower extremity. Circumstances of the snake encounters are described in Table 1. All but one of the bites occurred in the wild. Two patients had a history of prior snakebites and were the only two with a history of illicit substance abuse. Three subjects reported alcohol use, but none were intoxicated at the time of the bite. Tobacco use was reported in one subject. The most common symptoms reported were paresthesias and pain. All subjects had paresthesias, often described as an "electric" sensation. Seven patients described them as painful, and three rated the pain as "severe". The most common clinical findings were erythema and

Table 1(#99). Circumstances of snake encounter.

Subject	Age	Sex	Bite location	Intentional interaction?	Circumstances
1	8	M	Finger	**No**	Patient fell on ground and landed next to snake
2	16	F	Finger	Yes	Bitten while attempting to kill the snake with a machete
3	39	M	Finger	Yes	Patient mistook the coral snake for a nonvenomous snake
4	69	M	Both hands	Yes	Attempted to remove snake from his dining room. Bitten three times on one hand and twice on the other.
5	13	M	Finger	Yes	Bitten while trying to move the snake from the road
6	21	M	Finger	Yes	Bitten while relocating a snake off his property
7	10	M	Finger	Yes	Bitten while trying to move the snake from the road
8	12	M	Finger	Yes	Bitten while trying to liberate a snake his older brother had captured earlier in the day
9	15	F	Foot	**No**	Walking barefoot at night and stepped on a snake she did not see
10	31	M	Finger	Yes	Bitten while relocating a snake off his property, barehanded
11	11	M	Finger	Yes	On a scouting trip, he was told by more senior scouts that the snake was nonvenomous and safe to handle
12	16	F	Finger	Yes	Patient mistook the coral snake for a nonvenomous snake
13	5	M	Hand	**Unknown**	Playing outside. Exact circumstances unknown
14	72	F	Toe	No	Bitten by an unseen snake while walking in the dark, wearing flip flops.

Table 2(#99). Clinical course.

Subject	Pain	Paresthesia	Swelling	Erythema	Treatment with antiemetic	Treatment with opioid	Other treatment	LOS
1	+	+		+		+		< 24 h
2	+	+	+	+		+		25 – 48 h
3		transient						< 24 h
4		+	+	+	yes – for nausea after opioid use	+		< 24 h
5	+	+				+		< 24 h
6	+	+			yes - prophylactic	+		< 24 h
7		+	+	+		+	Corticosteroids	25 – 48 h
8	+	+				+		< 24 h
9	+	+	+	+	yes - prophylactic	+		< 24 h
10	+	+			yes - prophylactic	+		< 24 h
11		+		+		+		< 24 h
12		+		+	yes – for nausea after opioid use	+	Diphenhydramine, ketamine	< 24 h
13		+		+	yes – for emesis prior to opioid use	+	Acetaminophen	25 – 48 h
14		+				+		< 24 h

LOS: length of stay.

swelling. Erythema contiguous to the bite site was noted in eight patients, four of whom also had mild swelling. Swelling was not noted in patients without erythema. No patient developed tissue damage (Table 2). There were no cases of hematotoxicity, rhabdomyolysis, hypotension, or respiratory symptoms.

No patient had any objective weakness. Thirteen subjects were treated with opioids. Six patients were treated with antiemetics: three prophylactically and two for opioid-induced nausea. One patient developed nausea and non-bloody, nonbilious emesis within one hour of the bite, prior to receiving opioids. No patients were treated with antivenom. Antibiotics were not administered to any patient, and no infections were reported.

Conclusions: Envenomations from *M. tener* in Southeast Texas are characterized by paresthesias that are often painful. Mild swelling and erythema at the envenomation site are also common. Neurotoxicity necessitating intervention with antivenom or mechanical ventilation did not occur.

KEYWORDS coralsnake, envenomation, snakebite

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100. Monocled Cobra (Naja kaouthia) Envenomation Requiring Mechanical Ventilation

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Background: There are 5,000–10,000 emergency department (ED) visits for snakebites annually in the United States (U.S.). Bites from non-native snakes are uncommon, accounting for 1.1% of envenomations reported to poison centers between 2012–2018. Here we discuss a N. kaouthia envenomation resulting in local tissue injury and respiratory failure.

Case Report: A previously healthy 30-year-old male was bitten by his captive monocled cobra at 1900 while performing routine enclosure maintenance. The patient contacted the regional snakebite expert, who coordinated with the local zoo to provide Thai Red Cross (TRC) cobra antivenom. At the first hospital, he was noted to be mildly hypotensive, bradycardic, and confused. His hand was swollen and ecchymotic. His breathing seemed labored, so he was intubated using midazolam, etomidate, and rocuronium. His blood pressure and heart rate improved, and he did not require vasopressors or atropine. He was then transferred via helicopter air ambulance to a quaternary care center near the zoo. He remained hemodynamically stable in flight. He arrived at the receiving facility at 2300 with the following vital signs: Heart rate 80, blood pressure 211/119 mm Hg, rectal temperature of 97.1° F, and his oxygen saturation was 96% while on the ventilator. His exam was notable for two small puncture wounds to the right third digit and significant swelling extending from the hand to the forearm. His laboratory studies were unremarkable (Table 1). In the ED, five vials of TRC cobra antivenom were administered over one hour. The swelling continued to extend proximally to the middle of the arm. No necrosis or discoloration was noted. The affected extremity was elevated, and the patient was admitted to the medical intensive care unit (MICU) at 0340. One hour later the patient had an additional bradycardic episode to the 20s that corrected with 1 mg of atropine. The remainder of his ICU course was uncomplicated. He was extubated 35 hours after the envenomation. He was noted to have a large blister at the bite site. He requested discharge, so he was observed for an additional nine hours before going home, where he has recovered without incident.

Table 1(#100). initial laboratory studies.

	Result	Normal range
Sodium [mEq/L]	139	135-145
Potassium [mEq/L]	3.5	3.5-5.1
Chloride [mEq/L]	110	95-109
CO2 [mEq/L]	24	24-32
BUN [mg/dL]	9	7-22
Creatinine [mg/dL]	1.07	0.50-1.40
Glucose [mg/dL]	105	70-99
WBC [K/mm^3]	9.2	3.7-10.4
Hemoglobin [g/dL]	15.4	14-18
Hematocrit [%]	45.2	42-54
Platelet [K/mm^3]	230	133-450
PT [sec]	12.7	12-14.7
INR	0.95	0.85-1.17
PTT [sec]	23.6	22.9-35.8
CK [U/L]	195	12-191

Case Discussion: Envenomations following *N. kaouthia* bites are characterized by local tissue injury and various neurotoxic effects, including respiratory and skeletal muscle weakness. Nonspecific signs and symptoms such as headache, vomiting, diarrhea, and dizziness are common. Hematologic toxicity is rare. Cardiovascular manifestations, e.g. hypotension, bradycardia, are not typical of *N. kaouthia* envenomations. Our patient's bradycardia and hypotension were likely secondary to vagal stimulation. Conversely, the transient elevated blood pressure was likely due to anxiety and discomfort. Antivenom is the specific treatment for snake envenomation, and there are several that are approved for *N. kaouthia*. Cholinesterase inhibitors may reduce toxicity from postsynaptic alpha toxins by increasing acetylcholine concentrations.

Conclusion: Healthcare providers should be prepared to treat local and neurological manifestations following N. kaouthia envenomations with supportive care and one of the recommend antivenoms.

KEYWORDS cobra, envenomation, snakebite

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101. Clinical Features and Outcomes of Copperhead Envenomations Treated with Either Crotalidae Polyvalent Immune Fab (Ovine) or Placebo in Adolescents

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Objectives: A randomized clinical trial recently demonstrated that patients treated with antivenom recover faster from copperhead (*Agkistrodon contortrix*) envenomations than subjects treated with placebo. The purpose of this study was to see if there was a similar benefit in the adolescent population and to compare recovery in adolescents versus adults.

Methods: This is a secondary analysis of a multi-center, randomized, double-blind, placebo-controlled trial assessing the efficacy of Crotalidae polyvalent immune Fab (ovine) (CroFab; FabAV) in the management of copperhead envenomations. The primary outcome for this analysis was limb function at 14 days post-envenomation, measured by the Patient Specific Functional Scale (PSFS). Secondary outcomes included PSFS score at other times, time to achieve full recovery, and analgesic requirements.

Results: There were eight adolescent subjects in the original trial. Three were treated with FabAV and five were assigned to the placebo group. The primary outcome, the mean PSFS at day 14, was 8.5 for the placebo group versus 8.9 for the Fab AV group. Adolescents recovered faster than the adult subjects in the original trial, particularly in subjects randomized to the placebo group. The median PSFS for untreated adolescents at 14 days was 8.5, compared to 7.4 in adult subjects. No adolescents had hematotoxicity or required surgical intervention.

Conclusions: Adolescent copperhead envenomation patients have a similar clinical course to adults but with slightly faster improvement. Antivenom appears to accelerate recovery and decrease opioid usage.

KEYWORDS copperhead, envenomation, snakebite

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Table 1(#101). Study participants.

	FabAV recipients	Placebo recipients	All subjects
Number	3	5	8
Age (median, IQR)	14 [13, 14]	15 [14, 16]	14 [14, 15]
Male (n, %)	1 (33.3%)	4 (80.0%)	5 (62.5%)
Lower extremity envenomation	3 (100%)	2 (40%)	5 (62.5%)
Time to treatment (hours, median, IQR)	11.1 [7.5, 13.2]	5.5 [5.1, 6.4]	6.0 [4.8, 12.1]
State			
Texas	1 (33.3%)	4 (80.0%)	5 (62.5%)
Georgia	1 (33.3%)	0 (0.0%)	1 (12.5%)
Virginia	1 (33.3%)	0 (0.0%)	1 (12.5%)
West Virginia	0 (0.0%)	1 (20.0%)	1 (12.5%)
Initial Severity: Mild	3 (100.0%)	4 (80.0%)	7 (87.5%)

Table 2(#101). Clinical Outcomes.

	Fab Recipients	Placebo Recipients	All Subjects
Total Vials of FabAV Received (median, IQR)	12 [12, 12]	0 [0, 0]	6 [0, 12]
PSFS Scores (mean)			
Day 3	2.8	3.7	3.4
Day 7	5.6	7.2	6.6
Day 10	7.8	7.7	7.7
Day 14†	8.9	8.5	8.7
Day 17	9.1	9.1	9.1
Day 21	10.0	9.5	9.7
Day 24	10.0	9.6	9.8
Day 28	10.0	9.9	9.9
Proportion of patients fully recovered			
Day 3	0%	0%	0%
Day 7	33%	20%	25%
Day 10	33%	0%	12.5%
Day 14†	33%	20%	25%
Day 17	33%	60%	75%
Day 21	100%	60%	75%
Day 24	100%	80%	87.5%
Day 28	100%	80%	87.5%
Highest INR	1.1 (range 1.0–1.1)	1.2 (range 1.1–1.2)	1.2 (range 1.0–1.2)
Lowest Platelet (K/100mm^3)	268 (range 268–318)	155 (range 155–318)	155 (range 155–318)
Lowest Fibrinogen (mg/dL)	228 (range 228–369)	217 (range 217–353)	217 (range 217–369)

† Primary study outcome of the source clinical trial was difference in the PSFS 14 days after treatment.

102. Prevalence of Fentanyl and Analogues in Nonfatal Opioid Overdoses at the Heart of the Opioid Epidemic in NYC

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Background: The opioid epidemic continues as a significant public health crisis, with the Bronx suffering the highest rate and number of deaths in NYC. Since 2013, there has been a global surge of fentanyl-related overdose deaths, contributed to by illicitly manufactured fentanyl and/or fentanyl analogs (IMF). One approach to combatting this crisis is "Relay," a novel NYC Department of Health & Mental Hygiene-sponsored program that engages a peer-delivered response to nonfatal opioid overdoses. It provides real-time overdose prevention education, naloxone, peer support, and linkage to care for 90 days after a nonfatal opioid overdose. In June 2019, a spike in nonfatal opioid overdoses occurred in our emergency department (ED), with 16 patients in 36-hours. To investigate this sudden increase, and because data from 2018 showed that fentanyl was detected in 65% of unintentional overdose deaths in the Bronx, we began analyzing urine samples to assess the prevalence of IMF in our urban ED.
Methods: For each nonfatal opioid overdose recognized in our ED, the Relay Team was activated. After resuscitation, as part of routine care, patients were asked to provide a urine sample. Specimens were analyzed with the hospital-based urine drug screen (UDS) (Union DAT, Beckman Coulter, Brea, CA), and sent out for "Fentanyl and Analogues, Urine" (#738660, Laboratory Corporation of America Holdings, Burlington NC) to detect IMF (e.g., fentanyl, norfentanyl, acetylnorfentanyl, or acetylnorfentanyl).
Results: From June 29, 2019 through February 27, 2020 (the date which the send out testing methodology changed), there were 397 nonfatal opioid overdose activations of Relay. Of these 397 cases, 274 (66.3%) had fentanyl testing ordered, of which 124 (45.3%) were either cancelled or not collected. One hundred forty-nine urine specimens (54.4%) were obtained and tested. Of the samples tested, 131/149 (87.9%) were positive for IMF; 105/149 (80.2%) that were positive for IMF had a simultaneous UDS resulted. Of these, 77/149 (51.7%) were positive for both IMF and opioids. There were 23/105 (15.4%) positive for IMF which had a corresponding UDS that was negative for opioids but were positive for either "THC-alone" (n = 3), "cocaine-alone" (n = 7), "benzodiazepines-alone" (n = 3) or some combination of the three (n = 10).
Conclusion: Following a large outbreak of nonfatal opioid overdoses at a single hospital, we found almost 90% of patients tested positive for IMF. These cases were not restricted to heroin overdoses as approximately one-sixth of patients had no opioids detected on a simultaneous UDS. This suggests that IMF is still highly prevalent, and often independent of heroin use. Public health efforts should be focused on continued outreach, including effective post-overdose strategies such as Relay, naloxone distribution and harm reduction, opioid agonist therapy, and other support resources.

KEYWORDS fentanyl, opioid, overdose

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103. Acute Coronary Syndrome and Recreational Drug Use: an Amsterdam-based retrospective study

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Background: Cocaine use is a well-established risk factor for cardiac events. Additionally, other recreational drugs (RD), are proposed as potential cardiac risk factors, however evidence is limited. A worse cardiovascular and all-cause outcome has been described for RD-associated ACS, compared to ACS without RD use. The aim of this study was to explore RD use in a contemporary cohort of young ACS patients.
Methods: Between June 2016 and October 2019, ACS patients aged 18 to 50 years, whom presented at the OLVG hospital in Amsterdam, were retrospectively included for analysis. Medical chart review to obtain RD use, patient and clinical characteristics, cardiac risk factors, outcome and follow up was performed.
Results: Despite standard protocol to subject AMI patients <50 years old to a TST-U and extensive attention for the importance for taking a recreational drug history in our hospital, 52.1% of young ACS patients did not have a RD history recorded or TST-U performed. Therefore, from 478 eligible patients, a total of 229 patients were included in the study. Recreational drug use prior to ACS was present in 24.9% of all included patients, with cannabis (16.2%) and cocaine (4.8%) most commonly observed. Three other patients were identified, the first patient without any cardiovascular risk factors used cannabis oil. The other two patients had considerable cardiovascular risk factors, and developed ACS after methamphetamine mono-ingestion and amphetamine and methamphetamine co-ingestion. Table 1 shows the patient characteristics of non-RD users, cannabis and cocaine users. Recreational drug users were predominantly young men (87.7%), and tobacco use was significantly higher in RD users compared to non-users (OR 7.41, 2.19-25.0 95% CI, P = 0.001). Other cardiac risk factors were similar. After cocaine use, the systolic bloodpressure (132 vs 141 mmHg), diastolic bloodpressure (85 vs 87 mmHg) and heartrate (79 vs 77/minute) on admission are not different compared to the non-RD using young ACS patients. Compared to non-users, RD-users demonstrated significantly higher levels of peak CK-MB (104 U/L ± 116 vs 62 U/L ± 96, P = 0.041) and CAMI patients also demonstrated significantly higher peak hs-cTn levels (30.9ng/L ± 55.0 vs 17.8ng/L ± 162.2 (10log-transformed), P = 0.044). On coronary angiogram all cocaine related ACS patients showed coronary artery disease.
Conclusion: Data on RDs was available in almost half the young ACS patients. Of these patients almost 25% had recently used RDs, most commonly cannabis and cocaine. Patients with a RD related ACS had high cardiovascular risk profiles compared to non-RD patients, mostly due a higher prevalence of smoking. Furthermore, although a causal relationship cannot be determined, our findings suggest that RD-users had larger myocardial injury.

KEYWORDS Recreational drugs, Acute coronary syndrome, Cannabis

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Table 1(#103). Patient characteristics of non-RD users, cannabis and cocaine users.

	Non-RD users (n = 172; 75.1%)	Cannabis users (n = 37; 16.1%)	P-value**	Cocaine users (n = 11; 4.8%)	P-value***
Male	132 (76.7)	30 (81.1)	0.567	11 (100)	0.125
Age in years	45.3 (5.5)	42.8 (5.3)	0.014	41.1 (6.3)	0.016
Tobacco use	101 (59.1)	33 (89.2)	<0.001	11 (100)	0.028
Hypercholesterolemia	118 (68.8)	27 (73.0)	0.601	8 (72.7)	1.000
Hypertension	48 (27.9)	12 (32.4)	0.581	0 (0)	0.069
Diabetes Mellitus	17 (9.9)	4 (10.8)	0.771	1 (9.1)	1.000
Positive family history for CVD	59 (34.3)	12 (32.4)	0.828	5 (45.5)	0.520
Obesity	38 (22.2)	9 (24.3)	0.782	2 (18.2)	1.000
Atherosclerosis in past medical history	33 (19.2)	5 (13.5)	0.417	1 (9.1)	0.692
GRACE score	78 (37)	63 (11)	0.297	97	0.621
Vital signs					
Heartrate	77 (16)	76 (20)	0.801	79 (10)	0.643
Systolic blood pressure	141 (26)	137 (30)	0.463	132 (13)	0.076
Diastolic blood pressure	87 (17)	85 (15)	0.400	85 (12)	0.674
Respiratory rate	17 (4.5)	16 (4.5)	0.111	17 (5.4)	0.970
Oxygen saturation	98 (2)	98 (2)	0.656	98 (3)	0.830
Temperature	36.7 (0.6)	36.6 (0.6)	0.207	36.6 (0.6)	0.600
Type of ACS			0.187		1.000
STEMI	85 (49.4)	19 (51.4)		6 (54.5)	
NSTEMI	73 (42.4)	18 (48.6)		5 (45.5)	
Unstable angina pectoris	14 (8.1)	0 (0)		0 (0)	
Peak hs-cTn (ng/L)	17.8 ± 162.2	30.9 ± 55.0	0.044	58.9 ± 1621.8	0.426
Peak CK-MB (U/L)	62 ± 96	114 ± 118	0.021	88 ± 120	0.536
Left Ventricular (LV) Function			0.029		0.093
Normal LV function	81 (47.1)	10 (27)	0.026	2 (18.2)	
Mild LV dysfunction	26 (15.1)	9 (24.3)	0.174	4 (36.4)	
Moderate LV dysfunction	8 (4.7)	6 (16.2)	0.011	0 (0)	
Severe LV dysfunction	4 (2.3)	1 (2.7)	0.889	1 (9.1)	
Unknown	53 (30.8)	11 (29.7)	0.896	4 (36.4)	
Cause of ACS			0.078		0.092
Significant stenosis	87 (50.6)	14 (37.8)		6 (54.5)	
Thrombus	31 (18.0)	10 (27.0)		2 (18.2)	
Spasm	0 (0)	2 (5.4)		1 (9.1)	
Stenosis + trombus	19 (11.0)	3 (8.1)		1 (9.1)	
Unknown	26 (15.1)	7 (18.9)		0 (0)	
Other*	9 (5.2)	1 (2.7)		1 (9.1)	
Number of vessels involved			0.353		0.761
0	19 (11.6)	7 (20.0)		0 (0)	
1	87 (53.0)	20 (57.1)		8 (72.7)	
2	36 (22.0)	4 (11.4)		2 (18.2)	
3	22 (13.4)	4 (11.4)		1 (9.1%)	

RD: recreational drug; CVD: cardiovascular disease; GRACE-score: Global Registry of Acute Coronary Events score; ACS: acute coronary syndrome; STEMI: ST elevated myocardial infarction; NSTEMI: non-ST elevated myocardial infarction; hs-cTn: high sensitive cardiac troponin (10log-transformed); CK-MB: creatine kinase myocardial band. Categorical variables are noted as n (%) and continuous variables as mean (+/- SD). Abbreviations: CVD; cardiovascular diseases. *Other causes involve: temporary thrombus, non-significant plaque with ulcus, plaque rupture, plaque shift, spontaneous coronary artery dissection and cardiac filling defects. **The first p-value: cannabis versus non-RD users. ***The second p-value: cocaine versus non-RD users.

104. Cardiovascular complications at the Emergency Department following cannabis intoxication

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Background: Cannabis consumption is commonly considered harmless and safe. With 188 million recreational users worldwide in 2017 and a 27% rise in popularity between 1998 and 2017, the emergency departments (ED) subsequently reported an increased incidence of cannabis-related complications, including cardiovascular in complications. These complications can be severe, like acute coronary syndrome and arrhythmias, and occur even in young, healthy people. Despite the growing evidence associating cannabis with the development of cardiovascular complications, quantitative data providing insight in the frequency of these complications in an ED population are limited. Therefore, this study aimed to explored the frequency of cardiovascular symptoms and complications in a cannabis-intoxicated ED-population.

Methods: A retrospective observational cohort study including cannabis-intoxicated patients admitted at the ED of the OLVG hospital in Amsterdam between January 2016 and December 2019 was performed. Exclusion criteria were mixed intoxication with other drugs and patients younger than 18 years old. Data collection was complete by medical chart review and included demographic and clinical characteristics, combined use with alcohol, all reported symptoms, the cardiovascular complications acute coronary syndrome and arrhythmia, risk factors and treatment. Cardiovascular symptoms (CVS) were defined as palpitations, chest pain and syncope. Comparisons were made using descriptive statistics and logistic regression to obtain odd's ratios. A p-value of $p < 0.05$ was considered statistically significant.

Results: A total of 1689 (19.6%) patients were included in the study, of whom 868 (51.4%) patients reported cardiovascular symptoms. The most frequently reported symptoms were palpitations (27%, n = 460), followed by syncope (17.4%, n = 294) and chest pain (6.1%, n = 103). CVS were most common among men and tourists (Table 1). Table 2 shows the clinical characteristics of

Table 1(#104). Characteristics of patients without CVS and with CVS and odds-ratios. Continuous values expressed as mean (+/-SD), categorical values as number (% of column).

	Non-CVS N= 821	CVS N = 868	OR (95%CI)	p-value	aOR* (95%CI)	p-value
Age in years (+/-SD)	30.2 (9.9)	32.7 (12.2)	1.2 (1.1-1.3) *per 10-year increment*	<0.001	1.2 (1.1-1.3) *per 10 year increment*	<0.001
Male	495 (60.3%)	559 (64.4%)	1.2 (0.98-1.45)	0.08	1.2 (0.95-1.42)	0.13
Tourist	664 (81%)	734 (84.6%)	1.3 (1.01-1.67)	0.04	1.3 (1.00-1.7)	0.05

(*continued*)

Table 2(#104). Clinical characteristics of each symptom.

	Non CVS N = 821 (48.8%)	Palpitations N = 456 (27.1%)	OR 95%CI	P-value	Chest pain N = 100 (6%)	OR 95%CI	P-value	Syncope N = 292 (17.4%)	OR 95%CI	P-value
Demographics										
Age in years	30 (9.9)	31 (10.8)	0.9 (0.81-0.98) *Per 10 year increment*	0.02	34.6 (12.9)	1.2 (1.02-1.4) *Per 10 year increment*	0.03	33.6 (13.1)	1.2 (1.08-1.33) *Per 10 year increment*	0.001
Median (IQR)	27 (18-73)	28 (18-70)	-	0.26	32 (18-72)	–	0.03	30 (18-69)	–	0.04
Male	495 (60.3%)	268 (58.3%)	0.8 (0.63-0.98)	0.032	80 (80%)	2.5 (1.5-4.2)	<0.001	212 (72.6%)	1.7 (1.3-2.3)	<0.001
Clinical characteristics										
Heartrate (bpm)	101 (21.6)	111 (23.3)	–	<0.001	105 (23.5)	–	0.003	85 (21.5)	–	<0.001
Tachycardia	394 (48%)	327 (71.1%)	3.5 (2.7-4.4)	<0.001	66 (66%)	2.06 (1.3-3.1)	0.001	74 (25.3%)	0.28 (0.21-0.37)	<0.001
Bradycardia	12 (1.5%)	5 (1.1%)	0.26 (0.10-0.64)	0.004	2 (2%)	0.56 (0.13-2.3)	0.075	32 (11.4%)	7.4 (4.2-12.9)	<0.001
SBP (mmHg)	127 (18.1)	132 (18.7)	–	<0.001	133 (19.9)	–	0.001	117 (19.0)	–	<0.001
DBP (mmHg)	74 (14.2)	77 (12.5)	–	<0.001	79 (13.8)	–	0.001	68 (13.5)	–	<0.001
Hypertension	156 (19%)	97 (21.1%)	1.3 (1.02-1.75)	0.037	26 (26%)	1.7 (1.05-2.7)	0.024	28 (9.6%)	0.4 (0.28-0.66)	<0.001
Hypotension	8 (1%)	2 (0.6%)	0.18 (0.4-0.74)	0.018	1 (1.1%)	0.4 (0.5-2.9)	0.35	22 (8.1%)	6.7 (3.4-13.3)	<0.001
Alcohol use	189 (23%)	37 (8%)	0.20 (0.14-0.30)	<0.001	15 (15%)	0.6 (0.34-1.05)	0.073	123 (42.1%)	3.3 (2.5-4.3)	<0.001
Complication										
ACS	0	1[a] (0.2%)			3[a] (2.9%)			0		
Arrhythmia	0	4[b] (0.9%)			0			2[b] (0.7%)		
Treatment										
Benzodiazepine	437 (53.2%)	340 (74.6%)			64 (64%)			35 (12%)		
Nitroglycerine	1 (0.1%)	4 (0.9%)			12 (12%)			0		

For comparison, the first column (non-CVS) represents patients without any CVS. Continuous values expressed as mean (+/-SD), categorical values as number (% of column). SBP: systolic blood pressure, DBP: diastolic blood pressure. Hypertension defined as SBP >140mmHg and/or DBP >90mmHg, hypotension as SBP <90mmHg and/or DBP <60mmHg.Complications marked with a = combination of palpitations and chest pain, b = combination of syncope and palpitations.

the three cardiovascular symptoms. Patients with palpitations had a higher baseline heartrate and systolic blood pressure compared to patients without palpitations ($p < 0.001$) and often presented with tachycardia (71.1%). Males were more likely to report chest pain (aOR 2.5, 95%CI 1.5-4.2, $p < 0.001$). Syncope was associated with bradycardia (aOR 4.6 (2.5-8.7) $p < 0.001$), alcohol use (aOR 2.6, (1.9-3.5), $p < 0.001$) and hypotension (aOR 3.2, (1.5-6.8) $p = 0.002$). Eight patients had a cardiovascular complication, of which three with ACS and five with an arrhythmia (0.5% of the total population).

Conclusion: Cardiovascular symptoms after cannabis consumption were very common, covering over half of the cannabis intoxicated ED patients (51.4%). Cardiovascular complications following cannabis intoxication were uncommon and accounted for only 0.5% of our study population. The clinical relevance of these symptoms and the risk of a subsequent cardiovascular complication remains unclear. Determining cannabis as a risk factor for cardiovascular complications could not be established based on our data, mainly because the number of complications was too small.

KEYWORDS Cannabis, Cardiovascular symptoms, Cardiovascular complications

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105. Self-reported Cocaine Use in Amsterdam Emergency Department Chest Pain Patients is Reliable

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Objective: The aim of this study was to determine patient self-reported illicit drug-history reliability for chest pain patients at the Emergency Department (ED).

Methods: A retrospective analysis of prospectively collected data of chest pain patients between 18 and 45 years old, presenting at the ED of the OLVG hospital in Amsterdam, between 1 June 2016 and 31 October 2019, was undertaken. We included patients with a documented history for illicit drug use and compared them to urine toxicology screening (Utox) results. All patients with an available self-reported illicit drug-history and a Utox were included, no patients were excluded. At this hospital, nurses and physicians are trained in performing an illicit drug-history, specifically cocaïne, and often perform Utox for screening purposes.

Results: A total of 223 patients met the inclusion criteria. The mean age was 32 ± 6.9 years, 82.5% of the patients were male and 22.9% of the patients were tourists. Of all patients (141; 63%) with a positive Utox, 130 (92%) patients reported recent illicit drug use. However, only 57% (80/141) of the patients reported the same drugs as the Utox. The sensitivity and specificity of the self-reported illicit drug-history were 57% (80/141) and 91% (75/82), respectively. However, a sub-analysis showed that the sensitivity of the self-reported cocaine use was 93% (95/102, 95% CI 0.87–0.97), amphetamine use was 40% (4/10, 95% CI 0.14–0.72), methamphetamine (MAP) / 3,4-methyleendioxymethamfetamine (MDMA) use was 65% (11/17, 95% CI 0.39–0.85) and tetrahydrocannabinol (THC) use was 49% (39/79, 95% CI

0.38–0.61). Age (OR 1.02, 95% CI 0.97–1.1), gender (OR 0.39, 95% CI 0.13–0.91) and nationality (OR 0.97, 95% CI 0.48–2.1) are not significantly associated with self-reported illicit drug-history reliability.
Conclusion: The sensitivity and specificity of the self-report cocaine use in chest pain patients aged 18 to 45 years old, is equivalent to urine toxicology screening. However, for THC, amphetamine and MAP/MDMA, the self-reported drug-history is unreliable.

KEYWORDS Illicit drugs, Self-reported reliability, Cocaine
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106. Susie Q to 'Come Down' from K2: an Interesting Constellation of Symptoms in an Incarcerated Individual

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Objective: Quetiapine (Seroquel®) is an atypical antipsychotic with potent sedative and anxiolytic properties. An antagonist at dopamine, serotonin, and adrenergic receptors, it is used to treat schizophrenia, bipolar and depressive disorders. Quetiapine intoxication results in sedation, coma, hypotension, miosis, QT prolongation along with anticholinergic effects. Recreational use of quetiapine, or "Susie Q", has been reported in populations such as incarcerated individuals, patients monitored during treatment for substance use, or individuals on parole/probation. In addition to use for strong sedating effects, it is taken to 'come down' from stimulants and to potentiate opioids. "K2" is a slang name for synthetic cannabinoids (SC). SCs have been increasingly identified as substances of abuse since 2010 with use concentrated in certain demographics similar to quetiapine abuse. SC intoxication can include agitation, psychosis, tachycardia, seizures, and hallucinations. Some of the newer generation SCs have also presented with bradycardia, hypoglycemia and coma among other symptoms. We present a case of quetiapine use to 'come down' from SC intoxication in an incarcerated individual.
Case Details: An 18-year-old incarcerated male was found unconscious. He was playing cards an hour prior to his presentation when he reportedly stood, felt dizzy, lost consciousness and fell hitting his head on cell bars. He was unconsciousness for ten minutes with some 'rhythmic jerking' reported. Prior to this episode he had nausea, vomiting, and diarrhea for two weeks but no history of seizures. His current medications included metformin, lisinopril, and ondansetron. In the ED, the patient was hypotensive, bradycardic, and slightly hypoglycemic. His creatinine was elevated to 3.54 with no previously documented renal insufficiency. He was given naloxone and atropine without response and pressors were started for persistent hypotension. On day 2 the patient's hemodynamics improved, pressors were stopped, his glucose and renal function normalized as did his mental status. He initially denied use of any substance until an 'expanded' urine drug screen returned positive for quetiapine. He subsequently conceded his 'card friend' had quetiapine available and he also admitted to using "K2". He'd taken the quetiapine to, "sober up," from the SC intoxication. By day 3 all of the patient's symptoms resolved and he was back to baseline.
Conclusion: This case highlights the misuse of prescribed medication in an incarcerated individual. In addition to quetiapine, drugs such as bupropion, gabapentin, diphenhydramine, and clonidine are frequently misused. SC's are also frequently abused because they are difficult to detect in standard urine screens. In our patient the quetiapine was used to help 'come down' from the SC. A variety of uncommon symptoms occurred altogether in this patient prompting extensive workup, although they have been reported separately for quetiapine or SC use alone. Abuse of prescription drugs is common in the criminal justice system with predominant drugs changing according to availability. By understanding patterns of abuse and the drugs that are available to special populations we can better predict and then mitigate misuse, more effectively limiting complications from use including overdose. Additionally, it may result in more appropriate use of psychiatric medications in incarcerated individuals.

KEYWORDS seroquel, synthetic cannabinoids, bradycardia
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107. A Non-Surgical Approach to Management of Lepidopterism Following Ingestion of a Woolly Bear Caterpillar (Pyrrharctia Isabella)

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Background: Systemic symptoms resulting from exposure to members of the Lepidoptera order such as moths, butterflies, and caterpillars is known as *lepidopterism*. Most cases of lepidopterism are mild and result from dermal exposure to urticating hairs or spines, some of which contain venom, present on the body of the moth, butterfly, or caterpillar. Ingestion of members of the Lepidoptera order is less common and generally more medically significant, as the urticating hairs may get embedded in the patient's mouth, hypopharynx, or esophagus leading to dysphagia, drooling, edema, and possible airway obstruction. In prior cases of symptomatic caterpillar ingestion reported in the English language literature, extensive efforts to remove urticating hairs were made. We present a case of a young child who was managed conservatively without any attempt to remove urticating hairs after ingestion of a woolly bear caterpillar (*Pyrrharctia isabella*). The patient's mother provided informed consent for the publication of this case.
Case Report: A previously healthy 19-month-old male presented to the emergency department 90 minutes after ingesting half of a deceased woolly bear caterpillar. Immediately after ingestion, the child began to cry and appeared to be trying to pull something out of his mouth, but he had already swallowed the caterpillar. He subsequently vomited but remained inconsolable for over an hour, prompting his parents to seek medical care. His physical exam was notable for embedded hairs in his lips, oral mucosa, and right tonsillar pillar with corresponding areas of erythema. The patient underwent a bedside flexible laryngoscopy which revealed a single hair embedded in the epiglottis without significant edema. He was admitted for observation and received a single dose of 0.5mg/kg oral dexamethasone followed by three doses of 0.5mg/kg intravenous dexamethasone. The following morning, the patient appeared comfortable and was able to tolerate food and water by mouth; he was observed for an additional day to ensure he did not develop significant edema after cessation of steroids and was discharged in good condition at the end of that observation period. At a follow up visit one week after discharge, his exam was notable for some mild tonsillar

edema without visible hairs; this edema had resolved at a subsequent visit the following week.
Case Discussion: To our knowledge, there is only one other case of woolly bear caterpillar ingestion reported in the English language literature. In that case, attempted removal of urticating hairs under sedation worsened the patient's edema, prompting direct laryngoscopy in an operating room to facilitate further urticating hair removal. Other case series describing symptomatic ingestions of other caterpillar species describe various efforts made to remove hairs, often including bronchoscopy and esophagoscopy in addition to direct laryngoscopy. Our case demonstrates that, despite the barbed appearance of these hairs, they fall out reasonably quickly without intervention.
Conclusions: Lepidopterism secondary to caterpillar ingestion is amenable to conservative management and does not require the routine removal of urticating hairs in patients who do not show signs of airway distress and are able to tolerate oral intake.

KEYWORDS Caterpillar, Lepidopterism, Pyrrharctia isabella

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108. Successful Management of Monocled Cobra (Naja kaouthia) Envenomation with Neuro Polyvalent Antivenin

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Background: While a monovalent antivenin specific to the Monocled Cobra (Naja kaouthia) exists and is frequently used in treatment of these envenomations, there are no reports of the use of the broader Thai Red Cross Society Neuro Polyvalent Snake Antivenin (NPAV) (Queen Saovabha Memorial Institute) in human envenomations by Naja kaouthia. Venom of the Naja species exhibit varying levels of cardiotoxicity, hemotoxicity, and neurotoxicity, and patients often present with neurologic symptoms including ptosis, respiratory difficulty, and weakness. Duration and severity of hematologic, cardiac, and neurologic symptoms are improved by prompt administration of antivenin.
Case Report: The patient was a 32-year-old male who presented to an outside hospital approximately 1 hour after being bitten by his sibling's female monocled cobra. Shortly after arrival, he began to have difficulty breathing. He was administered succinylcholine and etomidate and intubated. He was placed on propofol and fentanyl for sedation and sent via helicopter to the tertiary care center. On evaluation, patient was intubated and sedated. Two punctate fang marks were noted to the left thumb with mild tissue edema of the hand. Initial labs showed hematocrit 37.9 %, platelet count of 153,000/uL, INR 1.1, and fibrinogen 352 mg/dL. He was given 8 vials of NPAV upon arrival to the ED without any adverse reactions, and was admitted to the intensive care unit. Repeat labs that afternoon showed hematocrit 39.7 %, platelet count of 264,000/uL, INR 1.2, and fibrinogen 223 mg/dL. He was extubated approximately 36 hours after his envenomation with improvement in hand edema and no signs of local tissue necrosis. His symptoms resolved completely. He was discharged 24 hours later in good condition.
Case Discussion: Purified equine Naja kaouthia antivenin is frequently used in the management of Naja envenomations. NPAV has been shown to effectively neutralize various venoms in vitro, including those of the Naja and Bungarus species. The end result is a much quicker time to resolution of clinical findings, and lower morbidity and mortality, than in cases in which antivenin is not used. We were unable to find any cases that reported the use of of this NPAV in envenomation of humans by Naja kaouthia.
Conclusions: We report here the first successful use of Thai Red Cross Society Neuro Polyvalent Antivenin in the management of a Naja kaouthia envenomation in a human. While envenomation by crotalid spp is more common in the United States, providers should be aware of management options for exotic snakes given they are often kept in zoos or by private collectors.

KEYWORDS Envenomation, Antivenin, Cobra

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109. Cerebral Edema and Brain Death Following Intravenous N-Acetylcysteine Overdose

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Background: Cerebral edema from N-acetylcysteine (NAC) is rare. Two case reports describe cerebral edema following infusion of 2450 mg/kg over 6.75 hours, and 3050 mg/kg over 32 hours. We present a patient that received 1242.2 mg/kg NAC over 8.3 hours associated with cerebral edema and brain death.
Case Report: A 17-year-old female weighing 48.3 kg presented to a community hospital after an unwitnessed ingestion of 11.5 grams (238.1 mg/kg) of acetaminophen reportedly one hour prior. Vital signs included: T 36.8C; HR 99 BPM; BP 111/74 mmHg; RR 18/min; SpO2 99% room air. Her symptoms included mild nausea and vomiting pill fragments.
Acetaminophen concentrations at two and four hours post-ingestion were 135.5 and 89.5 ug/mL (896.1 and 591.8 umol/L) respectively. Initial ALT and AST were 16 and 21 IU/L. Given the uncertainty surrounding time of ingestion, NAC was initiated. She was placed on a two-step IV NAC protocol ordered as 150 mg/kg over one hour, followed by 15 mg/kg/hr for 20 hours (total 450 mg/kg). During therapy, vomiting worsened with minimal relief from 50 mg dimenhydrinate, 8 mg ondansetron, and 10 mg metoclopramide. Flushing and a maculopapular rash developed and were treated with 50 mg diphenhydramine. After 8.3 hours of treatment, it was discovered that NAC had continued at 150 mg/kg/hour and was stopped. The patient received a total of 1242.2 mg/kg (60,000 mg) NAC.
One hour after discontinuation, the patient was confused with shallow respirations, followed by agitation, diaphoresis, and seizures. She was treated with IV lorazepam, an IV loading dose of 20 mg/kg phenytoin, intubation and sedation with propofol. She progressed to decerebrate posturing with fixed dilated pupils. A non-contrast head CT demonstrated cerebral edema with cerebellar tonsillar herniation.
The patient was transferred to a tertiary care centre ICU where an external ventricular drain was placed. Her intracranial pressure was 25 mmHg. Treatment with mannitol, hypertonic saline, vancomycin, ceftriaxone, and norepinephrine and vasopressin was initiated to maintain cerebral perfusion pressure. Investigations for bacterial and viral infections were unremarkable. Urine immunochemistry for drugs of abuse was positive for THC and benzodiazepines. ALT and AST remained normal at 13

and 30 IU/L, and INR was 1.4. Aggressive supportive measures continued, including management of persistently elevated intracranial pressure. MRI 3 days post-ingestion demonstrated ongoing cerebral edema, diffuse ischemic changes, and cerebellar tonsillar herniation. Clinical examination and further neuroradiological investigations indicated brain death. Care was withdrawn and the patient died 86 hours post-ingestion.

Case Discussion: To our knowledge, this is the lowest reported quantity of IV NAC associated with cerebral edema. The Naranjo score was 6, indicating a probable adverse drug event.

Two possible mechanisms for NAC-associated cerebral edema have been described: increased glutaminergic signaling resulting in seizures and subsequent edema, and intracerebral accumulation of hyperosmolar NAC solution.

Conclusion: We report a case of cerebral edema and death following infusion of 1242.2 mg/kg NAC over 8.3 hours. Clinicians must be aware of the potential for IV NAC supratherapeutic dosing errors and their clinical features, including anaphylactoid reactions, intractable vomiting, and altered mental status.

KEYWORDS N-acetylcysteine, Cerebral Edema, Death

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110. Analeptic Dose of Flumazenil in a Toddler without Benzodiazepine Exposure

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Background: Analeptic effects are reported with "high" doses of flumazenil, but this threshold is not well described, especially in children. In this case, we describe the possibility of flumazenil acting as an "analeptic", or wake up drug, in a pediatric patient with no identified benzodiazepine exposure.

Case Report: A previously healthy 22-month-old male went down for a nap in his usual state of health. A few hours later, his mother noticed he seemed to be "gasping for air." He became unarousable and a family member performed CPR. When paramedics arrived, he was unresponsive, but had a pulse. Drug paraphernalia and intoxicated people were present in the house. The patient was supported with bag-mask ventilation during transport and 0.5 mg IM (0.04 mg/kg) naloxone was administered with a "partial" response.

Upon arrival to the ED, he was still unresponsive and apneic. Temp was 37.4 °C, pulse 150 bpm, BP 102/77, and SPO_2 82% with bag-mask ventilation. After a dose of 0.2mg naloxone, he became more alert, fighting the mask and crying with IV placement. Initial labs included a venous blood gas with pH of 7.22, pCO_2 40 mmHg, bicarbonate 16 mEq/L, and glucose of 329 mg/dL. The remainder of his initial work-up was normal, including a CBC, BMP, hepatic panel, amylase, lipase, ethanol, head CT, and urinalysis.

Patient was admitted to the pediatric critical care unit and toxicology was consulted. Initial toxicology exam was normal, but symptoms recurred 1.5 hours after the last naloxone dose. He was rousable to noxious stimuli, had pinpoint pupils, a slow respiratory rate, increasing end-tidal CO_2, and SPO_2 85-88%. Escalating bolus doses of naloxone (total 1.8mg) were given over 1 hour with slight improvements in breathing and mental status. After 4 mg of naloxone was given, he remained lethargic but had normal breathing and pupils. Flumazenil 0.2 mg (0.018 mg/kg) was administered with complete arousal back to normal mental status (Figure 1). Infusions of naloxone and flumazenil were used throughout his 4-day hospital stay with recurrence of symptoms after infusion weaning. Urine drug screen immunoassay detected buprenorphine. Mass spectrometry (LC/MS/MS) detected norbuprenorphine, methamphetamine (121 ng/mL), and amphetamine (86 ng/mL). Ethanol was negative. Blood was sent to a national reference laboratory for a novel benzodiazepine assay and non-directed testing—no other substance was found. He developed

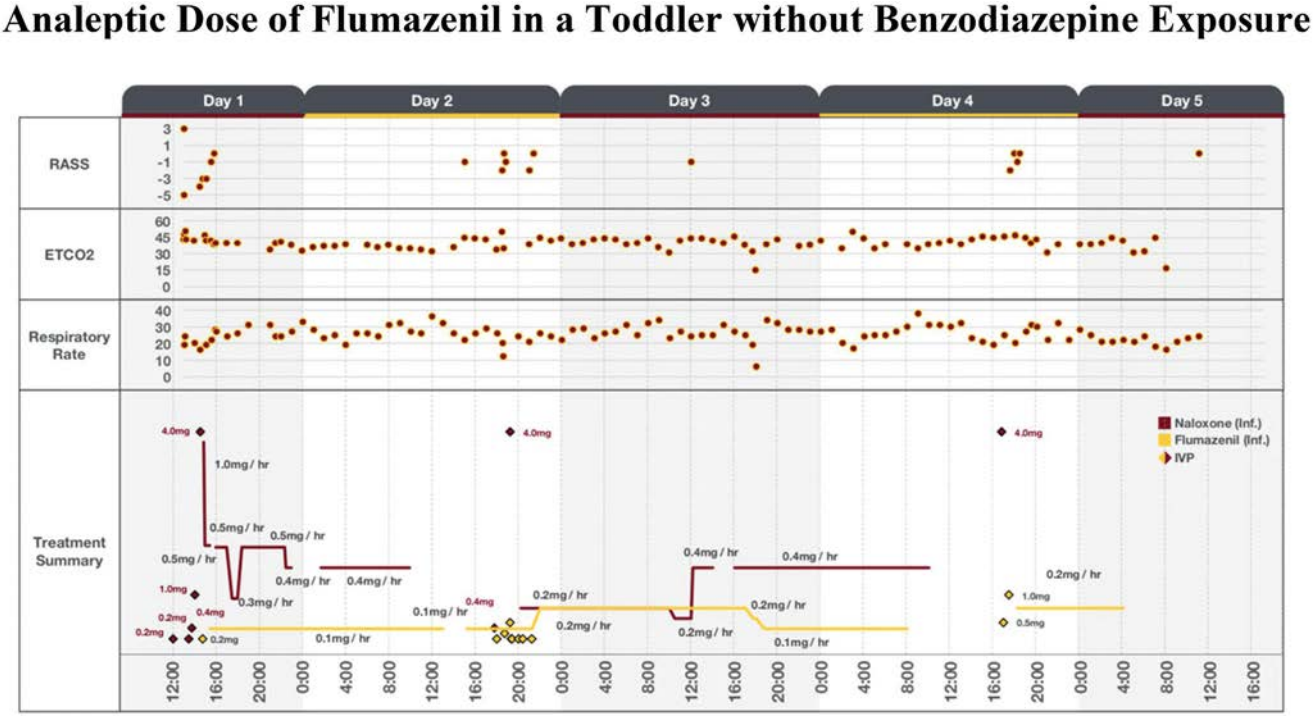

Figure 1(#110). Infusion and boluses of naloxone and flumazenil over time in relationship to respiratory rate, end-tidal CO2, and RASS (Richmond Agitation-Sedation Score). IVP-IV Push, demonstrated in diamonds. Not all data was available for all time points

cough and wheezing during admission and tested positive for respiratory syncytial virus (RSV).
Case Discussion: It was evident on serial toxicologic and critical care assessments that the patient responded to both antidotes, especially flumazenil at doses from 0.018-0.044 mg/kg. A co-ingestion was suspected, but after advanced toxicology testing yielded no other drug exposure, we concluded flumazenil may have been acting as a pure analeptic. It may have been reversing sedation secondary to methamphetamine washout, buprenorphine toxicity with insufficient naloxone dose, or mild RSV illness. Alternatively, there may have been an error leading to false negative results. The child completely recovered and did not require intubation during his admission.
Conclusion: Flumazenil may be inherently analeptic at a dose of 0.018 mg/kg in a toddler.

KEYWORDS Pediatric, Flumazenil, Buprenorphine

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111. Mercury, Merchants, and Misfortune - Face the Truth

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Background: Mercury has been used in skin lightening creams and beauty products as it inactivates the melanin production pathway. Chronic dermal exposure to the inorganic mercury can lead to accumulation in the tissues and eventually cross the blood-brain barrier. Clinical effects include neurologic sequelae, gastrointestinal effects, and renal injury. We present a case of toxicity after chronic dermal exposure to a mercury-containing skin cream.
Case Report: A 43-year-old, healthy female presented to her primary care provider (PCP) with headache and fatigue and reported that she had been using a skin-lightening facial cream from Mexico daily for over one year. She had seen a news report of mercury in beauty products. Her PCP ordered a metals screen. Her serum mercury level was 140 mcg/L and then 137 mcg/L drawn 2 weeks later. A toxicology consult was obtained and recommended oral dimercaptosuccinic acid (DMSA, succimer) 10 mg/kg every 8 hours for 5 days, then twice daily for 2 weeks. Meanwhile the patient reported ongoing dizziness, headache, burning sensation like ants crawling on her head, and cognitive issues with missing numbers for 2-3 weeks before treatment. About 8 days into treatment, she was admitted to the hospital for severe headache, anorexia, nausea, diarrhea, myalgias, fatigue, fever, and transiently elevated AST/ALT. Lumbar puncture and MRI were negative for CNS infection. The hospital lab reported a serum mercury level of 81.2 mcg/L and a 24-hour urine mercury level of 152 mcg/L. The succimer was stopped twice over a 10-day period during admission due to side effects. The patient was able to tolerate succimer with diphenhydramine, ibuprofen, and acetaminophen. A subsequent 24-hour urine mercury level was 203 mcg/L. After discharge the patient's serum mercury level was 54 mcg/L. She completed her succimer therapy, and symptoms resolved. Three months later, her serum mercury level declined to 15 mcg/L.
Case Discussion: The patient obtained the skin product from a compounding pharmacy in Mexico that had placed the product in a name-brand container. While neither lab was able to speciate the serum or urine mercury levels, the State Health Services lab determined that the skin cream contained 29,000 parts per million (ppm) of inorganic mercury. Skincare products containing no more than 1 ppm of mercury can legally be sold in the United States. Our patient had obtained a highly concentrated mercury-laden skin cream, had used it for over a year, and had developed elevated serum and urine mercury levels. Neurologic symptoms have been reported at urine levels greater than 100 mcg/L, and renal impairment at whole blood levels greater than 500 mcg/L. Notably, mercury levels do not correlate with toxicity. Our patient had elevated mercury levels, reported various neurologic symptoms, but showed no changes in renal function.
Conclusion: Despite mercury's known toxicity, it can still be found in compounded or adulterated skin care products. Our patient became moderately symptomatic after dermal absorption of a highly concentrated product. Her levels declined with succimer treatment that required hospital admission for management of adverse effects.

KEYWORDS Inorganic mercury, Skin-lightening facial cream, Dimercaptosuccinic acid (DMSA, succimer)

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112. Dangers of Huffing Computer Cleaner Sprays are Hard to Dust Off

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Background: Compressed air products marketed as computer and electronic duster sprays contain fluorinated hydrocarbons like difluoroethane or tetrafluoroethane. Inhalant abuse involves practices known as dusting (inhaling directly) or huffing (inhaling fumes sprayed onto fabric). Inhalant abuse affects many organ systems; however, the central nervous system is most susceptible, causing euphoria, hallucinations, and dizziness. Complications include frostbite, lethargy, syncope, dysrhythmias, hypoxia, seizures, and sudden death. This study intended to describe inhalant abuse from computer and electronic duster sprays reported to a statewide poison center network.
Methods: Cases were computer and electronic duster spray exposures reported to a statewide poison center network during 2000-2018 where the route was inhalation and the reason was intentional abuse/misuse. Computer and electronic duster spray exposures were identified by reviewing all records where the substance verbatim field mentioned "computer," "keyboard," "electronic," "dust," "compressed," or "canned." Case distribution was determined for factors related to patient demographics, exposure circumstances, management, and outcome.
Results: A total of 722 computer and electronic duster spray inhalation abuse cases were identified. The annual number of exposures increased from 6 in 2000 to 64 in 2009 then fluctuated between 40 and 65 during 2010-2018. The patient age distribution was 20 (2.8%) 6-12 years, 274 (38.0%) 13-19 years, 177 (24.5%) 20-29 years, 119 (16.5%) 30-39 years, 63 (8.7%) 40-49 years, 29 (4.0%) 50-59 years, 2 (0.3%) 60 years or older, and 38 (5.3%) unknown age; 458 (63.4%) of the patients were male, 258 (35.7%) female, and 6 (0.8%) unknown sex. Most (n = 492, 68.1%) exposures occurred at the patient's own residence, 76 (10.5%) at a public area, 34 (4.7%) at school, and 120 (16.6%) at other/unknown locations. The management site was 69 (9.6%) on site, 522 (72.3%) already at or en route to a healthcare facility, 119 (16.5%) referred to a healthcare facility, and 12 (1.7%) at other/unknown locations. The most frequently reported clinical effects were tachycardia (n = 161, 22.3%), drowsiness/lethargy (n = 89, 12.3%), hypertension (n = 70, 9.7%), syncope (n = 67, 9.3%), vomiting (n = 55, 7.6%), nausea (n = 51, 7.1%), confusion (n = 45, 6.2%), agitated/irritable (n = 44, 6.1%), and dizziness/vertigo (n = 40, 5.5%). The most common treatments were intravenous (IV) fluids (n = 165, 22.9%), fresh air (n = 152, 21.1%), oxygen (n = 138, 19.1%), dilute/irrigate/wash (n = 43, 6.0%), and benzodiazepines (n = 41, 5.7%). The medical outcomes were 112

(15.5%) no effect, 154 (21.3%) minor effect, 207 (28.7%) moderate effect, 34 (4.7%) major effect, 2 (0.3%) death, 4 (0.6%) not followed-judged nontoxic, 70 (9.7%) not followed-minimal clinical effects possible, 128 (17.7%) unable to follow-potentially toxic, and 11 (1.5%) unrelated effect.
Conclusions: Computer and electronic duster spray inhalant abuse cases most commonly involved patients who were male, aged 13-39 years, were managed at a healthcare facility, and had moderate outcomes, but also two deaths.

KEYWORDS Fluorinated hydrocarbons, Computer and electronic duster sprays, Inhalant abuse

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113. Benzocaine Exposures in Young Children Appear Numbingly Uneventful

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Background: Over-the-counter (OTC) topical oral anesthetics commonly contain benzocaine for temporary pain relief in the mouth and throat. Such products for teething pain carry a risk of causing methemoglobinemia in children. Consequently, in May 2018, the U.S. Food and Drug Administration (FDA) warned that OTC benzocaine-containing products should not be used in children younger than two years. This study intended to describe benzocaine exposures in children five years of age and younger reported to a poison center network.
Methods: Cases were exposures to benzocaine-containing products involving patients aged 0-5 years reported to a statewide poison center network during 2000-2018. Exposures included products containing other active ingredients in addition to benzocaine. We used descriptive statistics to report the various factors related to patient demographics, exposure circumstances, management, and outcome.
Results: A total of 5,255 pediatric benzocaine exposures were identified. The annual number of exposures declined from a peak of 432 in 2002 to 105 in 2018. Age distribution was 966 (18.4%) under 1 year, 1,442 (27.4%) 1 year, 1,798 (34.2%) 2 years, 690 (13.1%) 3 years, 219 (4.2%) 4 years, 121 (2.3%) 5 years, and 19 (0.4%) unknown age. Males comprised 2,696 (51.3%) of the cases. The exposure route was 4,684 (89.1%) ingestion, 448 (8.5%) ocular, 329 (6.3%) dermal, 37 (0.7%) otic, 34 (0.6%) inhalation, and 1 (0.0%) aspiration. The exposures were 5,194 (98.8%) unintentional, 10 (0.2%) intentional, and 46 (0.9%) adverse reaction. Most (n = 5,203, 99.0%) exposures occurred at the patient's own or another residence. The management site was 4,599 (87.5%) on site, 322 (6.1%) already at or en route to a healthcare facility, 321 (6.1%) referred to a healthcare facility, and 13 (0.2%) at other/unknown locations. The most frequently reported clinical effects were ocular irritation/pain (n = 250, 4.8%), vomiting (n = 111, 2.1%), red eye (n = 111, 2.1%), oral irritation (n = 63, 1.2%), drowsiness/lethargy (n = 45, 0.9%), and cough/choke (n = 37, 0.7%). The most common treatments were dilute/irrigate/wash (n = 3,781, 72.0%), food/snack (n = 473, 9.0%), and activated charcoal (n = 150, 2.9%). The medical outcome was 2,292 (43.6%) no effect, 389 (7.4%) minor effect, 34 (0.6%) moderate effect, 5 (0.1%) major effect, 338 (6.4%) not followed-judged nontoxic, 2,006 (38.2%) not followed-minimal clinical effects possible, 138 (2.6%) unable to follow-potentially toxic, and 53 (1.0%) unrelated effect; no deaths were reported. Limitations include the voluntary nature of reporting, not all were single-substance exposures, and not all cases were followed to a known outcome.
Conclusions: Pediatric benzocaine exposures reported to this poison center network have declined. Most involved male patients 1-2 years of age, were unintentional ingestions, were managed outside of a healthcare facility, and did not result in serious outcomes. Despite FDA warnings, exposures are anticipated due to the accessibility and availability of these products.

KEYWORDS benzocaine, oral anesthetics, methemoglobinemia

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114. Phosphide Exposures Foster Caution

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Background: Aluminum and zinc phosphides are used as grain fumigants and rodenticides. Following exposure to moisture or acid, phosphides release phosphine, a colorless, heavier-than-air, toxic gas with a garlic or rotten fish odor. Toxicity occurs after gas inhalation or solid ingestion, and may cause cough, dyspnea, dizziness, nausea, vomiting, hypotension, chest tightness, and seizures. Rapid progression to multiorgan failure, cardiovascular collapse, and death may occur. This study intended to characterize phosphide exposures reported to a statewide poison center network.
Methods: Cases were phosphide exposures reported to a statewide poison center network during 2000-2018. A phosphide exposure was defined as an exposure assigned the Toxicall® substance Generic code 0201036 (aluminum phosphide) or 0201052 (zinc phosphide). Case distribution was determined for various factors related to patient demographics, exposure circumstances, management, and outcome.
Results: A total of 228 phosphide exposures were identified: 142 (62.3%) aluminum phosphide and 86 (37.7%) zinc phosphide. The annual number of exposures ranged between 3 and 31. The patient age distribution was 48 (21.1%) 0-5 years, 5 (2.2%) 6-12 years, 18 (7.9%) 13-19 years, 27 (11.8%) 20-29 years, 34 (14.9%) 30-39 years, 25 (11.0%) 40-49 years, 26 (11.4%) 50-59 years, 18 (7.9%) 60 years or older, and 27 (11.8%) unknown age; 147 (64.5%) of the patients were male, 69 (30.3%) female, and 12 (5.3%) unknown gender. The exposure route was 141 (61.8%) inhalation, 72 (31.6%) ingestion, 30 (13.2%) dermal, 5 (2.2%) ocular, 2 (0.9%) injection, and 4 (1.8%) unknown. The exposures were 204 (89.5%) unintentional, 22 (9.6%) intentional, and 2 (0.9%) unknown reason. Most (n = 121, 53.1%) exposures occurred at the patient's own residence, 71 (31.1%) at a workplace, 17 (7.5%) at a public area, and 19 (8.3%) at other/unknown locations. The management site was 75 (32.9%) on site, 123 (53.9%) already at or en route to a healthcare facility, 19 (8.3%) referred to a healthcare facility, and 11 (4.8%) at an unknown location. Frequently reported clinical effects were nausea (n = 39, 17.1%), vomiting (n = 35, 15.4%), headache (n = 22, 9.6%), dizziness/vertigo (n = 17, 7.5%), cough/choke (n = 17, 7.5%), dyspnea (n = 17, 7.5%), and tachycardia (n = 13, 5.7%). Most common treatments were dilute/irrigate/wash (n = 75, 32.9%), fresh air (n = 57, 25.0%), oxygen (n = 55, 24.1%), and intravenous (IV) fluids (n = 40, 17.5%). The medical outcome was 53 (23.2%) no effect, 54 (23.7%) minor effect, 24 (10.5%) moderate effect, 4 (1.8%) major effect, 6 (2.6%) death, 4 (1.8%) not followed-judged nontoxic, 52 (22.8%) not followed-minimal clinical effects possible, 17 (7.5%) unable to follow-potentially toxic, and 14 (6.1%) unrelated effect.
Conclusion: Most reported aluminum and zinc phosphide exposures involved adults, male patients, were unintentional, and occurred by inhalation. Most exposures resulted in nonserious outcomes, although six deaths occurred.

KEYWORDS Phosphides, Phosphine gas, Fumigants and rodenticides
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115. Chloroquine and Hydroxychloroquine Exposures Reported to Poison Centers before the COVID-19 Pandemic

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Background: Structurally similar to quinine, both chloroquine (CQ) and hydroxychloroquine (HCQ) are well-known antimalarials with anti-inflammatory properties additionally used to manage systemic autoimmune diseases such as rheumatoid arthritis and lupus. Adverse effects from CQ and HCQ include gastrointestinal upset, pruritus, agitation, drowsiness, dizziness, headaches, and visual/auditory disturbances. Severe toxicity occurs with electrolyte abnormalities, conduction disturbances, myocardial depression, and dysrhythmias. Notably, these drugs have a narrow therapeutic range that may yield severe complications such as cardiomyopathy, neuromyopathy, and retinopathy. Due to potential antiviral activity against COVID-19, CQ/HCQ are being studied for prophylaxis or treatment. This study intended to characterize CQ and HCQ exposures reported to poison centers prior to the COVID-19 pandemic.
Methods: Cases were CQ and HCQ exposures reported to a statewide poison center network during 2000-2019. Exposures included CQ and HCQ with and without coingestants, as well as cases not followed to a final medical outcome. Case distribution was determined for patient demographics, exposure circumstances, and, for cases involving only CQ and HCQ, management and outcome. Descriptive statistics were used.
Results: A total of 758 CQ and HCQ exposures were identified: 73 (9.6%) CQ and 685 (90.4%) HCQ. The patient age distribution was 221 (29.2%) 0-5 years, 32 (4.2%) 6-12 years, 70 (9.2%) 13-19 years, 429 (56.6%) 20 years or older, and 6 (0.8%) unknown age; 514 (67.8%) of the patients were female. The majority (n = 753, 99.3%) of exposures occurred by ingestion. The exposure reason was 543 (71.6%) unintentional (including 310 [40.9%] therapeutic error), 184 (24.3%) intentional, 24 (3.2%) adverse reaction, and 7 (0.9%) other/unknown. Most (n = 716, 94.5%) exposures occurred at the patient's residence, 29 (3.8%) at another residence, and 13 (1.7%) at other/unknown locations. There were 423 (55.8%) exposures involving only CQ and HCQ, for which the management site was 237 (56.0%) on site, 109 (25.8%) already at or en route to a healthcare facility, 70 (16.5%) referred to a healthcare facility, and 7 (1.7%) at other/unknown locations. In the CQ/HCQ-only exposures, the most frequently reported clinical effects were nausea (n = 23, 5.4%), vomiting (n = 23, 5.4%), drowsiness/lethargy (n = 20, 4.7%), hypotension (n = 15, 3.5%), tachycardia (n = 13, 3.1%), electrolyte abnormality (n = 11, 2.6%), and conduction disturbance (n = 10, 2.4%). Most common treatments were activated charcoal (n = 177, 41.8%), dilute/irrigate/wash (n = 91, 21.5%), food/snack (n = 54, 12.8%), and intravenous (IV) fluids (n = 50, 11.8%). Medical outcomes were 152 (35.9%) no effect, 29 (6.9%) minor effect, 32 (7.6%) moderate effect, 8 (1.9%) major effect, 28 (6.6%) not followed-judged nontoxic, 147 (34.8%) not followed-minimal clinical effects possible, 24 (5.7%) unable to follow-potentially toxic, and 3 (0.7%) unrelated effect; no deaths were reported.
Conclusions: Prior to investigational use for the COVID-19 pandemic, most CQ and HCQ exposures involved adults, female patients, unintentional exposures, and occurred by ingestion. More than half of isolated CQ and HCQ exposures were managed on-site and did not have serious outcomes.

KEYWORDS chloroquine, hydroxychloroquine, COVID-19
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116. Laundry Pod-Related Injuries Treated at Emergency Departments

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Background: In 2012, single-dose laundry detergent packs or pods consisting of concentrated laundry detergent enclosed in a water-soluble membrane were introduced in the United States (US). Shortly after their introduction, poison centers and healthcare providers began reporting injuries resulting from laundry pod exposures such as vomiting, cough or choke, ocular irritation or pain, red eye, drowsiness or lethargy, nausea, and oral irritation. In response, in December 2015 voluntary standards for laundry pods and their packaging and labeling were released to reduce the risk of laundry pod exposures. The objective of this study was to describe laundry pod-related injuries managed at US emergency departments (EDs).
Methods: Data were obtained from the National Electronic Injury Surveillance System (NEISS), a database of consumer product-related injuries collected from the EDs of approximately 100 US hospitals. National estimates are calculated from the database records based on the sample weight assigned to each case based on the inverse probability of the hospital being selected for the NEISS sample. Laundry pod-related injuries reported during 2012-2018 were identified by reviewing the two narrative text fields for any mention of "pod," "pack," or "pak." Those records that also included 0949 (Laundry soaps or detergents) in either of the two product code fields or mentioned in the narrative fields that the product was a laundry detergent were included in the study. The distribution of estimated laundry pod-related injuries was determined for various factors related to patient demographics, injury circumstances, diagnosis, and disposition.
Results: A total of 1,131 laundry pod-related injuries were identified, resulting in a national estimate of 31,154 injuries. The annual estimate was 1,623 in 2012, 2,623 in 2013, 5,877 in 2014, 5,723 in 2015, 5,591 in 2016, 5,398, in 2017, and 4,319 in 2018. The seasonal distribution was 6,036 (19.4%) in December-February, 7,538 (24.2%) in March-May, 9,379 (30.1%) in June-August, and 8,200 (26.3%) in September-November. The patient age distribution was 27,099 (87.0%) 0-5 years, 1,825 (5.9%) 6-12 years, 540 (1.7%) 13-19 years, and 1,689 (5.4%) 20 years or older; 16,885 (54.2%) of the patients were male and 14,269 (45.8%) female. The route of the injury was 19,302 (62.0%) ingestion, 10,297 (33.1%) ocular, 1,854 (6.0%) dermal, and 82 (0.3%) inhalation. Of the estimated 25,881 injuries with a reported location, 25,223 (97.5%) occurred at home, 422 (1.6%) other public property, 153 (0.6%) school, and 84 (0.3%) street or highway. The most common diagnoses were poisoning (n = 19,789, 63.5%), dermatitis or conjunctivitis (n = 4,752, 15.3%), and chemical burns (n= 3,411, 10.9%). The disposition was 28,229 (90.6%) treated or examined and released, 314 (1.0%) treated and transferred to another hospital, 1,624 (5.2%) treated and admitted for hospitalization, 547 (1.8%) held for observation, and 439 (1.4%) left without being seen.
Conclusion: The estimated number of laundry pod-related injuries treated at EDs increased during 2012-2014 then declined during 2015-2018. The patients were most often age 0-5 years. The majority of the injuries occurred by ingestion followed by ocular route. Most patients were treated or evaluated and released from the ED.

KEYWORDS Laundry detergent, Laundry pods, Emergency department
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117. Frequency of Poison Center Cases Involving Surgical Issues: One Year Retrospective Review

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Background: The North American poison center model involves physician medical toxicologists providing primary management advice for poisoned patients. Although consultations with other specialties occurs regularly, particularly with specialists in critical care as well as nephrology, consultation with surgeons in management of poisoned patients is infrequent. This study seeks to determine the frequency of cases managed by a poison center for which involvement of a surgeon or surgical subspecialists may be beneficial.
Methods: A pharmacist specialist in poison information and a physician medical toxicologist reviewed all cases managed by the Qatar Poison Center in its first year of operations. Cases considered relevant to surgeons included: foreign body ingestions; caustic exposures including ingestions, ocular exposures, and dermal burns; animal bites and stings; toxin-induced liver failure;; and all cases involving potential or actual compartment syndrome.
Results: A total of 198 cases met criteria noted above. Cases in each category are noted below, with the exception of compartment syndrome and liver failure, for which there were none.

Caustic exposures: 108
Foreign body ingestion: 48
Button Battery 8
Neodynium (high power) magnet 4
Water beads 3
Body packer 1
Regular battery 3
Unknown/other 24

Animal Bite/Sting: 29
Cat 10
Snake 5
Dog 3
Monkey 2
Human 2
Camel 1
Hamster 1
Lizard 1
Rabbit 1
Spider 1
Stonefish 1
Turtle 1
Burn: 1

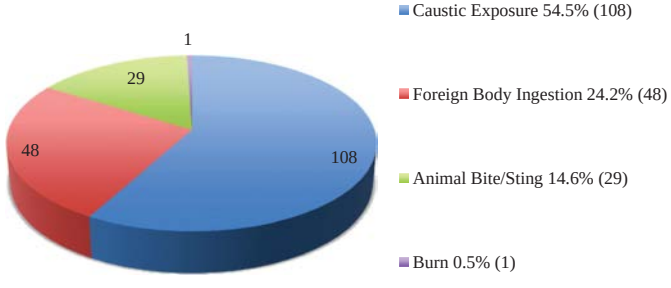

Figure (#117). Qatar poison center cases with surgical relevance.

Conclusions: In total, 198 poison center cases its our first year of operations were surgically relevant. Poison centers routinely manage most cases in these categories without surgical consultations. Regular consultation with surgeons might improve patient management, be of informational value to the surgical teams, and help establish relationships and lines of communication highly valuable in rare cases when immediate surgical intervention are emergently needed.

KEYWORDS surgical, caustic, foreign body
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118. Comparison of Expansion of Water-Absorbing Beads After Exposure to Potential Irrigation Fluids

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Background: Water-absorbing beads (WAB), also called gel beds, are superabsorbent hydroscopic polymers which increase greatly in size and volume after exposure to water. These have been commonly marketed as toys, and due to their ability to massively grow, have been a recognized cause of intestinal obstruction and even death after pediatric ingestions. Additionally, they may pose a risk when children insert these into the external ear canal.
Methods: This is a bench laboratory study evaluating the expansion of WAB after exposure to various fluids that may potentially be used to irrigate the bowel or external ear to facilitate expulsion of a WAB; water, normal saline, polyethylene glycol (PEG), and sunflower oil. Using digital calipers, the diameter of 12 WAB submerged in these four fluids was measured at times 0,1,2,3,7,9,11,13 and 15 hours. Results were compared by ANOVA to determine if the volume expansion differed between groups.
Results: A one-way ANOVA was conducted on 12 beads in each fluid group to examine the effect of irrigation fluid on bead expansion. Results showed that the type irrigation fluid used for WAB immersion lead to statistically significant differences in WAB size $F(3,467) = 892.16$, $p < 0.000$. Quantitatively, sunflower oil submersion resulted in no expansion, and the overall rate of expansion was fastest and final WAB size greatest in water, followed by normal saline, then PEG.
Conclusions: WAB exhibit different expansion behavior upon exposure to the fluids tested. These finding are consistent with greater expansion in fluids that have available free water. This information may inform or guide irrigation of the external ear canal or other orifice to facilitate removal of a WAB, as well as potential bowel irrigation after ingestion of WAB. Administration or attempted whole-bowel irrigation with mineral oil or food oil is not known to be safe and we do not recommend such. Mineral oil may safely be used for external auditory canal irrigation.

KEYWORDS water bead, irrigation, decontamination
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119. Capsaicin adverse events reported to the Food and Drug Administration

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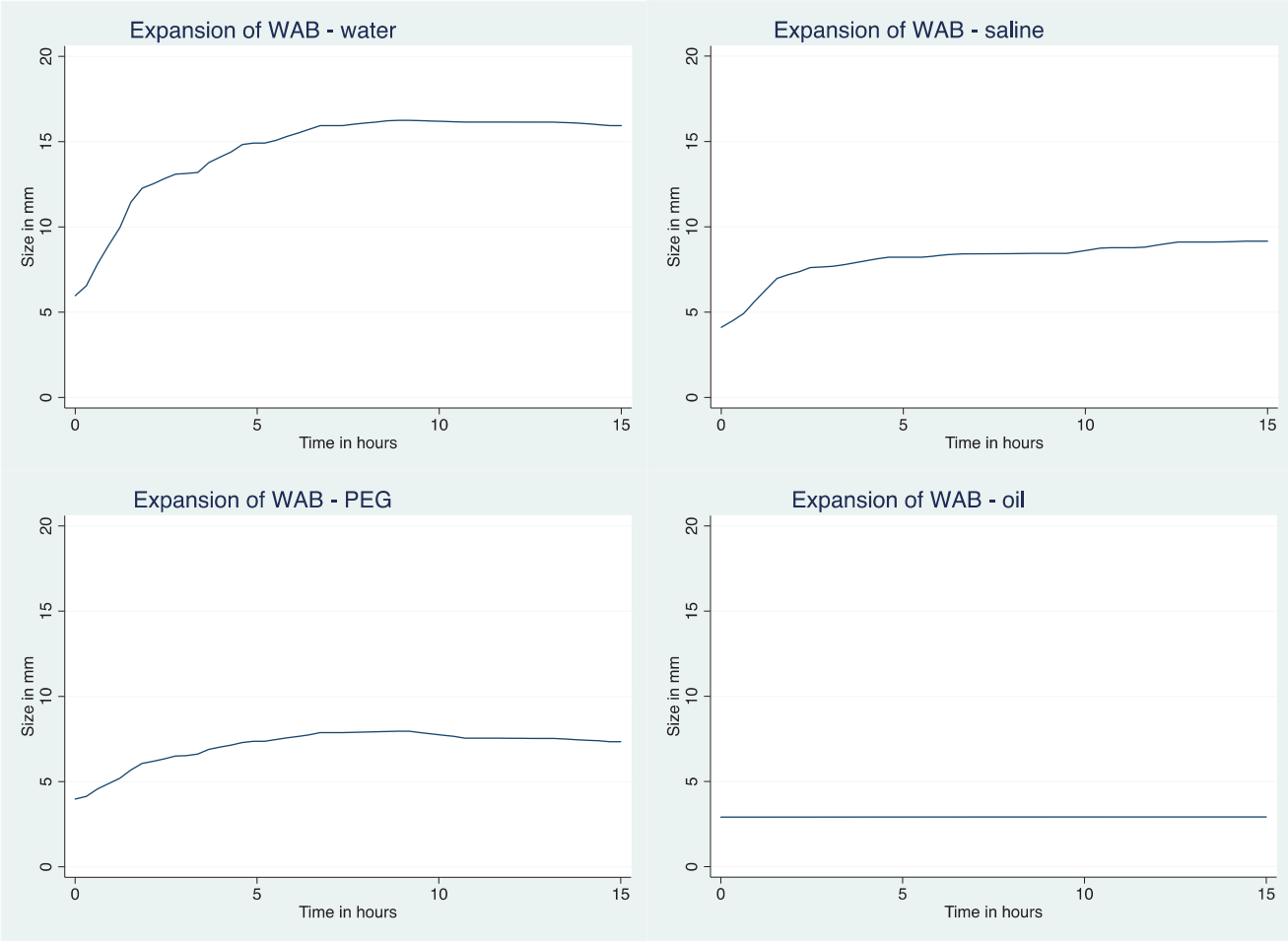

Figure (#118).

Background: Capsaicin, Capsicum pepper extract, has anti-inflammatory and analgesic properties. It is used as a topical medication for the management of neuralgia, neuropathy, and osteoarthritis. Capsaicin is a strong irritant and can cause dermal burning or stinging. If ingested, capsaicin can result in nausea, vomiting, abdominal pain, and diarrhea. Ocular exposure can cause tearing, ocular pain, and conjunctivitis. The objective of this study was to describe capsaicin medication adverse events reported to the United States Food and Drug Administration (FDA).
Methods: Data were obtained from the FDA Adverse Event Reporting System (FAERS), a national database that contains reports of drug and other biologic product adverse events and medication errors. Reports are coded using the Medical Dictionary for Regulatory Activities (MedDRA), a validated, internationally standardized medical terminology. The FAERS public dashboard was searched for all records added during 2000-2019 that reported capsaicin or Capsicum, and the raw data for the records were downloaded. Cases were all records with no substances other than capsaicin or Capsicum mentioned. The distribution of capsaicin adverse events was determined for various factors related to patient demographics, circumstances of the exposure, symptoms, and outcome.
Results: A total of 505 capsaicin adverse events were identified, 240 (47.5%) reported by a consumer, 218 (43.2%) by a healthcare professional, and 47 (9.3%) not specified. The patient's sex was 306 (60.6%) female, 153 (30.3%) male, and 46 (9.1%) unknown. Of the 286 patients with a reported age, 4 (1.4%) were 10-19 years, 21 (7.3%) 20-29 years, 25 (8.7%) 30-39 years, 84 (29.4%) 40-49 years, 59 (20.6%) 50-59 years, 55 (19.2%) 60-69 years, 29 (10.1%) 70-79 years, and 9 (3.1%) 80 years or older; the mean age was 51.7 years (range 10-87 years). Of the 340 cases with a reported reason for use of the product, the most common reasons were 84 (24.7%) neuralgia, 35 (10.3%) pain, 34 (10.0%) peripheral neuropathy, 33 (9.7%) arthritis, 25 (7.4%) arthralgia, and 24 (7.1%) myalgia. The most frequently reported adverse reactions were 99 (19.6%) application site pain, 68 (13.5%) pain, 66 (13.1%) application site erythema, 66 (13.1%) burning sensation, 65 (12.9%) application site burn, 53 (10.5%) blister, and 51 (10.1%) erythema. The reported outcomes were 100 (19.8%) not serious, 10 (2.0%) required intervention, 51 (10.1%) hospitalized, 15 (3.0%) disabled, 7 (1.4%) life threatening, 321 (63.6%) other outcomes, and 43 (8.5%) died.
Conclusion: Capsaicin adverse events most often involved patients who were female and 40 years or older. The product was most often used to treat neuralgia, neuropathy, arthritis, arthralgia, and myalgia. The most frequently reported adverse reactions were pain, burning sensation, erythema, and blisters. The majority of adverse events resulted in serious outcomes. However, these serious outcomes, including deaths, were not necessarily related to the capsaicin.

KEYWORDS capsaicin, Capsicum, FDA Adverse Event Reporting System

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120. Glow Product-Related Injuries Treated at Emergency Departments

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Background: Glow (chemiluminescent) products, such as glow jewelry and glow sticks, provide heatless chemical luminescence in a variety of colors. The active ingredients in many of these products are anthracene and oxalates synthesized with dibutyl phthalate. Although generally considered non-toxic, some injuries resulting from glow products may be treated at emergency departments (EDs). The objective of this study was to describe glow product-related injuries managed at United States (US) EDs.**Methods:** Data were obtained from the National Electronic Injury Surveillance System (NEISS), a database of consumer product-related injuries collected from the EDs of approximately 100 US hospitals. National estimates are calculated from the database records based on the sample weight assigned to each case based on the inverse probability of the hospital being selected for the NEISS sample. Glow product-related injuries reported during 2001-2018 were identified by reviewing the two narrative text fields for any mention of "glow" or "light" and "stick" or "necklace" or "bracelet" or "jewelry." The distribution of estimated glow product-related injuries was determined for various factors related to patient demographics, injury circumstances, diagnosis, and disposition.
Results: A total of 224 glow product-related injuries were identified, resulting in a national estimate of 8,215 injuries. The annual estimate declined during 2001-2007 then increased during 2008-2018. The highest proportion (n = 1,742, 21.2%) of the injuries were treated during July, followed by November (n = 1,463, 17.8%) and October (n = 847, 10.3%). Most (n = 4,601, 56.0%) of the injuries were treated during Friday-Sunday. The patient age distribution was 4,045 (49.2%) 0-5 years, 2,716 (33.1%) 6-12 years, 916 (11.2%) 13-19 years, and 539 (6.6%) 20 years or older; 4,825 (58.7%) of the patients were male and 3,390 (41.3%) female. The route of the injury was 4,253 (51.8%) ocular, 3,360 (40.9%) ingestion or oral, 386 (4.7%) otic, 205 (2.5%) dermal, and 173 (2.1%) nasal. Of the estimated 5,024 injuries with a reported location, 4,027 (80.2%) occurred at home, 483 (9.6%) place of recreation or sports, 308 (6.1%) other public property, 136 (2.7%) school, and 70 (1.4%) street or highway. The most common diagnoses were poisoning (n = 2,061, 25.1%), dermatitis or conjunctivitis (n = 1,204, 14.7%), chemical burns (n = 958, 11.7%), ingested foreign object (n = 791, 9.6%), and contusions or abrasions (n = 576, 7.0%). The most frequently affected body part was the eyeball (n = 4,313, 52.5%), all parts of the body (n = 2,061, 25.1%), and internal (n = 870, 10.6%). The disposition was 7,848 (95.5%) treated or examined and released, 91 (1.1%) treated and transferred to another hospital, and 277 (3.4%) left without being seen.
Conclusion: The estimated number of glow product-related injuries treated at EDs has increased over the last decade. The injuries were most often treated during July, October, and November and during Friday-Sunday. The patients were most often age 0-5 years and male. The majority of the injuries affected the eye. Most patients were treated or evaluated and released from the ED.

KEYWORDS glow product, chemiluminescent product, National Electronic Injury Surveillance System

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121. Prolonged Status Epilepticus in a Child Following Ingestion of Methomyl

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Background: Methomyl is a carbamate insecticide. There are few reports of human toxicity following ingestion. We present a case of methomyl poisoning in a child with a unique clinical course.
Case Report: A 17 kg four year-old swallowed a "little bit" of liquid, later confirmed to be methomyl, from a bottle he misidentified at time 1915. He presented to the emergency department (ED) at 1955 with pulse 108, respiratory rate 20, blood pressure 100/66, and temperature 36.4° C. The child was asymptomatic with no significant examination findings except hydrocarbon breath odor. At 2012, the child had a grand mal seizure and became incontinent of stool. The child continued with intermittent seizures despite repetitive pharmacological intervention. Laboratory values obtained at 2015 demonstrated normal basic metabolic panel and complete blood count. A nasogastric tube was placed at 2025 with 30 ml saline lavage followed by administration of 12.5 grams activated charcoal. An arterial blood gas (ABG) at 2020 revealed: pH 7.24, PCO_2 54.6, pO_2 250 on 4 liters nasal cannula oxygen. A bag-valve mask (BVM) was applied after saturations dropped to 70% at 2055. An ABG at 2057 revealed: pH 7.00, PCO_2 105, pO_2 203. At 2115, the saturations were 88% with BVM, pulse 168, and blood pressure 150/92. The patient was intubated emergently at 2115 with oxygen saturations increased to 100% and a pulse 175. A third ABG at 2134 revealed: pH 7.31, PCO_2 28.0, pO_2 428. A post-intubation chest x-ray was unremarkable. From the time of seizure onset to leaving the ED, the child received diazepam (10 mg), lorazepam (3 mg), phenytoin (340 mg), and phenobarbital (330 mg).
The child was transported to a tertiary care facility with continual seizures from 2155 to 2241 and received additional lorazepam (7 mg). Upon arrival to the intensive care unit, vitals were: T 39.7° C, P 180, BP 109/37, and RR 40 with 97% saturations while bagged. Examination at time of arrival revealed pupils 3 mm, increased salivation, lungs clear, and grand mal status epilepticus. An emergent EEG revealed status epilepticus and pharmacotherapy was administered until generalized bursts of fast and spike discharges ceased. Over the next 24 hours, the child received additional phenobarbital (890 mg), phenytoin (200 mg), lorazepam (6 mg) as well as atropine (0.4 mg), vecuronium (4 mg) and sodium bicarbonate (60 mEq). Within an hour of admission, the child became progressively hypotensive requiring vasopressors. An initial head CT was unremarkable. Two days later, papilledema was noted and a follow-up CT demonstrated diffuse cerebral edema and loss of ventricles. The child was declared brain dead 4 days after the ingestion and life support was removed.
Case Discussion: There are limited methomyl poisonings reported in children. This case is unique in the development of prolonged status epilepticus in a child following carbamate ingestion that was resistant to initial pharmacologic therapy and required phenobarbital-induced coma.
Conclusions: Methomyl poisoning in children can induce status epilepticus highly resistant to pharmacologic therapy.

KEYWORDS Methomyl, carbamate, seizures

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122. Lidocaine Toxicity during Tumescent Liposuction

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Background: Tumescent liposuction (TL) is a common liposuction technique that involves instillation of large volumes of 1% lidocaine with epinephrine into targeted adipose tissues. These high doses are considered safe amongst plastic surgeons due to the prompt removal of infiltrated tissue. We present the case of a woman who developed significant toxicity from a lidocaine dose considered to be standard for a TL procedure.

Research Question: Are these high doses of lidocaine safe?
Methods: 36 year-old-female received 3grams subcutaneous lidocaine into her abdominal wall for a TL procedure. She developed difficulty breathing, shaking of her hands, and a questionable loss of pulses. She underwent 30 seconds of CPR with return of circulation, and was intubated.
Vitals in the ED: 84bpm, 144/95mmHg, 14 breaths/min; 36C; O2 Sat 100% (intubated). Labs were significant only for an initial lactate of 3.9 mmol/L. CT head unremarkable. ECG: 92bpm, QTc 447, and QRS 76. Overnight VEEG results showing no epileptiform activity. She was discharged on day 3. Her peak lidocaine level was 15.9 micrograms/mL.
Results: Cardiac and CNS toxicity have been associated with lidocaine levels above 8-12 micrograms/ml. The most widely accepted maximum safe dose of lidocaine with epinephrine is 7mg/kg; our patient received 30mg/kg; the reported maximum safe dose during TL is 55mg/kg. It is unclear why this patient developed toxicity, but an inadvertent intravascular injection during intended subcutaneous administration would be the most likely explanation. By the time our patient presented to the ED, she was hemodynamically within normal limits, with a narrow QRS, and without any seizure activity.
Conclusion: There is a paucity of data to suggest that widespread lidocaine toxicity from TL exists, but it remains a common procedure that involves dosages of lidocaine that are widely considered to be toxic. The incidence of TL-induced lidocaine toxicity is warranted.

KEYWORDS Lidocaine, Tumescent, Liposuction

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123. Predatory Insulin Administration in Drug Facilitated Sexual Assault

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Background: Exogenous insulin use has been reported in many cases of self-harm, but less frequently in cases of assault. We report what we believe is the first case of predatory insulin administration for drug facilitated sexual assault.
Case Report: 16 yo F with history of neurofibromatosis presented to the Emergency Department (ED) with a relative after alleged physical assault. She reported being given a substance to drink and following this being amnestic to events. On physical exam, she was alert and had soft tissue swelling and abrasions to the R face, R chest, and R arm. While awaiting diagnostic radiology, she developed abrupt onset of altered mental status and had a tonic clonic seizure. Rapid glucose read <20 mg/dL. She received 2 mg of lorazepam intravenously and 25 grams of dextrose with resolution of the seizure. Repeat glucose after diagnostic imaging was 38 mg/dL. Patient had no prior history of diabetes or seizures and denied administering insulin or ingesting any diabetic agents. Persistent and prolonged hypoglycemia ultimately required a dextrose infusion of D15% at 125-200 mL/hour for 6 days (see chart). Toxicology diagnostic evaluation included a sulfonylurea panel which was negative, insulin level which was 602 McU/mL (normal range 4-30), pro-insulin level which was negative, and c-peptide level which was 0.5 ng/mL (normal range 1-4.4), consistent with administration of exogenous insulin, and physical exam revealed an apparent injection site on the R arm. Octreotide was administered at 50 mcg SQ every 6 hours for a total of 12 doses over 4 days until sulfonylurea panel returned negative. Patient ultimately disclosed a history of a forced sexual encounter following the physical assault. Child Protective Services, local law enforcement, and the FBI were involved in the investigation of suspected human trafficking.
Case Discussion: Exogenous insulin overdose is reported in many cases of self harm. Insulin levels are not typically obtained in these cases; however in case reports of massive overdose and/or prolonged hypoglycemia insulin levels obtained have been very elevated as in our case. The length of time supplemental dextrose is required varies based upon patient factors as well as the dose and type of insulin. While the dosage and type of insulin used in this case of malicious administration is unknown, the prolonged and profound hypoglycemia our patient experienced supports the administration of a large dose of likely a long acting agent.
Conclusions: While uncommon, predatory insulin administration should be considered in the differential diagnosis of profound and/or prolonged hypoglycemia.

KEYWORDS Insulin, Malicious Overdose, Hypoglycemia

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124. Virtual Toxicology Service: Developing A New Model of Specialty Care

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Background: Telehealth is a term used to describe delivery of health services over distance. Clinical toxicology has been a pioneer in this area with the development of Poisons Information Centres allowing centralized specialist advice to be provided over a large geographical area.
A dedicated Clinical Toxicology Unit optimizes the care and resource utilization of poisoned patients but is not available at most hospitals. The introduction of a fully digital integrated electronic medical record (ieMR) system allows the opportunity for specialist units to provide a virtual service to regional centres, through documenting written advice, ordering investigations and prescribing treatment into the ieMR.
Methods: We performed a prospective observational study of the first three months of a pilot Virtual Toxicology Service delivered by the Princess Alexandra Hospital Clinical Toxicology Unit at Logan Hospital. Patients were identified through the Emergency Department FirstNet dashboard on the Cerner

Table (#123). Predatory Insulin Overdose.

Day	Dextrose administration	Octreotide administration	Blood glucose range	Toxicologic laboratory values
1	D12.5% at 200 mL/h; D50 x 8 doses	50 mcg q6H	20-118 mg/dL	Insulin 602 mcU/mLCpeptide 0.5 ng/mLProinsulin negative
2	D15% 100-200 mL/h; D50 x 1 dose	50 mcg q6H	50-110	
3	D15% 125-190 mL/h; D50 x 1 dose	50 mcg q6H	37-200s	
4	D15% 100-175 mL/h	50 mcg q6H for 2 doses, then discontinued	76-300s	Insulin 158.3 McU/mLC peptide 2.0 ng/mL, sulfonylurea panel returned negative
5	D15% 125-175 mL/h; weaning schedule started	none	88-120	
6	D15% 60-150 mL/h; weaned to off	none	83-117	

Millennium ieMR. Relevant clinical information including history, vital signs, pathology results and ECGs was reviewed to determine a risk assessment and management advice which was documented directly into the patient's chart. This was followed by a phone call to the treating clinician to confirm advice was provided.
Results: Over the first 3 months of the pilot Virtual Toxicology Service there were 127 presentations (male 63 [50%], median age of 29 years [range 2-71 years]). Deliberate self-poisonings accounted for 85 (67%) presentations with the commonest exposure being paracetamol 27/85 (32%), quetiapine 16/85 (19%) and ibuprofen 15/85 (18%) respectively. Recreational intoxication accounted for 30 (24%) presentations which were largely following methamphetamine use (23/30 [77%]). There were 10 unintentional exposures which included four suspected snakebites.
The Virtual Toxicology Service advice included specific toxicological interventions (decontamination, antidote or specific treatment) in 19 (15%) presentations, documentation of minimum observation periods and criteria to clear patients in 66 (52%) presentations. In 40 (31%) cases the patient was suitable to be cleared from a toxicology perspective at the time of the virtual ward round.
Conclusion: With an integrated medical record providing a virtual consultative toxicology service is feasible and may enable patients at centres without dedicated toxicology units to receive specialized care at a similar level to centres with an on-site toxicology service.

KEYWORDS toxicology unit, virtual, model of care
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125. Aspirin Overdose: What is A Realistic Risk Assessment?

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Background: Aspirin is a metabolic poison and overdose causes acid-base disturbance and organ dysfunction. Risk assessment has been based on the recognised severity of chronic poisoning reported over 40 years ago. We investigated the severity of acute aspirin overdose and predictors of toxicity.
Methods: This is a retrospective series of acute aspirin overdoses presenting to two toxicology units from January 2000 to September 2019. Aspirin exposures >3000mg were identified in prospective clinical databases from toxicology presentations. Clinical notes were reviewed to obtain demographic data, clinical effects, investigations, complications and treatment.
Results: There were 170 cases in 143 patients (98 females [69%]) with a median age of 28 years (Interquartile range [IQR]: 20-44 years). Patients presented a median of 3.5 hours (IQR: 1.7-7.2 hours) post ingestion following a median aspirin ingestion of 7200mg (Range 3300-86400mg). Co-ingestions were taken in 131 (77%) presentations. Charcoal was given in 37 (22%) presentations a median of 3.0 hours (IQR: 2-4.5 hours) post-ingestion. Clinical features of tinnitus, vomiting and tachypnoea (respiratory rate >20 breaths per minute) occurred in 36 (22%), 45 (26%) and 61 (36%) cases, respectively. Confusion, coma (GCS <9) and hypotension occurred in 15 (9%), 9 (5%) and 17 (10%) cases respectively, although in most cases these were attributable to co-ingestions. A bicarbonate <20mmol/L occurred in 38 (22%) presentations. The median peak aspirin concentration was 276mg/L (IQR: 168-400mg/L), and there was a strong association between dose ingested and peak concentration (Pearson $r = 0.55$; $p < 0.0001$). There was a negative association between peak concentration and bicarbonate (Pearson r=-0.21; $p = 0.012$). There were four cases of severe toxicity, all ingesting >300mg/kg, and with peak salicylate concentrations >700mg/L. Urinary alkalinization was performed in 35 (21%) presentations. There were no instances of dialysis and no patient met any of the EXTRIP criteria for dialysis. 21 patients were admitted to ICU. The median length of stay was 18 hours (IQR: 7-24hours).
Conculsions: Acute aspirin overdose did not appear to cause severe toxicity. Severe toxicity was associated with ingestions >300mg/kg and both salicylate concentration and bicarbonate were associated with dose ingested.

KEYWORDS aspirin, salicylate, poisoning
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126. Beware of The Miracle Mineral Cure: A Case of Life-threatening Sodium Chlorite Overdose

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Background: Sodium chlorite is a chemical used as a bleaching agent and disinfectant. In alternative medicine circles it is marketed as "Miracle Mineral Supplement" a proclaimed curative for illnesses such as HIV, malaria, viral hepatitis and more recently COVID-19. We present a case of deliberate sodium chlorite poisoning resulting in severe toxicity with methaemoglobinaemia, acute kidney failure and haemolysis.
Case Report: A 29 yo male drank 90g of sodium chlorite flakes dissolved in water with suicidal intention. On arrival to hospital 30 minutes post ingestion he appeared cyanosed, diaphoretic with a heart rate of 100bpm, BP of 133/86 mmHg and oxygen saturations of 78% on 10L oxygen. He had profuse diarrhoea. His venous gas analysis showed a pH of 7.40, pCO_2 35, HCO_3 21, lactate 3.9 and methaemoglobin 40.5%. He received 2mg/kg of methylene blue following which his methaemoglobin concentration fell to 21%. He received a further 2mg/kg of methylene 30 minutes later and his methaemoglobin concentration fell to 6.2%. He was observed overnight where it was noted he had increasing oliguria. On day two his creatinine rose from 77 mmol/L to 355mmol/L. His urine output was only 4mL/h and intermittent haemodialysis was commenced. On day 2 his haemoglobin also decreased from 158 g/L to 102 g/L with a lactate dehydrogenase rise of 3630 unit/L consistent with haemolysis. The haemolysis progressed to a haemoglobin nadir of 57g/L on day 4. He received multiple red cell transfusion from day 4 to day 12. He was discharged home on day 13 although he continued to have dialysis three times per week until day 24 when his renal function recovered.
Case Discussion: Sodium chlorite is a powerful oxidative agent. Overdose is characterised by an initial methaemoglobinaemia followed by haemolysis and acute kidney injury.
There is very little data to guide the management of sodium chlorite poisoning with only a few case reports in the literature available. Initial use of methylene blue followed by the supportive management of renal failure and haemolytic anaemia with dialysis and red cell transfusion respectively were effective in this case.

KEYWORDS sodium chlorite, methaemoglobin, hemolysis
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127. Bites and Stings: An Analysis of Enquiries to the UK National Poisons Information Service (NPIS) between 2009 and 2019

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Background: The European adder (Vipera berus) is the only venomous snake in the UK. There are no native spiders of toxicological significance.
Objective: To review enquiries to the UK NPIS involving bites and stings from animals. Enquiries involving the European adder (Vipera berus) were excluded as these data have been reported previously.
Methods: The UK Poisons Information Database was interrogated for patient related enquiries between 01/01/2009 and 31/12/2019.
Results: The search retrieved 1,599 enquiries. Most related to chordates (n = 850, 53%) followed by arthropods (n= 591, 37%). The remaining 10% of enquiries involved cnidarians (n= 72), echinoderms (n = 41), annelids (n = 3) and molluscs (n = 1). In 41 enquiries the animal was not known.
Of the 850 enquiries regarding chordates, 629 (74%) involved reptiles, including snakes (n = 555), lizards (n = 71) and turtles (n = 3). Of the 591 enquiries regarding arthropods, 502 (85%) involved arachnids, including spiders (n = 449), scorpions (n = 41), ticks (n = 11) and mites (n = 1).
More detailed analysis was undertaken for enquiries regarding snakes and spiders since these comprised the majority (63%) of calls.
Of 555 snake enquiries, identification was reported in 348. These involved 307 exposures in 296 patients (10 of whom were bitten on multiple occasions). Pet snakes were implicated in at least 248 exposures.
Of 307 snake exposures, the families involved were Colubridae (n = 176, 57%), Pythonidae (n= 53, 17%), Boidae (n = 34, 11%), Viperidae (n= 29, 9%), Elapidae (n = 13, 4%) and other (n = 2, 0.7%). The maximum Poisoning Severity Score (MAXPSS) was known in 300 exposures and was none in 80, minor in 182, moderate in 25, severe in 12 and fatal in 1. Only bites from Viperidae (n = 8) or Elapidae (n = 5) caused severe poisoning or fatality.
The advice of a consultant clinical toxicologist was sought in 58 of 307 snake exposures and 39 of these were further referred to a specialist toxinologist. The severity of poisoning was moderate or worse in 24/39 (62%) cases where toxinology expertise was sought.
Of 449 enquiries relating to spiders, identification was reported in 238. These involved 220 exposures in 219 patients (1 patient was bitten on multiple occasions). Pet spiders were implicated in at least 80 exposures.
Of 220 spider exposures, the families were Theridiidae (n= 121, 55%), Theraphosidae (n= 65, 30%) and other (n = 34, 15%). The MAXPSS was known in 218 exposures and was none in 19, minor in 162, moderate in 36 and severe in 1. The majority of exposures resulting in moderate or severe toxicity (n = 25) occurred following bites from Theraphosidae.
The advice of a consultant clinical toxicologist was sought in 43 of 220 exposures and 15 of these were further referred to a specialist toxinologist. The severity of poisoning was at least moderate in 10/15 cases where toxinology expertise was sought.
Conclusion: Bites from snakes and spiders account for the majority of enquiries to the UK NPIS regarding bites and stings. These enquiries pose a challenge for UK poisons information specialists and consultant clinical toxicologists, with specific toxinology expertise sometimes required.

KEYWORDS snake, spider, venom

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128. Bites from Non-Native Viperidae and Elapidae Snakes Reported to the UK National Poisons Information Service 2009-2019

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Background: Most severe cases of snake bite envenoming are inflicted by species of the family Viperidae (including rattlesnakes, adders and vipers) and Elapidae (including cobras, taipans and mambas).
Objective: To review all enquiries to the UK NPIS involving bites from snakes belonging to the Viperidae and Elapidae families. All cases regarding Vipera berus (European adder) which is native to the UK were excluded.
Methods: The UK Poisons Information Database was interrogated for patient related enquiries between 01/01/2009 and 31/12/2019 for all cases of bites from non-native snakes belonging to the Viperidae or Elapidae families.
Results: The search retrieved 64 enquiries regarding 42 exposures involving 33 patients (7 of whom were bitten on two separate occasions and one who was bitten on three separate occasions). Of these 42 exposures, 29 involved Viperidae (70%) and 13 involved Elapidae (30%).
Exposures to Viperidae involved 24 patients (21 of whom were male). Three patients were bitten by two different Viperidae on two different occasions and one patient was bitten by three different Viperidae on three different occasions. Sixteen bites were from pets, 7 bites occurred in the context of occupational exposure and 6 patients were bitten overseas. Bites from rattlesnakes were most common accounting for 11 exposures. The site of the bite was documented in 27 of 29 exposures, of which 24 occurred on the hand and three on the leg. The maximum Poisoning Severity Score (MAXPSS) was known in 26 exposures; minor (n= 9), moderate (n= 9) and severe (n = 8). Advice was sought from a clinical toxinologist in 20 exposures. Antivenom was administered in 11 exposures (in three antivenom was administered overseas). Follow up was undertaken in 16 exposures. Complete recovery was documented in 11 and the outcome was unknown in 5 (3 of whom self-discharged against medical advice). No deaths were reported.
Exposures to Elapidae involved 11 patients (10 of whom were male); 10 exposures were from cobras. Two patients were bitten

by two different Elapidae on two different occasions. Seven bites were from pets, 5 bites occurred in the context of occupational exposure and in one case the circumstances of exposure was unknown. The site of the bite was documented in 9 of the 13 exposures, 6 of which occurred on the hand, and one each on the arm, leg and foot. The MAXPSS was known in 12 exposures; minor (n= 7), severe (n = 4) and death (n= 1). Advice was sought from a clinical toxinologist in 11 exposures. Antivenom was administered in 5 exposures. Follow up was undertaken in 8 exposures with complete recovery in 5, ongoing features (n = 1), permanent sequelae (n = 1) and one death following a bite from a King Cobra (*Ophiophagus Hannah*). Antivenom was administered on the scene but the patient died before reaching hospital.
Conclusions: Envenomations from Viperidae or Elapidae snakes are infrequently reported to the UK NPIS with most occurring following bites from pets or in the context of occupational exposure. Severe envenomation has been observed necessitating antivenom administration.

KEYWORDS snake, elapidae, viperidae

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129. Medical Toxicology Rotation Continuity During Coronavirus Pandemic

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Background/Objective: To continue our Medical Toxicology rotation in light of Coronavirus restrictions we quickly needed to restructure our service so that rounds and teaching would become completely virtual. Our rotation is composed of medical and pharmacy students, residents (mostly emergency medicine), fellows, and attending medical toxicologists and clinical toxicologists.
Methods: Medical Toxicology rounds began using the Zoom teleconference platform on Monday March 16, 2020. All rotating students, residents, fellows and attendings were able to join in the teleconference. Daily rounds and didactics were held via a standard teleconference link. Clinical rounds consisted of presentations of patients whom the resident or fellow on-call was consulted on from the prior 24 hours and follow up case presentations for patients who remained "active". Didactic teaching included journal club, formal fellow presentations, and student and resident presentations on a toxin of one's choice. Residents from our affiliated hospitals who were in quarantine for Coronavirus were invited to join rounds. Guest toxicologists were also invited to participate in rounds. We conducted a brief survey of our rotating residents and students during the transition month to teleconference.
Results: We were successful in maintaining our active Toxicology service and had no interruption while switching to teleconferencing. Attendance by both residents and fellows remained the same, but attendings participated more frequently than pre-pandemic. We were required by some medical schools to attest to how we accomplished rounds via teleconferencing and that students would not be required to leave their homes. We were the only rotation within the metropolitan area of our home institution who had no disruption in medical student rotations since the beginning of the pandemic.
Prior to the enforcement of stay at home measures at the beginning of the pandemic some resident and student rotators had experienced rounds both in person and by teleconference. The unstructured survey showed: residents preferred teleconference rounds; students preferred in-person rounds stating that in-person it was easier to focus with less distractions. Students however preferred to ask questions via the chat function while teleconferencing because it was less intimidating.
Conclusion: We were able to make a successful transition to a tele-education service and were able to maintain standards of clinical medicine and teaching despite imposed limitations during a pandemic. We were able to make changes by remaining flexible and creative. Teleconferencing allowed our service to be maintained without interruption and improved our daily attendance. The numbers of individuals attending rounds increased and there was more participation in case discussions. Medical students had no interruption in their clinical rotation and learning.

KEYWORDS Teaching, teleconferencing, pandemic

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130. Clinical and biochemical effects of patient initiated, over-the-counter low-dose dimercaptosuccinic acid (DMSA) chelation therapy for lead exposure

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Background: Plumbism in adult occurs secondary to environmental, occupational, recreational and intentional self-harm activities. While blood lead level (BLL) based chelation guidelines are more readily established for children, there is no similar consensus for adult patients and the decision to chelate is a delicate balance of the risks of chelation therapy weighed against benefits of preventing end organ toxicity. With easy access to individual lab data and chelators, patients may take this decision into their own hands.
Case Report: A 55-year old male engineer with a history of Kennedy's disease (spinal bulbar muscular atrophy) had progressive paresthesias of his lower extremities and associated subjective foot drop. He grew up in a farm house, currently lives in a 120-year old house, and approximately one decade ago spent extensive time stripping old paint. Environmental analysis revealed presence of lead dust throughout the house; detailed questioning did not reveal any other source of exposure. Vitals and exam were notable for a normotensive, thin man with mild gynecomastia, a positional fine tremor, atrophy of facial and bulbar musculature, and absence of gingival lead lines; neurologic findings were at the patient's baseline. He had obtained self-pay blood heavy metal screening on day 0 demonstrating a BLL of 38 mcg/dL; confirmatory level on day 21 was 45 mcg/dL. After referring a protocol obtained on a Facebook group, the patient purchased DMSA through Living Supplements (South Africa; photo enclosed) and titrated TID dosing from approximately 0.5 mg/kg to 1 mg/kg; approximately $1/10^{th}$ of the commonly used dose for initiation of DMSA chelation. Labs obtained at the patient's first toxicologic evaluation (day 125) revealed BLL 13.6 mcg/dL, normal creatinine, complete blood count, and urinalysis as well as absence of detectable cadmium, mercury, and arsenic. Aminolevulinic acid dehydratase activity was normal. Despite no clear indication for chelation, urine lead/Cr ratio was 58 mcg/g and urine zinc/Cr ratio was 1697 mcg/g—both indicative of active ongoing chelation even at such a low dose. Chelation stopped on day 131; repeat studies obtained on day 139 showed random lead/Cr ratio of 21 mcg/g and urine zinc/Cr ratio of 1,153 mcg/g, suggestive of decline towards baseline physiologic function.
Discussion: DMSA chelation therapy is associated with risks of trace metal deficiency, neutropenia, and allergic reactions. Our

study highlights the risks of widespread social media use to guide chelation therapy combined with easy internet access to foreign chelating products. Additionally, we observed biochemical evidence of effective chelation occurring at 1/10th of conventionally prescribed doses—a phenomenon not previously described.
Conclusion: Primary physicians, poison control centers, and toxicologists alike should approach chelating "supplements," regardless of dose, with tremendous caution.

KEYWORDS DMSA, dimercaptosuccinic acid, lead
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131. Carbon Dioxide Toxicity in Theater Workers from High-volume Stage Haze and Fog Propellants

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Background: Stage haze and fog are commonly used in theater, music and dance productions, as well as other events. Many commercially available stage fog systems use a propylene glycol-based fog solution mixed with a propellant of carbon dioxide or nitrogen gas. Thousands of professionals, students, and amateurs in the performing arts can be exposed to stage fog in their workplaces, sometimes for 10-20 hours during multi-show production days.
Case Series: Members of our multi-disciplinary team were contacted to evaluate a series of four actors and stagehands in a major Broadway production. All reported symptoms after being exposed to high-volumes of stage fog. The patients (two males and two females ages 29 to 45) were all veterans theater workers and had been exposed to stage fog before. One patient reported asthma and allergies, but the other patients denied underlying medical or psychiatric illnesses. Others reported symptoms, but did not request evaluations.
The fogs in this production were identified as CO2-propelled, propylene glycol and 1,2-butanediol based derivatives. Both personal and area sampling for CO2 was conducted for the show's producers during multiple performances. Personal monitoring showed peak short-term exposure levels (STEL) among workers in wardrobe, dressers, stage managers, and automation board operators (Max STEL from 11,060 to 13,933 ppm). The highest 8-hour time weighted averages (TWA) were reported for an automation board operator, wardrobe workers and a stage manager (TWA from 3,731 to 4,346 ppm over multiple shows). Area sampling showed the highest STELs in the revolve, a mechanical room below the stage (17,460- 20,972 ppm over 25 shows), stage right trap room (12,383-18,180 ppm, 84 shows) and orchestra pit (5040-18,920 ppm, 9 shows). Following this testing, HVAC modifications were implemented to introduce additional outdoor air.
Reported symptoms included vertigo, delayed motor and cognitive function, headaches, and syncope. Two patients were evaluated in emergency departments following episodes of syncope with return to baseline mental status after removal from the environment; reported vital signs were notable only for tachycardia. No patient required hospitalization.
Discussion: Human responses to carbon dioxide exposure vary widely and symptoms have been reported at levels as low as the 1000 ppm range. The OSHA guidelines for CO2 exposure (30,000 STEL and 5,000 TWA) are based on five weekly eight-hour workdays. These standards may not be appropriate for theater workers who can work 12-16 hours in direct proximity to stage fog during peak production. Other performing arts venues (including part-time, amateur and student productions) may also use stage fog in similar exposure settings.
Conclusion: Anyone contemplating the use of stage haze or fog should consider the potential for health effects among workers and others, some of whom may have underlying conditions and may experience prolonged exposures. Preventive measures for CO2 exposure are usually available. Health care professionals should be aware of this potential exposure when working with performing arts workers.

KEYWORDS carbon dioxide, stage fog, theater
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132. Significant hypothermia associated with mitragynine and cannabis use

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Background: Cannabis use is associated with varying levels of subjective cold sensation but similarly has been reported to cause hyperthermia. Similarly, with profound CNS depression owing to its opioid agonism, and due to its interactions with dopamine and alpha-2 receptors, mitragynine can theoretically induce hypothermia. There is a paucity of clinical data in humans corroborating any of these animal-model observations.
Case Report: A 30-year old 68 kg male that lives with his parents presented at 0745 to the emergency department with a chief complaint of "chills and ringing in the ears." His medical history is notable for depression, treated with escitalopram only. He reports smoking, vaping, and dabbing THC constantly throughout most days for relaxation, and additionally uses mitragynine powder to help with insomnia. The evening before presentation, he ingested 4 grams of MitraGaia™ powder mixed with water. He slept indoors in his own bed and notified his parents in the morning that he felt unwell. His vital signs on arrival to the ED were notable for a temperature of 92.0 deg F, HR 50, with BP 118/66 mm Hg. His initial exam revealed a drowsy but not somnolent individual who was palpably cool and clammy, with slightly sluggish distal perfusion, and with normal sized reactive pupils and a normal respiratory rate and effort. EKG demonstrated shivering artifact with sinus bradycardia, prolonged QT to 503 ms, and Osborn waves. Labs were notable for a lactate of 2.4 mmol/L, potassium of 2.5 mEq/L, and serum bicarbonate level of 20 mEq/L. Glucose was minimally elevated at 169 mg/dL, while ethanol and salicylate were undetectable. An eight-panel urine drug screen was positive only for cannabis; confirmatory serum levels obtained on admission were notable for minimally elevated cannabis and metabolite levels: Delta-9 THC level of 11 ng/mL, Delta-9 carboxy THC level of 81 ng/mL, 11-Hydroxy Delta-9 THC level of 1.8 ng/mL. Mitragynine level was 61 ng/mL; higher than levels associated with fatality in previous case reports. A broad infectious, endocrinologic, and metabolic workup revealed no further explanation for the hypothermia. He was treated with a forced-air rewarming system, potassium replacement, and room-temperature intravenous crystalloid solution. Over the course of four hours, his heart rate nadired at 36, and his core temperature corrected to 97.7 deg F. All symptoms resolved. All laboratory abnormalities corrected with rewarming and supportive care; he was discharged the next day in fine condition.
Discussion: While cannabis is implicated in this presentation, drug levels are metabolites are not consistent with severe cannabis toxicity. Mitragynine levels were above fatal reference ranges

many hours after ingestion with associated hypothermia, acidosis, and both electrolyte and cardiac instability.
Conclusions: Mitragynine contributed to hypothermia with circulatory dysfunction in an otherwise healthy young man. Clinicians should be aware of this potential when evaluating patients that either use kratom products or are found to be hypothermic.

KEYWORDS mitragynine, cannabis, hypothermia

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133. Cannabis toxicity in the E-cigarette and vaping-use associated lung injury (EVALI) epidemic: an inpatient toxicology service experience

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Background: Presently, the EVALI epidemic is thought to be related to exposure to high levels of vitamin E acetate (VEA) and e-cigarette use containing tetrahydrocannabinol (THC) demonstrated on forensic analytic toxicologic evaluation. The cumulative toxicity of THC likely plays a role in the pathophysiology of EVALI, but no published data exist on the clinical presentations and associated clinical toxicologic laboratory data in these patients.
Case Series: Our institutions cared for a total of six patients that met the CDC case definition for EVALI; all were co-managed by a toxicology consultation service. 5/6 patients were male, and the mean age was 22.3 years. Most patients described vaping habits of at least 1000 mg of THC daily (the contents of most commonly observed single illicitly obtained cartridges), while all vaped at least 1000 mg weekly. In each case where urine THC-COOH was obtained on admission, levels were all uniformly above assay limits (>500 ng/mL). In cases where levels were delayed by six and nine days, they resulted at 447 ng/mL and 213 ng/mL, respectively. All cases had negative confirmatory urine drug screens for cocaine, amphetamines, barbituates, opiates, phencyclidine, methadone, and benzodiazepines. 67% displayed clinically significant nausea and vomiting; two patients had hyperemesis requiring treatment. Furthermore, one patient went into THC withdrawal at approximately two days into his hospital stay. Every patient was treated with steroids and antibiotics at various points throughout their hospital stay; one intubated patient developed a pneumothorax requiring tube thoracostomy.
Discussion: Every EVALI patient admitted to our hospital had urine THC-COOH levels greater than assay when levels were obtained on admission. Current surveillance and epidemiologic data do not capture clinical toxicology data in these patients, and no available commercial laboratory is presently able to provide precise quantification of THC metabolites in these patients owing to their significant elevation. Moreover, we suspect that clinically significant signs of THC toxicity (including hyperemesis and withdrawal) are underreported in EVALI cases.
Conclusion: We recommend that precise clinical toxicologic analytic evaluation of EVALI-suspected patients occur on admission, and as part of state and nationwide surveillance. Finally, bedside toxicology evaluation should be encouraged wherever possible.

KEYWORDS EVALI, cannabis toxicity, vaping

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134. Age- and gender-bias disparities in EKGs obtained following drug overdose limit effectiveness of quality measures

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Background: Adverse cardiovascular events (ACVE) are common, occurring in upwards of 20% of drug overdoses. While factors including QRS widening, QT prolongation and dysrhythmias and ischemia on an EKG can point towards an increased risk of ACVE, an EKG must be obtained promptly to recognize these risk factors. Accordingly, the American College of Medical Toxicology (in partnership with the ToxIC registry) developed a set of quality measures to ensure benchmark performance for emergency department and toxicology programs in the management of acute overdose, to include obtaining an EKG within 60 minutes of arrival to the ED in all patients of all ages. We sought to evaluate the presence of existing biases in obtaining timely EKGs and to characterize common limitations in meeting this benchmark.
Materials and Methods: Using a database of ICD-10 diagnoses for acute overdose, we developed a registry of all patients poisoned between the years 2016-2019 treated at four community hospitals with an aggregate census of 125k visits/yr. We abstracted data to include the time of presentation, time initial EKG was obtained, time until verified EKG intervals were recorded for computerized point-of-entry (CPOE) validation, and basic demographic information. Reviewers were blinded to the ingestion or exposure. We defined pediatric patients as those age less than or equal to 18 years of age. Cases were excluded if they contained restricted/protected information, incomplete data regarding any element of time, or referenced EKGs obtained more than 90 minutes prior to placement in an ED bed.
Results: A total of 1,641 cases were evaluated. Among all ages, female patients met the time-to-EKG benchmark of <60 minutes

Table (#133).

Age (years)	Sex	Nature of Exposure	Urine THC-COOH Level (ng/ml), time obtained	GI Symptoms	Pulmonary Symptom Duration (days)	Level of care required	Intubated	Steroids and Antibiotics Given?	Clinical Complications
23	female	Flavored vape, 1 g THC/day	213, obtained nine days after admission	No	7	ICU	No	Yes	None
30	male	"Constant" THC vaping	>500, on admission	No	3	ICU	Yes	Yes	Pneumothorax and pneumomediastinum
19	male	Flavored vape, 1 g THC/day	447, obtained six days after admission	Yes (hyperemesis)	5	ICU	No	Yes	None
20	male	<1 g THC/week by history	>500, on admission	Yes	4	ICU	No	Yes	None
21	male	1 g THC every 2-3 days	>500, on admission	Yes (hyperemesis)	6	Floor	No	Yes	None
21	male	Flavored vape, 1 g THC/day	>500, on admission	Yes	7	ICU	No	Yes	THC withdrawal on day #2

46.2% of the time, while men met the benchmark 39.3% of the time ($p < 0.01$). This disparity persisted when evaluating the percentage that received an EKG within 24 hours (55.5% for women, 46% for men, $p < 0.001$). This finding was not observed between pediatric patients where males were observed to meet the benchmark 48.6% of the time and females 48.3% of the time ($p = 0.97$). Furthermore, pediatric patients were more likely to have a faster turnaround to an EKG-read recorded for CPOE purposes when compared to adults (2.15 vs 3.6 days, $p < 0.001$). A separate internal review found that time-to-EKG completion was much greater when known cardiotoxic xenobiotics were implicated.
Discussion and Conclusions: Quality control benchmarks are an important part of evaluating clinical practice but face significant limitations due to implicit gender and age bias. We observed that adult men were less likely to have a timely EKG performed and noted that if the EKG was not complete in the ED, it was unlikely to be completed at all. As many drug-drug interactions are only checked based on finalized EKG reads, disparities to read times highlight a need for vigilance in ordering habits. Further prospective study is necessary to evaluate the etiology of gender bias in obtaining timely EKGs.

KEYWORDS EKG, bias, QCDR
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135. A review of xylazine-associated fatalities: an emerging public health emergency

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Background: Xylazine is a sedative and analgesic approved for veterinary uses, and acts in a manner similar to clonidine through central α-adrenergic agonism. It is only used in veterinary medicine, but is easily obtainable, inexpensive, and can produce profound analgesia and muscle relaxation, making it an increasingly popular drug of abuse. Small outbreaks have been noted in mainland US cities, and more recent widespread use of this so called "anestecia de caballo" (horse anesthetic) is ongoing in Puerto Rico. In collaboration with the Cook County Medical Examiner's office and Illinois Department of Public Health, we observed many cases of xylazine-associated fatalities and aim to better characterize their presentation.
Materials and Methods: Postmortem peripheral and caval blood samples from decedents with a suspected drug-related overdose were evaluated. Using a combination of ELISA, GC, and HPLC/TOF-MS forensic analytic methods, we screened for common xenobiotics with reflex confirmatory tests using a commercially available assay. We included cases if a measurable xylazine concentration was above laboratory minimum detectable limits (5 ng/mL).
Results: A total of 40 drug-related fatalities in 2019 had measurable xylazine levels; no similar cases were observed the year prior. The mean whole blood xylazine level was 17.6 ng/mL with a range of 5 (lower limit of detection) to 79. Of these cases, 93% also had detectable levels of fentanyl, fentanyl analogues, or carfentanyl. Heroin, codeine, methadone, hydrocodone and morphine were often found as well. 14 cases had detectable levels of naloxone; in each case where naloxone was present, there was at least one opioid/opiate present as well. The most commonly associated over-the-counter adulterant was diphenhydramine, which was present in 80% of cases. Interestingly, quinine was present in 28% of cases, and caffeine in 58% of cases. Commonly associated recreational or illicit drugs implicated include tetrahydracannabinol, cocaine, 3,4-methylenedioxyamphetamine (MDA), and 3,4-methylenedioxymethamphetamine (MDMA).
Discussion: Xylazine is an uncommon drug of abuse and cutting agent for opioid products available in North America. Its central α-adrenergic agonism can produce hypotension and bradycardia that make management of suspected opioid intoxication more challenging. While we are unable to quantify the exact contribution of xylazine to each patient's cause of death, this is the largest collection of fatalities associated with xylazine reported to date.
Conclusion: Anyone caring for poisoned patients should recognize the pathophysiology of xylazine intoxication and be aware of its presence amidst the opioid epidemic.

KEYWORDS xylazine, fatality, postmortem
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136. Retrospective review of pediatric (age 0-5) hydroxyzine ingestion and triage threshold for poison center referral to a healthcare facility

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Background: Unintentional pediatric ingestions of both prescription and over-the-counter medications are common. Hydroxyzine is increasingly being prescribed for the treatment of anxiety in adolescents and adults in addition to their classical role for the treatment of pruritis and allergic conditions. While case reports discuss many of the hazards associated with larger quantity self-harm ingestions, little is known about the risks of unintentional hydroxyzine exposure in young children. Data exists for similar compounds, including diphenhydramine and doxylamine, however there is no similar data for hydroxyzine to guide poison center specialists or toxicologists caring for these children.
Materials and Methods: The pediatric exposure records from a regional poison center were reviewed for the time period of 2011-2019. All records for patients aged 0-5 who presented with a hydroxyzine ingestion were analyzed. Cases were included if the patient was exposed to either pill or liquid form via the oral route of ingestion and were excluded if another substance was ingested or if the route was any other than oral (e.g. ocular). We evaluated only cases where both dose provided by history and a known weight were documented and excluded all other records from the analysis. Cases lost to follow up were also excluded. We evaluated the final disposition of the patient, medications administered, vital signs and laboratory studies obtained, and documented signs or symptoms associated with toxicity.
Results: A total of 159 cases were identified; 77 were excluded for the reasons above. The median and mode of dose ingested were 20 mg and 10 mg, respectively. The average dose ingested was 2.11 mg/kg (range 0.3 mg/kg to 12.7 mg/kg). Of 82 included cases, a total of 6 were referred to the ED and 5 ultimately presented to the ED; none of these patients required admission, medication administration, or any interventions outside of telemetry monitoring. A single 5-year old referred to the ED presented with tachycardia but vital signs were otherwise unremarkable. Cases with a total amount of ingestion >5 mg/kg were more likely to be referred to the ED ($p < 0.01$), however there were not observed differences in symptoms noted between ingestions of <5mg/kg and >5 mg/kg ($p = NS$). All cases with an ingestion of <10 mg/kg or <150 mg total dose did not have any demonstrable clinically significant outcomes and could have been managed at home.
Discussion and Conclusions: Antihistamines including hydroxyzine are widely available and a common source of accidental

poisonings in infants and toddlers. This retrospective data set shows that 10 mg/kg is well tolerated in this age group. The ingested doses by history may not be accurate and as an additional measure of safety, a 7.5 mg/kg triage threshold criteria could safely be used for home management of these unintentional ingestions.

KEYWORDS hydroxyzine, threshold, poison center

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137. Case Report: Ethosuximide Overdose

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Background: Ethosuximide is a succinimide derivative anticonvulsant medication typically used in the treatment of absence seizures. Toxicity is rare, but signs and symptoms of toxicity have previously been reported to include nausea, vomiting, CNS depression, ataxia, stupor, and coma. No previous case reports have described hypotension or bradycardia. Relatedly, the pharmacokinetics of ethosuximide show primary hepatic metabolism by CYP3A4 and have previously demonstrated a relatively long half-life up to 30 hours in children and 50-60 hours in adults. However, reports on potential toxicokinetic variance at supratherapeutic doses are limited.
Case Report: A 17-year-old male with no significant past medical history presented from an outside facility approximately six hours after an intentional overdose with ethosuximide in a suicide attempt. The patient ingested an estimated fifty to sixty 250 mg tablets. He was initially sedated and complaining of nausea and emesis. Ethosuximide level on day of presentation was 55 mg/L. Serial levels were obtained and downtrended to 39 mg/L. His GC/MS urine screen was positive for ethosuximide and nicotine. The patient continued to be sedated throughout the initial 24 hours at this facility. He also demonstrated a transient episode of significant bradycardia and hypotension with nadirs of 47 bpm and 51/40 mmHg, respectively . He was managed supportively with fluids and antiemetics. No rebound of symptoms or serum levels occurred. Patient improved and was monitored in the hospital prior to inpatient psychiatric hospitalization on hospital day 2.
Discussion: The purpose of this case report is two-fold: to elucidate previously undescribed sequelae of overdose and to report the observed pharmacokinetics. After an estimated ingestion of 12,500 to 15,000 mg ethosuximide, initial serum level obtained at 6.3 hours post ingestion was 55 mg/L. The patient exhibited nausea and emesis with subsequent development of CNS depression. The patient also experienced a transient episode of bradycardia and hypotension, which has not previously been reported in toxicity. He did not require vasopressor support, and the episode resolved with no evidence of concurrent mental status changes, end organ damage, or other long-term clinical sequelae from ingestion. Regarding pharmacokinetics, ethosuximide is hepatically metabolized (80%) primarily by CYP3A4 to inactive metabolites, and approximately 10 to 20% may be excreted unchanged in the urine. Half-life has been reported to be relatively prolonged at 30 hours in children and 50-60 hours in adults. In this patient, serial ethosuximide levels were 55, 53, 51, 40, 44, and 39 mg/L at time points of 6.3, 11.6, 15.4, 21.8, 28.2, and 34.3 hours respectively, suggesting half-life in overdose resembling pharmacokinetic values.
Conclusion: This case report reveals potential additional features of ethosuximide overdose, including hypotension and bradycardia, in addition to those commonly reported. Additionally, the data suggest ethosuximide in overdose continues to undergo prolonged elimination.

Table 1 (#137). Ethosuximide levels at respective time points after initial ingestion.

Time	Time Post Ingestion (Hours)	Ethosuximide Level (mg/L)
Ingestion - 4:30	6.3	55
10:45	11.6	53
16:07	15.4	51
19:55	21.8	40
Day 2 - 2:20	28.2	44
8:40	34.3	39
14:45		

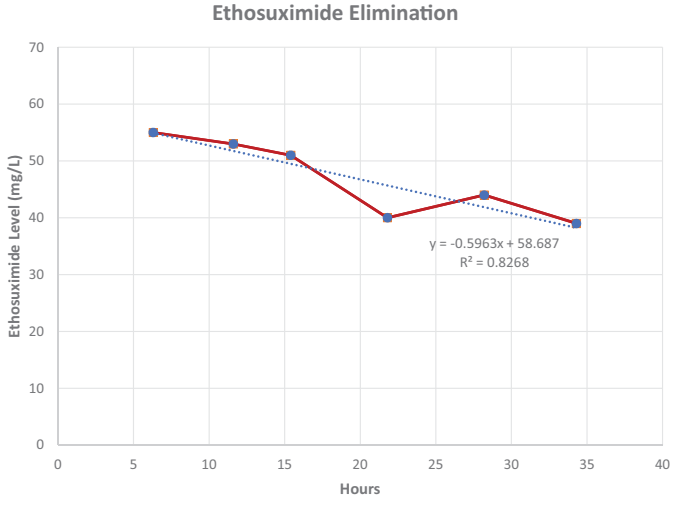

Figure (#137).

KEYWORDS Ethosuximide, Toxicity, Elimination

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138. Timing of embolic phenomena after hydrogen peroxide exposure: a systematic review

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Background: When ingested, hydrogen peroxide (H_2O_2) can cause significant morbidity and mortality due to right- and left-sided air emboli that damage vital organs and/or cause cardiovascular collapse in addition to locally caustic effects. Hyperbaric therapy is a recommended treatment for left-sided symptoms (e.g., stroke, seizure, myocardial infarction (MI)).
Objective: The purpose of this systematic review and meta-analysis was to define the time of onset of embolic phenomena after H_2O_2ingestion using cases described in the literature and reported to US Poison Centers (USPCs) to inform observation and treatment recommendations.
Methods: Literature searches using terms related to $H_2O_2$and embolism were performed in PubMed, EMBASE, CINAHL Complete, Web of Science, Scopus, and Google Scholar from database conception to May 29, 2019. Articles were screened by two independent reviewers based on *a priori* inclusion and exclusion criteria.

Data on each case, including demographics, volume and concentration of exposure, timing of embolic symptom onset, and type(s) of embolic event were extracted from literature cases and previously collected poison center documentation from a previous publication in 2017. Cases were merged if date of publication, demographics, timing, concentration, and embolic phenomena were identical between the PCC report and an independent journal article. Potentially reversible embolic phenomena (altered mental status, stroke, seizures, MI), hemodynamic instability, and gas emboli in either ventricle, pulmonary arteries or coronary arteries were defined as clinical effects of interest (CEOI). Cases with unknown time of onset were excluded from analysis (n = 15). Portal venous gas, GI hemorrhage, and pneumomediastinum were also recorded.

Results: 126 cases were included for analysis: 85 from the database search and 41 from prior USPC reports. There were 211 clinical events, not including death. Death occurred in 17 cases and death cases were included if presenting symptoms involved a CEOI. One late-occurring death was due to a surgical complication, not considered a CEOI. There were 97 CEOIs. Type and number of CEOI, median time of onset with interquartile range and max time of onset were: neurologic 68 (70%), median 0.5 h [IQR =2, max 72]; right ventricle gas/hemodynamic instability 22 (23%), 0 [IQR =1, max 12]; and MI 10 (10%), 0 [IQR =1, max 20]. 6/69 cases where CEOIs documented had symptom onset >/=10 h, all from USPC data set.

Discussion: 90% of embolic phenomena and hemodynamic instability occurred within 10 h. No individual case reports with a verified time of onset were >8 h although several USPC cases were of longer duration. Selection/publication bias in literature cases may skew to earlier time of onset whereas imperfect estimation of timing in USPC cases and protocolized follow up intervals may bias toward later documented times of onset.

Conclusion: Embolic phenomena and hemodynamic instability after H_2O_2ingestion most often manifests within 8h of ingestion. However, delayed symptoms have also been reported in a minority of cases. This information can help poison centers define the risk of development of embolic phenomena over time and can inform reasonable observation guidelines until further evidence emerges.

KEYWORDS Hydrogen Peroxide, Embolism, Observation

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139. Packaging and labeling of methyl salicylate containing essential oils

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Background: Oil of wintergreen has long been recognized for its high methyl salicylate content, which may pose a hazard in exploratory pediatric ingestions. Birch oil presents a similar risk. These products are widely available to consumers for topical use or aromatherapy. The purpose of this study was to assess a convenience sample of both products from multiple vendors with regard to warning labels, declaration of ingredients, presence of child resistant closures, and liquid flow rates.

Methods: Products were purchased from internet sites. Labeling was read by investigators to determine if each product was specifically noted to be "not for internal use" and consumers were warned to keep away from children, then this information was recorded in a spreadsheet. Each product was tested for presence of a child resistant cap. If a flow restrictor was present, the rate of flow per 30 seconds was measured using a timer.

Results: Seventeen products were assessed, 11 wintergreen, and 6 birch oil. The median volume of liquid in the containers was 15 mL (range 5 - 118). The plant common and/or scientific name was stated in all of the product labels. One birch oil product had labeling that mentioned methyl salicylate content, but did not specify the concentration. Among the birch samples 3/6 (50%) had child-resistant closures, and 4/6 (66.6%) warned on the bottle to keep out of reach of children. Only 1/6 had the specific warning, "not for internal use". Five of the 6 birch products had a flow restrictor in place, but in one sample the flow was so rapid (approximately 5 mL/15 seconds that accurate measurement was challenging. In the other 4 birch samples with restrictors, flow rates ranged from 3 to 6 mL/30 seconds.

Among wintergreen oil samples, 6/11 (54.5%) had child resistant closures, and 9/11 (81.8%) warned on the bottle to keep out of reach of children. A specific warning such as "not for internal use" or "for external use only" was present on 4/11 (36.4%) bottles. Flow restrictors were present in 7/11 (63.6%) samples. Flow rates ranged from 3 to 8.75 mL/30 seconds.

Discussion: Essential oils sold for topical use or aromatherapy are not regulated by the US Food and Drug Administration as drugs. Therefore, compliance with labeling and packaging safety standards is largely voluntary.

Conclusions: Salicylate-containing essential oils sold for topical use or aromatherapy may contain warnings to keep away from children and avoid ingestion, but this is not universal. Some are packaged with child resistant closures and/or flow restrictors, but flow rates are variable, potentially allowing a toxic exploratory salicylate ingestion. Consumers might also mix the oils with products in other containers, possibly facilitating access by young children.

KEYWORDS Salicylate, Essential Oils, Product safety

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140. Pennyroyal Exposures Reported to U.S. Poison Centers, 2000-2019

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Background: Pennyroyal oil, obtained from the plant *Menthe pelegium*, has been used as a flea repellant, herbal remedy, and abortifacient. Because the active ingredient pulegone is metabolized by CYP450 enzymes to hepatotoxic metabolites, use as an abortifacient has been associated with liver failure and death. The purpose of this study was to track the incidence of pennyroyal ingestions among pregnant women from 2000 through 2019 and to determine if this was affected by changes in state reproductive law following the 2016 U.S. presidential election.

Methods: The American Association of Poison Control Centers' National Poison Data System (NPDS) was queried for all intentional pennyroyal ingestions among women of childbearing age who were pregnant by history or had a positive pregnancy test from 1/1/00-12/31/19. State reproductive laws were tracked through www.plannedparenthoodaction.org to determine if the case originated in a state that prohibited abortion prior to 20 weeks gestation.

Results: During the study period pennyroyal ingestions were reported to US poison centers by 39 women from 25 states with a median age of 23 years (range 14-36), and median gestational age by history of 7 weeks (range 4-38). Six patients were admitted to an ICU, 7 to a medical floor, 11 were treated and released, and in 15 cases the patient was lost to follow up or left against medical advice. The most frequent medical outcome was minor effect (n = 15). There were 11 patients that were unable to be followed, 4 with moderate effect, 4 who were not followed as minimal effects were expected, 4 with no effect, and one with an unrelated effect. There were no major effects or deaths. Among

the clinical effects, there were no reports of aminotransferases >1000 or >100 IU/L. There were no cases reported in 2015, 2016, 2017, or 2019. The one ingestion in 2018 occurred in a state (Washington) with minimal abortion restrictions.
Discussion: Variations in state reproductive law can disproportionately affect low income women in states with more restrictive laws. Those who cannot afford to travel out of state for a procedure (typically not covered by insurance) can sometimes purchase toxic xenobiotics in attempts to end pregnancies. This intent might not be captured in an NPDS study because desire to terminate pregnancy may not be revealed to practitioners as the reason for the ingestion. Use of pennyroyal as an abortifacient is well known among healthcare professionals due to its association with systemic toxicity, but other xenobiotics have also been used for this purpose.
Conclusions: Pennyroyal exposures reported to U.S. poison centers did not increase after the 2016 election. However, alternative approaches may be more appropriate to detect a rise in abortifacient use. These might include enhanced NPDS studies focused on multiple agents, along with requests for information from case narratives. In addition, the Toxicology Investigators Consortium registry of patients seen at bedside by a medical toxicologist could be used to study this issue prospectively with a targeted questionnaire tailored for practitioners consulting on pregnant women.

KEYWORDS Essential oils, Abortifacient, Pregnancy
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141. Outcomes in Unintentional Exposures to Salicylate and Non-salicylate-containing Essential Oils Reported to U.S Poison Centers

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Background: Essential oils are marketed for topical use or aromatherapy. They are not regulated as drugs so may be regarded by consumers as "natural" and relatively benign, but the degree of toxicity varies between products. The purpose of this study was to compare medical outcomes in unintentional ingestion exposures reported to U.S. poison centers (PCs) between essential oils with and without salicylate content.
Methods: The American Association of Poison Control Centers' (AAPCC) National Poison Data System (NPDS) was queried for cases with unintentional ingestion exposures to liquid formulations of salicylate-containing essential oils (SCEOs), including wintergreen and birch oil from 1/1/00-12/31/19 with a medical outcome of moderate or major effect, or death. All ages were considered, but cases of intentional self-harm were excluded. Cream or ointment formulations were excluded. NPDS was also queried for unintentional ingestion exposures to miscellaneous essential oils (MEOs) and medical outcomes for the two groups were compared using Fisher's exact test.
Results: There were 68 patients in the SCEO group, including 5 birch and 63 wintergreen oil exposures. Median age was 39.5 years (range 1-92); 54% were male. Fifty-five (80.9%) of the SCEO patients were coded as having moderate effects, 12 (17.6%) had major effects, and one died ($p < 0.0001$ compared with MEOs). The most common emergency department (ED) dispositions, when documented, were critical care unit admission (53.7%), followed by non-critical care unit admission (26.9%), and treated/released (14.9%), ($p < 0.0001$ compared with MEOs). Disposition was documented in 67/68 cases.
There were 1878 patients in the MEO group. Median age was 3 years (range 3 days - 99 years); 47.6% were male. Of the 1878 patients, 1788 (95.2%) had moderate effects, 90 (4.8%) had major effects, and there were no deaths. The most common ED disposition, when documented, was treated/released (62.4%), followed by admission to a non-critical care unit (15.8%), and admission to a critical care unit (13.1%); 129 (9.7%) were lost to follow up or left against medical advice, 75 (5.2%) refused referral, and 2 were admitted to behavioral health. In 464/1878 cases, disposition was unknown.
Discussion: This study is limited by the fact that we did not have access to individual case narratives; we did know specific clinical effects observed and treatments provided through NPDS documentation. The determination that a toxic exposure results in mild, moderate, or major effects is made by individual PCs using a formula developed by the AAPCC. An assignment of major suggests potentially life threatening or disfiguring effects, while moderate effects are less dangerous but still require treatment. In some cases information provided to PCs by health care facilities may have been inaccurate, incomplete, or miscoded upon entry into the NPDS database.
Conclusion: Unintentional ingestions of salicylate-containing essential oils are associated with a higher proportion of major effects, and are more likely to be treated in a critical care unit compared with other essential oil products.

KEYWORDS Essential oil, Salicylate, Poison center
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142. Integration of Graduate Medical Students for a Poison Center's COVID-19 Response

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Background: Since January of 2020, the novel coronavirus (COVID-19) has increasingly strained the United States healthcare system. Our poison control center (PCC) has worked closely with State and County Departments of Health Services in previous public health threats, including water contamination, influenza, West Nile Virus and novel opioids. These existing relationships assisted in establishing a COVID-19 hotline for the state. Based on staffing concerns and predicted surge in call volume, we established a COVID-19 rotation for GME students at our PCC. This rotation fulfilled graduate medical education (GME; medical school students, interns and residents) requirements for medical students and residents removed from clinical rotations due to COVID-19 restrictions.
Method: Our PCC notified our regional College of Medicine and host facility's GME Departments about the PCC COVID-19 rotation for students and residents to do a non-patient contact clinical rotation at the PCC. This modified rotation consisted of an introductory lecture to COVID-19 on pathophysiology, testing strategies, treatments (including real-time research), and public health/epidemiology guidance and recommendations. We then provided an orientation to the PCC and its electronic records system, including how to record cases into our database. Rotators were asked to work three, 4-hour shifts per week for the duration of their rotation block. A schedule was placed on a shared computer drive for students to sign up for shifts. The PCC Educator would perform a two hour orientation shift on the phones with each group of new rotators to ensure competency. Email updates were regularly provided to ensure rotators were kept current with new and revised Health Department responses and mandates.

Results: The first rotation started on April 3, 2020, with eight rotators. In total, there has been five rotation blocks, of three to four week's duration, with rotators assisting PCC staff with COVID-19 calls. From April 3, 2020 through May 18, 2020, a total of 33 rotators have provided over 800 hours of staffing and answered over 2,200 of the nearly 15,000 COVID-19-related calls the center has managed. The PCC also had a press release about the program, and local media interviewed several rotators with one stating: "It's very humbling to know that we're entering residency in the middle of this international crisis that no one has ever seen before. … I'm excited to be able to learn."
Conclusions: Emergency preparedness planning for PCCs requires nimble staffing solutions for surge capacity. Poison centers should establish relationships with graduate medical education (i.e. nursing, pharmacy, medical) programs to help increase potential staffing resources. Other resource pools include emergency (pre-hospital) medical services and undergraduate students.

KEYWORDS coronavirus, public health, poison control denter

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143. Increase in Centruroides Sculpturatus Envenomations During a State's Pandemic Response

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Background: Envenomations by *Centruroides sculpturatus* (bark scorpion) represent the single largest exposure category for our state's Poison and Drug Information System (PDIS). Since 2011, the PDIS has seen a steady decline of about 7% in the annual reporting of scorpion envenomations. Interestingly, the state's population has shown a consistent increase since 2011, adding on average 76,537 residents each year.
Methods: On January 26, 2020, the state's Department of Health Services (DHS) reported an index patient diagnosed with the novel coronavirus (SARS-CoV-2) or COVID-19. Throughout the next several weeks and months the state's governor and department of public health officials imposed various restrictions to limit the spread of the virus among the state's population. Included in these measures were school and non-essential business closures, cancellation of elective surgical procedures, and a shelter in place order. The net effect from these orders was an increase of time spent by people in their homes. Through a review of the PDIS's shared electronic medical record (EMR) system, a significant increase in scorpion envenomations was observed during this time frame compared to the previous year.
Results: On March 11, 2020 the governor announced a Declaration of Emergency for the state. On March 31, 2020 a stay at home order was issued along with many additional social distancing initiatives, which then expired on May 15, 2020. During the period of March 11 through May 15, 2020 the PDIS had a 21% increase in scorpion envenomations compared to the same time frame during the previous year.
Conclusion: During social distancing and state mandated shelter in place orders, there was an increased risk for unintentional scorpion envenomations. Poison Centers have a responsibility to provide education and awareness to the community regarding safety practices in the home which can reduce the risk of unintentional envenomations and other poisonings.

KEYWORDS envenomation, centruroides, coronavirus

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144. A Case Report of an Unintentional Infant Exposure to Xylazine

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Background: Xylazine is a non-narcotic drug used extensively in veterinary practice for sedation, analgesia, or general anesthesia. Structurally, it resembles phenothiazines and tricyclic antidepressants. Pharmacologically, it's similar to clonidine and thus a potent partial agonist of peripheral and central pre-synaptic alpha-2 receptors resulting in decreased sympathetic outflow. This typically leads to bradycardia, hypotension, sedation, and respiratory depression. We describe the clinical course during an unintentional ingestion of xylazine in a 10-week old patient.
Case Discussion: A 4.4kg, 10-week old female was brought to an emergency department by her mother after suddenly becoming unresponsive on their car ride home. The patient's mom had denied taking any medications and had not breastfed the child that day. Pertinent past medical history included a non-specific apneic episode (Apgar scores of 5 and 6 at 1 and 5 minutes, respectively) at birth that resulted in a 3-day, and otherwise unremarkable neonatal intensive care unit admission. On arrival to the emergency department she was noted to be minimally responsive with miosis but did awaken to tactile stimulation. Her vitals on presentation were: pulse 108, blood pressure 89/45, respiratory rate 20 and oxygen saturation of 100% on high-flow nasal cannula, tympanic temperature of 36.5 Celsius, Glasgow coma scale 13, and blood glucose of 97 mg/dL. Intravenous access was established and 0.02mg naloxone was administered without any noticeable improvement. Upon further questioning, the mom had reported that the patient had become symptomatic while on the car ride returning home from where a veterinarian was euthanizing their pet horse. An unremarkable urine drug screen and ethanol level prompted the order of a qualitative gas chromatography, mass spectrometry comprehensive (GC/MS) urine drug screen. Meanwhile, the patient was admitted to the pediatric intensive care unit for overnight observation. She had persistent drowsiness overnight but all vitals remained within normal limits. She remained arousable and maintained a patent airway throughout her hospitalization. Cranial computer tomography revealed no pathology and long-term video electroencephalography was conducted out of concern for non-convulsive status epilepticus. This was also unremarkable. Her urine GC/MS resulted approximately 12 hours after arrival to the emergency department and demonstrated the presence of xylazine. The mother was questioned again where it was determined that this medication was used to euthanizing process. The mother reported that she had assisted the veterinarian by drawing up several syringes with xylazine and storing them in a cup the child would later use to drink from resulting in the exposure. By the following morning the patient had returned to her baseline mental status with just supportive measures and cardiac monitoring and was discharged to home shortly thereafter without any further sequelae.
Conclusion: We report the clinical course and management of an unintentional infant exposure to xylazine that resulted in sedation which resolved with supportive measures and direct observation in a pediatric intensive care unit.

KEYWORDS pediatric, xylazine, unintentional

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145. Vaccine adverse events among older adults in the United States

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Background: The Vaccine Adverse Events Reporting System (VAERS) is a post-marketing surveillance program in the United States (US) that receives reports of adverse events following vaccination. Established in 1990, VAERS is co-administered by the Food and Drug Administration (FDA) and the Centers for Disease Control and Prevention (CDC). Anyone can report an adverse event to VAERS, including healthcare professionals, vaccine manufacturers, and laypersons. The number of older adults in the US is increasing. The Advisory Committee on Immunization Practices (ACIP) of the CDC recommends certain vaccinations for those 65 years and older. This study describes the pattern of vaccine adverse events reported among older adults.
Methods: Cases were all vaccine adverse events among older adults (age 65 years and older) where the vaccination occurred during 1991-2018 that were reported to VAERS. The distribution of cases was determined for selected variables.
Results: A total of 71,880 vaccine adverse events among older adults were identified. The breakdown by age groups were 41.1% 65-69 years, 26.4% 70-74 years, 16.7% 75-79 years, 9.5% 80-84 years, 4.5% 85-89 years, and 1.8% 90 years and older. Women accounted for 69.8% of the cases. Influenza vaccines accounted for 44.4% of the cases, pneumococcal vaccines for 38.4%, and herpes zoster vaccines for 25.7%. The number of adverse events for all vaccines increased from 351 in 1991 to 11,325 in 2018. The number of influenza vaccine adverse events increased from 260 in 1991 to 2,975 in 2018. The number of pneumococcal vaccine adverse events increased from 67 in 1991 to 3,097 in 2018. The number of herpes zoster vaccine adverse events increased from 184 in 2006 to 1,786 in 2012 then declined to 592 in 2017 before increasing to 6,425 in 2018. September-November accounted for 55.5% of the cases. States with the largest proportion of cases were California (7.7%), Florida (6.1%), Pennsylvania (5.0%), and New York (4.9%). The most commonly reported symptom categories were injection site erythema (19.0%), injection site pain (15.2%), erythema (13.6%), pain (13.5%), injection site swelling (13.1%), pyrexia (12.5%), pain in extremity (11.2%), chills (8.5%), injection site warmth (7.7%), headache (7.2%), rash (7.1), and pruritus (7.0%). An emergency department or doctor visit was reported in 73.3% of the cases. The case was classified as serious in 7.4% (5,338) of the cases; these included 5.4% (3,871) who were hospitalized and 0.9% (635) deaths.
Conclusions: The number of vaccine adverse events among older adults decreased with increasing age and most often involved women. The number of cases increased during 1991-2018, and the majority occurred during September-November. While the majority of cases involved an emergency department or doctor visit, relatively few were considered serious, although 5.4% were hospitalized and fatalities occurred in 0.9%. Note that a report to VAERS only confirms that the reported adverse event occurred sometime after the vaccine was given, and does not prove that the identified vaccine(s) caused the adverse event described. No proof that the event was caused by the vaccine is required in order for VAERS to accept the report.

KEYWORDS vaccines, geriatrics, adverse reactions

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146. Outcomes and symptoms associated with occupational cleaning product exposures reported to the National Poison Data System from 2000-2016

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Background: Occupational injuries result in a large economic burden from losses in wages, productivity and medical expenses. Annually, there are approximately 2.8 million nonfatal workplace injuries and illnesses reported by private industry employers as reported by the U.S. Bureau of Labor Statistics. There are almost 18,000 estimated exposures to harmful substances resulting in a median of three days away from work. A large percentage of these exposures are due to chemicals commonly found in cleaning products. This study describes the occupational exposures to cleaning products reported to the National Poison Data System (NPDS).
Methods: The NPDS was queried for all adult unintentional occupational cleaning product exposures reported to the American Association of Poison Control Centers between January 1, 2000 and October 1, 2016. Excluded cases were those with outcomes that were unrelated, confirmed non-exposures and those without a known outcome. Evaluable cases were consolidated into 16 cleaning product categories: acids, alcohols/glycols, alkalis, ammonia, chlorine containing products (CCP), borates, cationic detergents, hydrofluoric acid, laundry detergents, multiple products that included CCP, multiple products that did not include CCP, other, phenol, pine oil, soaps, unknown. The outcomes and symptoms for each category were characterized.
Results: There were 50,408 adult unintentional occupational cases identified during the study period. Of these, 32,521 were followed to a known outcome. The average age was 34.7, 51.3% of the patients were male and 97.2% of cases were acute exposures.
There were multiple routes of exposure for many cases with the four most common routes being ocular (n = 14,067), followed by inhalation (n = 9,750), then dermal (n = 8,391), and ingestion (n = 3,778).
The most common substances patients were exposed to were CCP (n = 8,553), alkalis (n = 6,409) or multiple products that included bleach (n = 3,332). The majority of cases resulted in either minor (n = 21,942) or no effects (n = 1,709). There were 8,620 cases with moderate effects, 244 with major effects and 6 deaths. Five of the six deaths were associated with CCP. Table 1 shows the number of cases by category and their associated outcomes.
The most common symptoms were: ocular irritation and pain (n = 13,717), red eyes and conjunctivitis (n = 5,350), dermal irritation (n = 4,681), coughing and choking (n = 4,303), other (n = 3,465), throat irritation (n = 3,116), dyspnea (n = 2,628), erythema and flushed skin (n = 2,922), superficial burn (n = 2,286), nausea (n = 1,663), headache (n = 1,436), second or third degree burn (n = 1,597), vomiting (n = 1,380), dizziness/vertigo (n = 1,232), lacrimation (n = 1,385), blurred vision (n = 1,415), corneal abrasion (n = 1,378), chest pain including non-cardiac (n = 1,019), edema (n = 982), bronchospasm (n = 643), ocular burns (n = 855), oral irritation (n = 646). Table 2 describes the symptoms by product category.

Table 1(#146). NUMBER OF CASES BY CATEGORY AND OUTCOMES.

CATEGORY	ACID	ALCOHOL/ GLYCOL	ALKALI	AMMONIA	BLEACH	BORATE	CATIONIC	HF	LAUNDRY	MULTI W/ BLEACH	MULTI	OTHER	PHENOL	PINE OIL	SOAP	UNKNOWN
CASES	2544	847	6409	352	8553	36	1528	341	289	3332	1748	4	399	212	1330	4597
OUTCOME (CASES/%)																
NO EFFECT	141/5.5	75/8.9	229/3.6	29/8.2	376/4.4	4/11.1	86/5.6	8/2.3	11/3.8	189/5.7	147/8.4	0/0	27/6.8	24/11.3	93/7.0	270/5.9
MINOR	1680/66.0	640/75.6	3787/59.1	250/71.0	6249/73.1	28/77.8	1076/70.4	200/58.7	200/69.2	2063/61.9	1053/60.2	4/100	283/70.9	156/73.6	993/74.7	3280/71.4
MODERATE	709/27.9	129/15.2	2303/35.9	70/19.9	1894/22.1	4/11.1	351/23.0	130/38.1	77/26.7	1042/31.3	522/29.9	0/0	85/21.3	32/15.1	241/18.1	1031/22.4
MAJOR	14/0.6	2/0.2	90/1.4	3/0.9	32/0.4	0/0	15/1.0	3/0.9	1/0.3	35/1.1	26/1.5	0/0	4/1.0	0/0	3/0.2	16/0.3
DEATH	0/0	1/0.1	0/0	0/0	2/0	0/0	0/0	0/0	0/0	3/0	0/0	0/0	0/0	0/0	0/0	0/0

Table 2(#146). COMMON SYMPTOMS BY CATEGORY.

CATEGORY	ACID	ALCOHOL/ GLYCOL	ALKALI	AMMONIA	BLEACH	BORATE	CATIONIC	HF	LAUNDRY	MULTI W/ BLEACH	MULTI	OTHER	PHENOL	PINE OIL	SOAP	UNKNOWN
SYMPTOM (CASES/%)																
OCULAR IRRITATION/PAIN	1141/45	454/54	2636/41	167/47	4237/50	15/42	899/59	59/17	98/34	438/13	363/21	1/25	198/50	78/37	691/52	2242/49
RED EYE/CONJUNCTIVITS	424/17	160/19	1109/17	52/15	1655/19	7/19	353/23	19/6	35/12	136/4	162/9	0/0	66/17	31/15	249/19	892/19
DERMAL IRRITATION	469/18	78/9	1525/24	25/7	740/9	0/0	195/13	216/63	31/11	255/8	288/16	0/0	77/19	20/9	134/10	628/14
COUGHING/CHOKING	261/10	38/4	362/6	50/14	1328/16	5/14	44/3	7/2	28/10	1423/43	353/20	0/0	17/4	19/9	77/6	291/6
OTHER	211/8	70/8	478/7	28/8	1011/12	10/28	70/5	38/11	33/11	688/21	259/15	0/0	33/8	29/14	105/8	402/9
THROAT IRRITATION	161/6	50/6	401/6	41/12	1022/12	5/14	85/6	11/3	22/8	647/19	198/11	1/25	25/6	30/14	105/8	312/7
DYSPNEA	180/7	30/4	242/4	25/7	742/9	0/0	27/2	5/1	24/8	804/24	249/14	0/0	14/4	7/3	41/3	238/5
DERMAL ERYTHEMA/FLUSHED	274/11	46/5	1002/16	17/5	458/5	0/0	139/9	91/27	19/7	157/5	190/11	1/25	48/12	11/5	76/6	393/9
DERMAL SUPERFICIAL BURN	218/9	18/2	1060/17	11/3	242/3	0/0	83/5	54/16	12/4	110/3	132/8	0/0	31/8	3/1	53/4	259/6
NAUSEA	84/3	44/5	208/3	20/6	489/6	1/3	31/2	1/0	37/13	268/8	170/10	1/25	13/3	30/14	59/4	207/5
HEADACHE	51/2	46/5	162/3	11/3	362/4	1/3	22/1	3/1	42/15	327/10	161/9	1/25	18/5	14/7	51/4	164/4
DERMAL BURN 2ND OR 3RD DEGREE	166/7	19/2	814/13	1/0	155/2	0/0	42/3	28/8	5/2	77/2	88/5	0/0	14/4	1/0	19/1	168/4
VOMITING	56/2	43/5	166/3	16/5	444/5	0/0	28/2	4/1	19/7	218/7	118/7	1/25	7/2	20/9	81/6	159/3
VERTIGO/DIZZINESS	58/2	48/6	133/2	13/4	284/3	3/8	12/1	7/2	45/16	257/8	161/9	0/0	13/3	3/1	30/2	165/4
LACRIMATION	121/5	21/2	251/4	14/4	464/5	1/3	84/5	8/2	6/2	88/3	60/3	0/0	14/4	8/4	59/4	186/4
BLURRED VISION	81/3	43/5	313/5	11/3	453/5	5/14	80/5	10/3	8/3	48/1	46/3	0/0	21/5	7/3	69/5	220/5
CORNEAL ABRASION	130/5	29/3	373/6	16/5	308/4	0/0	131/9	8/2	9/3	25/1	36/2	0/0	19/5	9/4	81/6	204/4
CHEST PAIN (INCL NON-CARDIAC)	57/2	12/1	124/2	11/3	304/4	1/3	10/1	7/2	10/3	257/8	92/5	0/0	11/3	7/3	13/1	103/2
EDEMA	80/3	18/2	267/4	9/3	210/2	2/6	42/3	44/13	2/1	65/2	60/3	0/0	12/3	4/2	36/3	131/3
BRONCHOSPASM	42/2	10/1	41/1	1/0	162/2	2/6	11/1	2/1	5/2	229/7	74/4	0/0	3/1	1/0	9/1	51/1
OCULAR BURNS	72/3	8/1	303/5	11/3	207/2	0/0	61/4	5/1	4/1	25/1	22/1	0/0	11/3	6/3	19/1	101/2
ORAL IRRITATION	48/2	13/2	121/2	10/3	187/2	1/3	35/2	6/2	7/2	49/1	30/2	0/0	7/2	10/5	30/2	92/2

Conclusion: The majority of cases resulted in either minor or no effects.
Chlorine containing product exposures were the most common occupational cases and had the most severe outcomes; five of the six deaths.
Employee exposures should use the Hierarchy of controls prevent unnecessary occupational exposures and mitigate the economic impact and the harmful effects from occupational exposures to cleaning products.

KEYWORDS Cleaning product, Occupational exposure, Chlorine containing

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147. Comparative Toxicity and Effects of Milnacipran vs. Levomilnacipran Utilizing Data Reported to the National Poison Data System

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Background: Milnacipran (MLN), brand name Savella, is a serotonin-norepinephrine reuptake inhibitor (SNRI) approved by the U.S. Food and Drug Administration (FDA) for the treatment of fibromyalgia in 2009. Toxicity is characterized by somnolence, nausea, vomiting, tachycardia, hypertension, and seizures.
Levomilnacipran (LMN), brand name Fetzima, is the L-enantiomer of MLN, approved by the FDA for major depressive disorder in 2013. Overdose data is limited; clinical effects are characterized as benign and fatalities have not been reported.
We were not able to identify any comparative studies between MLN and LMN. The objective of this study is to compare both drug's clinical effects and medical outcomes of exposures reported to the National Poison Data System (NPDS).
Methods: A retrospective cohort study was conducted analyzing data from the NPDS for single agent exposures (MLN vs LMN) reported to the American Association of Poison Control Centers (AAPCC) from August 2013 through December 2018. Excluded cases were those with multiple drug ingestions, non-ingestion route, outcomes that were unrelated, confirmed non-exposures, and no follow-up. Outcomes and symptoms were compared. Chi-square or Fisher exact test, relative risk and 95% confidence intervals were calculated between MLN and LMN for case outcomes as defined by AAPCC criteria, combined outcomes deemed mild that included no or minor effects, combined outcomes deemed severe that included moderate or major effects and death, and the most commonly reported symptoms.
Results: There were 91 MLN and 161 LMN cases that met inclusion criteria. The majority of patients were female, 69.2% for MLN and 70.2% for LMN. MLN age ranged from 13 months to 84 years old, median age being 11 years old. LMN age ranged from 11 months to 89 years old, median age being 25 years old.

Table 1(#147). MLN vs. LMN Outcomes.

	MLN n = 91	LMN n = 161	p-value	RR (95% CI)
Mild Outcome	73	135	0.5732	0.957 (0.847, 1.081)
No effect	45	87	0.5692	0.915 (0.711, 1.177)
Minor	28	48	0.9831	1.032 (0.875, 1.523)
Severe Outcome	18	26	0.5732	1.225 (0.712, 2.108)
Moderate	17	26	0.7278	1.157 (0.665, 2.015)
Major	1	0	>0.9999999	3.560 (0.121, 105.075)
Death	0	0	>0.9999999	1.761 (0.035, 87.950)

Table 2(#147). MLN vs. LMN Symptom Comparisons (>2% Incidence).

S/sx	MLN n (%)	LMN n (%)	p-value	RR (95% CI)
Abdominal Pain	2 (2.20)	3 (1.86)	>0.9999999	1.180 (0.201, 6.930)
Agitated/irritable	7 (7.69)	15 (9.32)	0.8506	0.826 (0.350, 1.950)
Conduction disturbance	2 (2.20)	3 (1.86)	>0.9999999	1.180 (0.201, 6.930)
Confusion	2 (2.20)	5 (3.11)	>0.9999999	0.708 (0.140, 3.574)
Diaphoresis	4 (4.40)	6 (3.73)	>0.9999999	1.180 (0.342, 4.070)
Dizziness/vertigo	2 (2.20)	12 (7.45)	0.1323	0.295 (0.068, 1.289)
Drowsiness/lethargy	10 (10.99)	11 (6.83)	0.3615	1.609 (0.711, 3.640)
Electrolyte abnormality	2 (2.20)	2 (1.24)	0.914	1.769 (0.254, 12.347)
Erythema/flushed	2 (2.20)	2 (1.24)	0.914	1.769 (0.254, 12.347)
Headache	3 (3.30)	6 (3.73)	>0.9999999	0.885 (0.227, 3.453)
Hypertension	9 (9.89)	11 (6.83)	0.5284	1.448 (0.623, 3.361)
Nausea	8 (8.79)	8 (4.97)	0.3527	1.769 (0.687, 4.554)
Other	7 (7.69)	17 (10.56)	0.6119	0.728 (0.314, 1.691)
Slurred speech	2 (2.20)	0 (0.00)	0.8294	7.123 (0.325, 156.201)
Tachycardia	11 (12.09)	25 (15.53)	0.5805	0.778 (0.402, 1.507)
Tremor	3 (3.30)	5 (3.11)	>0.9999999	1.062 (0.260, 4.338)
Vomiting	19 (20.88)	7 (4.35)	0.0001178	4.803 (2.100, 10.985)

Of the 91 MLN cases, 73 cases resulted in no/minor effects. There were 17 cases with a moderate outcome, one major effect outcome and no deaths. The most common symptoms were: vomiting, tachycardia, drowsiness/lethargy.

Of the 161 LMN cases included in our study, 135 cases resulted in no/minor outcomes. There were 26 moderate outcomes and no major effects or deaths. The most common symptoms were: tachycardia, agitation/irritability, dizziness/vertigo.

Outcome data is shown in Table 1. There were no significant differences between MLN vs LMN.

The most commonly reported symptoms (>2% incidence) are compared in Table 2.

In the MLN patients, there was significantly greater risk of developing vomiting (RR =4.8, 95% CI =2.09-10.99)

Conclusion: In this comparison of single agent ingestions of MLN and LMN, MLN had a greater risk of developing vomiting. Both medications are relatively safe, rarely resulting in serious effects. MLN and LMN may be safer alternatives to other SNRIs. There were no documented seizures or deaths in the cases evaluated in this study.

KEYWORDS Milnacipran, Levomilnacipran, Comparative toxicity

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148. Characterizing Pediatric Clonidine and Guanfacine Unintentional Therapeutic Errors

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Background: US poison control centers have experienced an increased incidence of calls regarding pediatric clonidine and guanfacine exposures. Severe and life-threatening symptoms such as bradycardia, hypotension, respiratory depression, and death have been noted in single-dose ingestions by observational studies. Therapeutic errors are often above current referral thresholds which are based on studies including naïve patients. We aim to characterize acute unintentional pediatric therapeutic errors for clonidine and guanfacine to better understand outcomes of overdose in patients chronically taking alpha-2 agonists.

Table 1(#148). Medical Outcome by Drug.

Medical Outcome	Clonidine N (%)	Guanfacine N (%)	Total N (%)
No effect	52 (44.8)	58 (63.7)	110 (53.1)
Minor effect	46 (39.7)	20 (22.0)	66 (31.9)
Moderate effect	18 (15.5)	13 (14.3)	31 (15.0)
Total	116 (100.0)	91 (100.0)	207 (100.0)

Table 2(#148). Medical Outcome by Dosing Scenario.

Medical Outcome	Double Dose N (%)	Other Scenarios N (%)	Total N (%)
No effect	83 (62.9)	27 (36.0)	110 (53.1)
Minor effect	32 (24.2)	34 (45.3)	66 (31.9)
Moderate effect	17 (12.9)	14 (18.7)	31 (15.0)
Total	132 (100.0)	75 (100)	207 (100.0)

Methods: This is a retrospective descriptive study of single substance unintentional therapeutic errors of clonidine or guanfacine in children ages 6-17 years old reported to a regional poison center from 2008-2018. Cases with an unknown outcome were excluded. Data was cross-tabulated for analysis.

Results: There were a total of 207 clonidine and guanfacine unintentional therapeutic errors in children 6-17 years old reported to the regional poison center (clonidine: 116 (56.0%), guanfacine: 91 (44.0%)). The majority of exposures occurred in males (76.8%) and in children 6-12 years old (82.6%). More clonidine exposures were managed at home than guanfacine (57.8% versus 50.5%). Few exposures were admitted to a non-critical care or a critical care unit (4.3% versus 0.5% respectively). The majority of errors resulted in either no or minor medical outcomes with no major effects or deaths reported (Table 1). More patients were given a double dose (132, 63.8%) compared to other therapeutic errors (75, 36.2%). A greater proportion of double doses experienced no medical outcomes and minor effects compared to other therapeutic errors (Table 2). Bradycardia in the double-dose group occurred in nine patients (6.8%) versus eleven patients (14.7%) in the other therapeutic errors. Similarly, hypotension occurred in twelve patients (9.1%) in the double-dose group compared to ten patients (13.3%) in the other therapeutic errors. Clinical effects occurring in >1% of the entire study population include: drowsiness (82, 39.6%), hypotension (22, 10.6%), bradycardia (20, 9.7%), dizziness (7, 3.4%), pallor (4, 1.9%), nausea (4, 1.9%), and miscellaneous (4, 1.9%). Respiratory depression was reported in one case only with guanfacine (0.5%). The most common therapies provided were IV fluids (16, 7.7%), atropine (2, 1.0%), naloxone (2, 1.0%), and activated charcoal (1, 0.5%). IV fluids were more commonly performed in clonidine (13, 11.2%) than in guanfacine (3, 3.3%). Atropine was performed in clonidine only (2, 1.7%).

Conclusion: Clinical effects in an acute unintentional therapeutic error of clonidine and guanfacine are similar to the expected adverse effects in therapeutic use. Though evaluation at a health care facility is common, admittance to non-critical and critical care units is rare. Bradycardia and hypotension are reported in about 10% of cases of therapeutic errors. Our data indicates even a double dose of an alpha-2 agonist may result in hypotension or bradycardia. Further research is required to determine an appropriate referral dose for therapeutic errors.

KEYWORDS Therapeutic Error, Clonidine, Guanfacine

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149. A Formula for Disaster? Inadvertent Ivermectin Ingestion in an Infant

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Background: Ivermectin is an anthelmintic agent used both in human and veterinary medicine. Ivermectin binds with high affinity to glutamate-gated chloride channels and activates them in invertebrates, resulting in parasite death. It is also an indirect GABA agonist, and a direct inhibitory glycine channel agonist. In therapeutic doses used for humans, ivermectin does not penetrate the CNS well due to p-glycoprotein drug pump (MDR1) activity. Genetic polymorphisms in these p-glycoprotein receptors can result in increased CNS penetration, as well as overdoses saturating these receptors, resulting in neurotoxicity. We present a case of a large confirmed ingestion resulting in minor symptoms only.
Case Report: A 7 month-old girl weighing 8.64 kilograms presented to a critical access hospital after ingesting a bottle of formula that was inadvertently mixed with 4.5 ounces bovine ivermectin 1% injectable solution. The ivermectin solution was diluted 1:10 with water for an estimated dose of 13.9 mg/kg. Ingestion had occurred 1 hour prior to the first call to the Poison Center. She was awake and alert with presenting vitals of pulse 142, blood pressure 109/79 and pulse oximetry 100% on room air. In the emergency department she had a total of 5 episodes of vomiting and received a dose of ondansetron. The patient's mother noted the child's emesis smelled like the product. The patient was transferred to a higher level of care for overnight admission. She remained neurologically intact, hemodynamically stable and was discharged home the following morning without additional interventions.
Discussion: Pediatric doses for treatment of onchocerciasis and strongyloidiasis range from 150-200 mcg/kg orally as a one-time dose for patients weighing greater than 15 kilograms. The lowest dose associated with severe toxicity in the literature was in a 16 month-old child who developed vomiting, tachycardia, drowsiness and hypotension after an estimated ingestion of 6.7-8.7 mg/kg. The exact dose that is toxic to humans, adult or child, is not known. Several factors may influence toxicity: absorption is increased when ingested with milk due to its high lipid solubility. Genetic variability in the MDR1 protein, a permeability-glycoprotein that is responsible for active excretion of many intracellular substances, may also predispose people to greater toxicity. Additional drug-drug interactions may also lead to toxicity across a broad array of systems including coagulopathy and hepatic injury, though the mechanism and prevalence of these interactions is unclear. In the case of our patient rapid onset of emesis may have limited systemic absorption. This may explain why our patient did not suffer significant neurological effects unlike other cases reported in the literature.
Conclusion: The dosing range where pediatric patients are at increased risk of systemic ivermectin toxicity is unclear. The error leading to a significantly higher than therapeutic dose of ivermectin ingested by this infant resulted in only minor gastrointestinal symptoms despite the possibility of neurotoxicity with large doses. It is likely prudent to monitor patients with large ingestions of ivermectin for development of neurotoxicity until a true toxic dose can be determined.

KEYWORDS ivermectin, pediatric, infant

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150. Silica Gel Products: Not Always Benign

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Background: Silica gel packets, are common devices used as desiccants for many medication products. Until recently, silica gel has ubiquitously been packaged in paper or cloth packets that have posed a simple choking hazard in young children. However, medical device manufacturers have developed a new cylindrical canister that serves as housing for the silica gel desiccant to be stored with medications (Image 1). These new cylindrical desiccant containers may pose an increased risk for esophageal obstruction.
Case Report: A 70-year-old male with a past medical history of chronic dysphagia, Barrett's esophagus, and lower esophageal sphincterotomy presented to an urban community emergency department (ED) complaining of sub-sternal chest pain, foreign body sensation in esophagus, and difficulty swallowing after taking his multiple morning oral medications. The patient responded well pharmacologically and the work up for chest and epigastric pain were determined to be negative. He was set to be discharged and managed as an outpatient. During discharge a per oral (PO) challenge was administered. Upon this PO challenge he reported that he was again unable to swallow PO liquids and a return of the feeling of "a knot in my esophagus." The discharge was halted, and a non-contrast computed tomography (CT) of the chest was ordered to evaluate the esophagus for stricture or foreign body. The CT results showed a 15mm foreign body within the gastro-esophageal (GE) junction/lower esophageal sphincter (Image 2). The ED care team again attempted to mechanically and pharmacologically dislodge the distal foreign body which was unsuccessful. The patient was admitted to the hospitalist service with a gastroenterology consultation for urgent esophagogastroduodenoscopy (EGD). The EGD was initially performed under procedural sedation but the endoscopist was also unable to advance the foreign body through the GE junction with the endoscope alone. The endoscopist then proceeded to have the patient endotracheally intubated, placed under deep sedation, and performed a second EGD attempt to remove the foreign body via a "Roth" net which was successful. The foreign body after successful removal was determined to be a cylindrical silica gel cannister measuring 11.5 mm. This patient had a history of a known high-grade esophageal stricture increasing the risk of esophageal foreign body obstruction.
Case Discussion: Patients frequently are required to take many medications daily; it should not be surprising that one could inadvertently ingest one of these desiccant canisters that may be the same color and shape of medications themselves, especially if the patient is older with decreased visual acuity. The desiccant canisters' non-malleable design in comparison to traditional desiccant packets also increases the risk of obstruction and subsequent complications that may increase morbidity in older at-risk populations. Through review of the literature it appears that these desiccant canisters were designed with a focus on improving production efficiency not patient safety.**Conclusion:** Cylindrical desiccant canisters pose an increased risk of choking and esophageal obstruction in patients with high risk of esophageal obstruction.

KEYWORDS Silica gel, Esophageal obstruction, Desiccant

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Image 1(#150). (Left) Image of traditional desiccant package. (Right) Image of new desiccant cylindrical canister for medications.

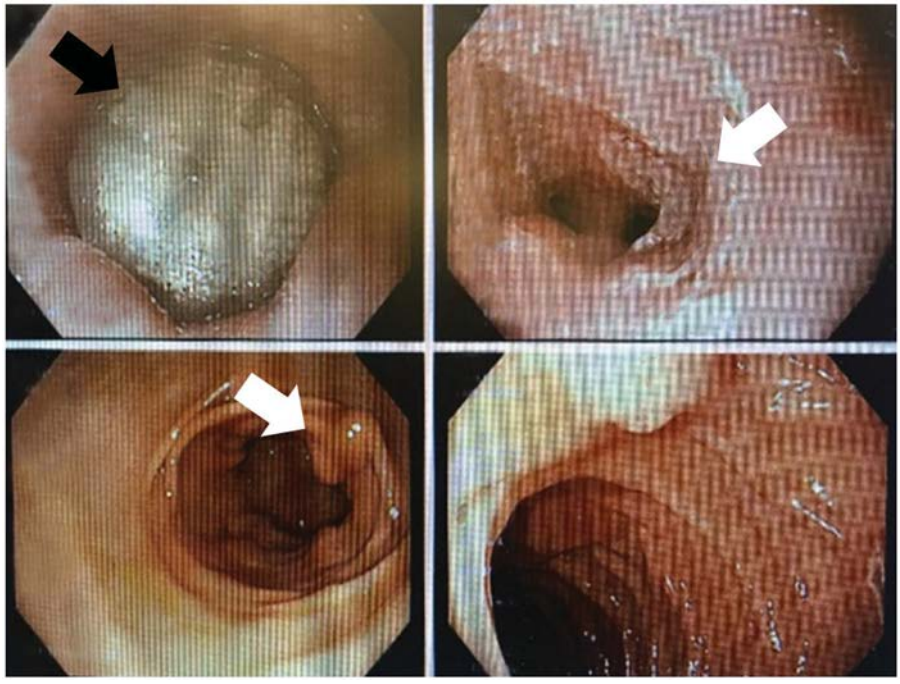

Image 2(#150). Image of this patient's EGD with the foreign body in sight at the GE junction displaying the esophageal strictures (white arrows) as well as the trapped desiccant canister (black arrow).

151. Life Threatening Tachydysrhythmia Due to Chronic Theophylline Toxicity Successfully Managed with Amiodarone

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Background: Theophylline is rarely encountered in the management of reactive airway disease due to its narrow therapeutic window and adverse effects. Cardiac dysrhythmias, most frequently supraventricular tachycardias are common in theophylline toxicity. Given its limited use, theophylline toxicity is seldom considered in the differential for life-threatening tachycardia. We describe a case of life-threatening tachydysrhythmia due to theophylline toxicity that was successfully managed with amiodarone.

Case Report: This is a single patient chart review. A 78-year-old man with chronic obstructive pulmonary disease on theophylline (400mg extended release daily) presented to the emergency department with altered mental status and tachypnea. His heart rate was 169 beats per minute and electrocardiogram showed sinus tachycardia. Labs were notable for the following: potassium 2.5 mmol/L, creatinine 1.7 mmol/L (baseline 0.8 mmol/L), troponin 2.4 ng/mL, lactate 4.2 mmol/L. He was intubated for hypercarbic respiratory failure. In the ICU, he developed new onset atrial fibrillation associated with hypotension. Theophylline toxicity was not considered as an etiology. He was started on amiodarone and norepinephrine infusions, with improvement in his heart rate to 120 beats per minute and normalization of blood pressure. The following day, he converted to normal sinus rhythm, his heart rate improved, and the norepinephrine was discontinued. He was continued on amiodarone for rhythm control. A theophylline level, sent at presentation, resulted two days later at >40 ug/mL.

Discussion: Theophylline enhances atrial automaticity and intracardiac conduction, increasing the occurrence of atrial fibrillation and other supraventricular tachydysrhythmias. Traditional management of theophylline toxicity includes the use of beta-adrenergic receptor antagonists to improve cardiac output. Amiodarone, a class III antiarrhythmic with beta-adrenergic receptor antagonist properties, likely provided rate control, prolonging diastole and increasing stroke volume.
Conclusion: Theophylline toxicity is rare and can result in tachycardia-induced cardiovascular collapse. Amiodarone may be useful in managing life-threatening theophylline associated tachydysrhythmias.

KEYWORDS Theophylline, Amiodarone, Cardiotoxicity

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152. Pediatric vortioxetine exposures reported to the national poison data system, 2013 - 2019

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Background: Antidepressants are among the most commonly-used drug classes in the United States. Vortioxetine is a novel multimodal antidepressant approved in the United States in 2013 for the treatment of major depressive disorder in adults that is an antagonist at the 5HT3, 5HT7, and 5HTD1 receptors, a partial agonist at the 5HT1B receptor, an agonist at the 5HT1A receptor, and an inhibitor of the 5HT transporter. Recent studies demonstrate its safety and efficacy in children and adolescents at doses similar to those used in adults. Limited information exists regarding toxicity from vortioxetine exposures. To date, the epidemiology and toxicity of pediatric vortioxetine exposures has not been analyzed.
Methods: A retrospective review was conducted using a data set generated from the National Poison Data System (NPDS) of pediatric vortioxetine exposures in patients less than 6 years of age from 2013 to 2019. Data collected included age, weight, gender, reason for ingestion, amount ingested, time of ingestion, chronicity of exposure, time to onset of symptoms, clinical effects, treatments administered, medical outcomes, and duration of effects. Cases were excluded if they involved substances in addition to vortioxetine, if age or medical outcome were not documented, if the case was not followed to outcome, or if it was confirmed that no exposure took place.
Results: A total of 318 cases were identified for analysis, with a significant increase over the given study period. Of the included cases, 256[SC1] (80.5%) resulted in no effect and 62 (19.5%) resulted in either a moderate ($n = 8$) or minor ($n = 54$) effect. The distributions of age and gender were similar between the patients in the moderate/minor effects category (mean age 1.97 ± 0.77 years, 52% males) compared to the no effect category (mean age 2.07 ± 0.75 years, 49% males). Drowsiness/lethargy (10, 3.14%) and vomiting (29, 9.12%) constitute the predominant clinical effects documented. For the cases in which a duration of effect was reported ($n = 65$), the majority resolved within 8 hours (49, 75%). A significantly lower proportion of cases in the moderate/minor effects group (20, 32%) compared to the no effect group (151, 59%) were managed on-site ($p < 0.001$), though overall only a small percentage of patients evaluated in a healthcare facility were admitted in each group (9, 21% vs. 13, 13%, $p = 0.205$).
Conclusions: Accidental pediatric single-substance exposures to vortioxetine resulted in minimal toxicity. The overall incidence of clinical effects was very low, with the most common symptoms being drowsiness/lethargy and vomiting. Pending further studies, this study supports home management for accidental exposures in asymptomatic patients and suggests no harm in home management for mildly symptomatic pediatric patients.

KEYWORDS vortioxetine, pediatric, unintentional

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153. Effect of Implementation of the QT Nomogram at a Regional Poison Center on the Frequency of Magnesium Replacement Recommendations Compared to a Control of QTc >500 msec

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Background: Historically at our Poison Center (PC), if adult patients had a QTc duration >500 msec, we empirically recommended 2g IV magnesium (Mag) as prophylaxis for Torsades des Pointes (TdP). The QT Nomogram (QTN) has been shown to be more sensitive and specific for predicting drug-induced TdP than a QTc cutoff of 500 msec. For quality assurance purposes we instituted the QTN to more precisely identify patients who might benefit from Mag. The purpose of this study was to determine if this intervention resulted in a change in the number of patients receiving a recommendation for Mag replacement, compared to their concomitant QTc measurements as controls.
Methods: Our IRB determined this study was exempt from review. Cases were identified prospectively by marking the free area in our electronic documentation database if the QTN was used to interpret the risk of Torsades des Pointes (TdP) and the need for Mag replacement. After initiating use of the QTN, Mag replacement was recommended only if the QT-HR plotted above the "at-risk" line on the QTN and the serum magnesium was below 2 mg/dL. ECG intervals (QT, QTc) and heart rates, serum magnesium, Mag recommendation and administration, and the occurrence of acute dysrhythmias (TdP, ventricular tachycardia/fibrillation, asystole) were recorded. Patients age <13 years-old were excluded.
Results: The QTN was used in 503 cases with documented QTc intervals during the 3 months following protocol implementation. All available QT-HRs from the initial ECGs were plotted on the QTN; there were 95 cases (18.9%) above the "at-risk" line (see Figure 1). In total 94 (18.7%) cases had QTc >500 msec; of these 59 (62.7%) were above the at-risk QTN line. Of 409 cases with QTc <500 msec, 33 (8.1%) were above the "at-risk" QTN line. Of 503 patients, PC recommended magnesium for 47 (9.3%); using our previous criterion of QTc >500 msec, PC would have would have recommended magnesium administration for 94 (18.7%), representing a 50% decrease ($p < 0.001$, Chi-squared). One patient died from acetaminophen-induced hepatic failure. No episodes of TdP were reported. Two patients had self-limited runs of ventricular tachycardia; neither case had a QTc >500 msec nor plotted above the "at-risk" QTN line (See Table 1). Magnesium replacement recommendations and administration for cases with QTc >500m sec are shown in Table 2.
Conclusion: Implementation of the QT Nomogram at our Poison Center led to a 50% decrease in recommendations for prophylactic magnesium. Only 2 patients experienced ventricular dysrhythmias; neither received magnesium under current recommendations, and neither would have received magnesium

Table 1(#153). Cases with ventricular dysrhythmias .

	Age/sex	Substance(s)	Initial QTc (msec)	Initial QT (msec)	Initial heart rate (bpm)	Above QTN "at-risk" line?	Dysrhythmia	Outcome
1	57/M	Quetiapine, unknown drug	416	368	77	No	VT	30-beats of self-limiting run
2	70/M	Unknown drug	482	380	97	No	VT	Self-limiting run

VT: ventricular tachycardia.

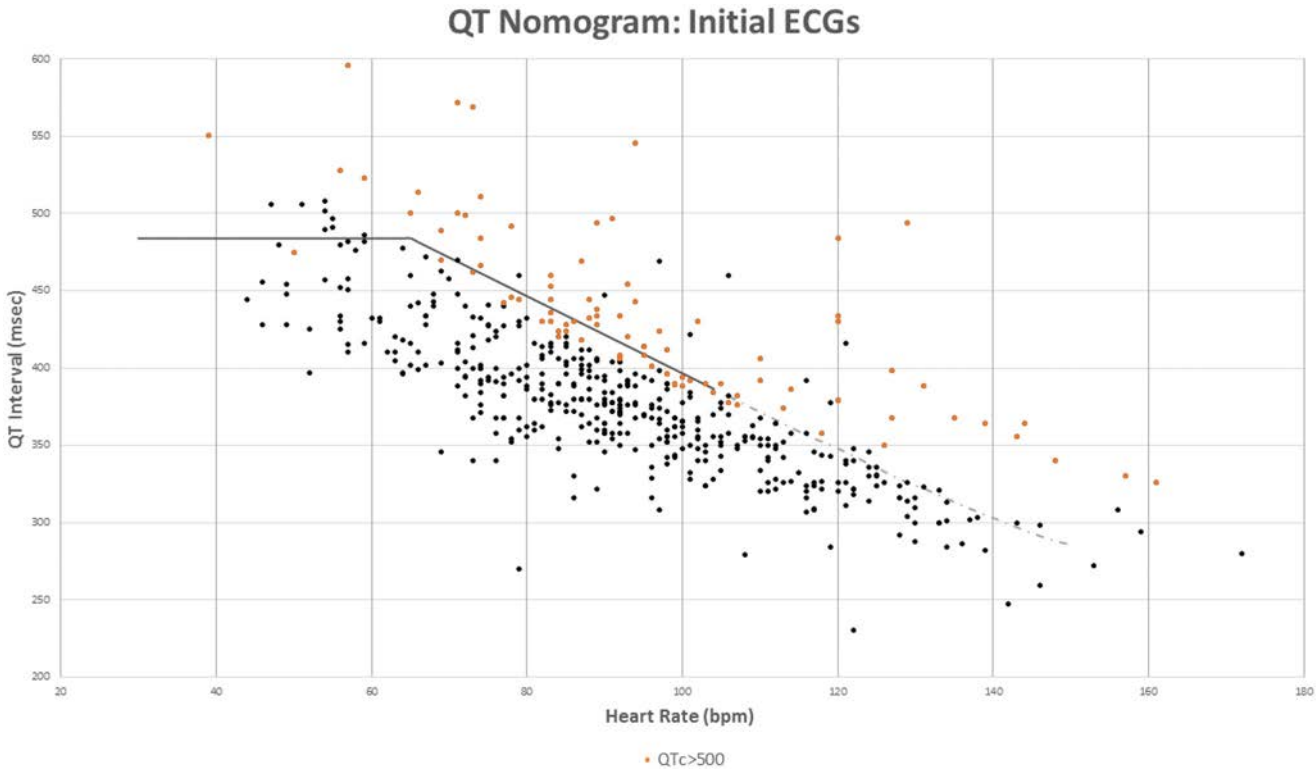

Figure 1(#153). QT-HR from initial ECGs plotted on the QT Nomogram.

Table 2(#153). IV Magnesium Replacement .

QTN at-risk line	Mag Recommended	Mag Recommended, Administered	Mag Not Recommended	Mag Not Recommended, Administered
For QTc >500 msec (n = 94)				
Above (n = 59)	31	27	28	5
Below (n = 31)	1	1	30	3
Unable to plot (n = 4)	0	0	4	1
For QTc <500 msec (n = 409)				
Above (n = 33)	16	11	17	1
Below (n = 366)	6	6	360	9
Unable to plot (n = 10)	1	1	9	2

using a QTc cutoff of 500 msec. Further study is needed to determine if the QT Nomogram can be used as a standard tool for Poison Centers to determine which patients should receive magnesium.

KEYWORDS QT nomogram, Magnesium, Quality assurance

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154. A retrospective study of dialysis in poisoning: what, when, and for how long

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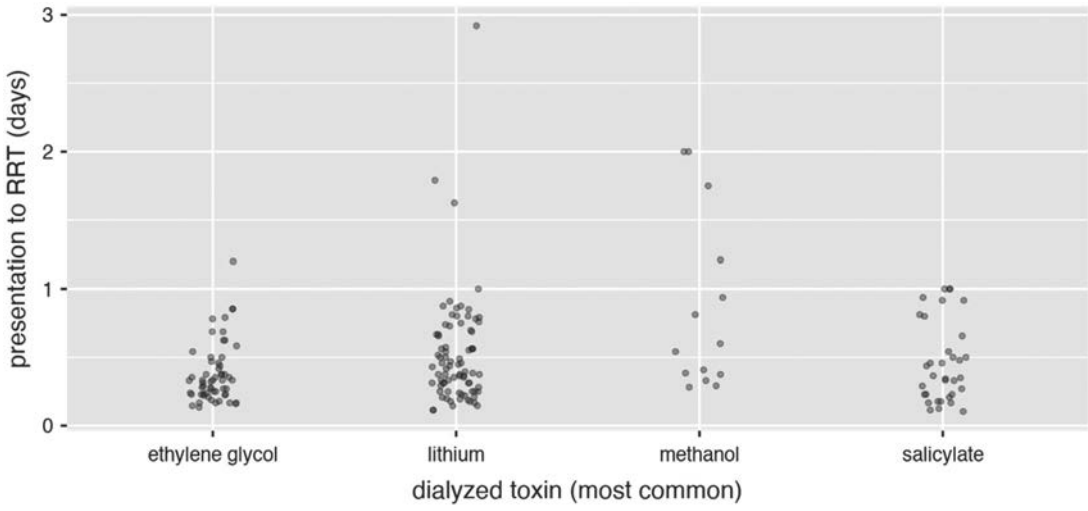
Background: Renal replacement therapy (RRT), such as hemodialysis, is commonly performed to treat acute and chronic poisoning, along with sequelae of poisoning. There are limited data describing the number of days patients require RRT after poisoning. The objective of study was to describe the duration, indications, and types of RRT reported to a single poison center.
Methods: Retrospective study of cases reported to a single poison center where RRT was utilized. Cases between 2010 and 2019 were included if a start date for RRT was known and either a final date of RRT was known or the patient died or was discharged on RRT. Patients that died or were discharged on RRT



Figure(#154). Time from presentation until initiation of renal replacement therapy for the four most common poisons included in the study.

Table (#154). Time from presentation and number of days on renal replacement therapy for the four most common agents included in the study.

Drug	Number of cases	Hours from presentation to RRT (median [IQR])	Number of days on RRT, [median, (IQR)]
Ethylene glycol	57	7.9 (5.5, 11.0)	3 (2, 6)
Lithium	80	10.2 (6.6, 16.1)	1 (1, 2)
Methanol	15	13.7 (9, 27.4)	1 (1, 2)
Salicylate	34	8.6 (5.5, 15.1)	1 (1, 1)

RRT: renal replacement therapy.

were assigned an unknown duration of days and were included for description of agents and time to initiation. Cases were excluded if RRT was coded but not performed, the patient was previously receiving RRT chronically, if it was determined the case was not related to an ingestion, or there was inadequate documentation. Trained, blinded abstractors extracted data from case notes. Time of day for initiation of RRT was divided into quartiles (0000-0600; 0600-1200; 1200-1800; 1800-0000). Statistics were performed with Jamovi v1.1.9.0. Values are presented as median and interquartile range (IQR). Nonparametric tests were performed due to non-normality of the data. Institutional review board determined this study exempt.

Results: The report identified 525 cases and 123 were excluded due to chronic RRT (n = 48), inadequate information (n = 33), medical cause of illness (n = 24), and no RRT performed (n = 24). The population was primarily male (n = 217; 54.0%) with a median age of 47 years (IQR: 33, 58). Indication for RRT included drug removal in 55% of cases. Duration of RRT was known for 366 cases [median 2 days (IQR: 1, 4)] and varied by indication. Median duration of RRT was shorter if drug removal was the indication vs when it was not (1 [IQR: 1, 2] vs 3 days [IQR: 2, 7]; $p < 0.001$). Most exposures were reported as single substances (n = 227). The three most common exposures were lithium (n = 73), ethylene glycol (n = 63), and salicylates (n = 35). When RRT was performed at least partly for drug removal, ethylene glycol was the substance with the longest duration of RRT (4.5 days [IQR: 2, 6.75]). Duration of the most commonly dialyzed agents are shown in the Figure. Most patients were started on RRT within the first day with a median of 14.7 hours (IQR: 8, 24) from presentation to initiation of RRT; time to initiation of RRT varied by agent. Most patients were initiated during the afternoon (39.4%) with 40.1% initiated between 1800 and 0600. Multiple RRT methodologies were performed with 323 patients receiving intermittent hemodialysis (iHD) at some point. In those that the order was known, it was more frequent to receive iHD before some form of continuous RRT (31/56).

Conclusion: RRT is frequently utilized after poisoning. In most cases, RRT was performed for drug removal. Patients treated for drug removal generally had fewer days on RRT than those treated for other indications.

KEYWORDS Renal replacement therapy, dialysis, toxic alcohol

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155. An Assessment of the Severity of Copperhead Bites Based on Extremity

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Objectives: The purpose of this study is to examine whether there is an association in severity of copperhead (*Agkistrodon contortrix)* bites depending on bite location (upper extremity [UE] vs lower extremity ≤), onset, duration, and extent of swelling, as well as dose of antivenom administered.

Methods: This was a retrospective evaluation of all copperhead bites reported to a single poison center between 1/1/2005 and 5/31/2019. Copperheads are endemic in the study area and account for >99% of annually reported snake bites. Cases were identified by generic code and case notes were reviewed. Data extracted included information on bite location, onset and duration of swelling, extent of progression of swelling, and dose of antivenom received. To measure extent of swelling, limbs were divided into 7 anatomical sections. The sections used were toe, foot, ankle, calf, knee, thigh, and hip for LE and finger, hand, wrist, forearm, elbow, bicep, and shoulder for UE. The section in which the bite occurred and the section furthest from the bite to which the swelling progressed were recorded and the extent of swelling was measured by the number of sections that the swelling moved across. Onset and duration of swelling were recorded from case notes. If patients arrived with swelling, the onset was coded as 1 hour after the bite. Data are presented as median and interquartile range (IQR).

Results: A total of 467 cases were reviewed and 401 included. Patients were primarily male (59%) with a median age of 44 (23, 56) years (Table). Of the 401 cases, 210 were LE bites and 188 UE bites, along with 1 unknown location and 2 non-extremity bites. Most bites occurred in the late afternoon. Extremity differed by time of day with a peak in the late afternoon for UE and in the

Table 1(#155). Demographics of copperhead envenomation victims.

	All (n = 401)	Upper extremity (n = 210)	Lower extremity (n = 188)	p-value
Male, n (%)	238 (59.3)	130 (68.8)	108 (48.8)	< 0.001
Female, n (%)	162 (40.4)	59 (31.2)	103 (51.2)	
Age, median (IQR)	44 (23, 56)	47 (32, 59)	39 (20, 52)	< 0.001

Unknown bite site for 1 and non-extremity site for 2 patients.

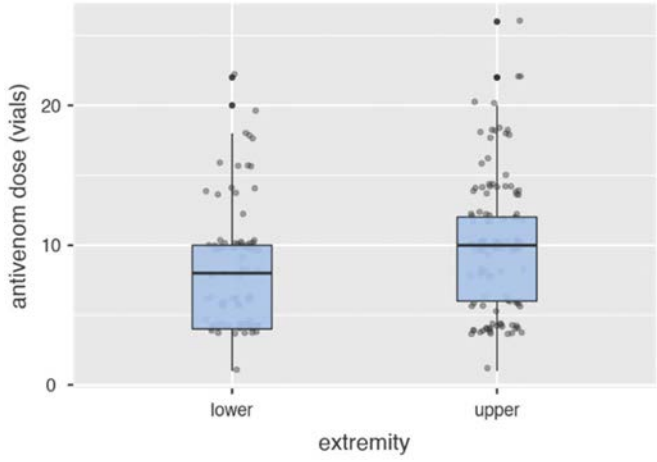

Figure 1(#155). Total dose of antivenom by extremity.

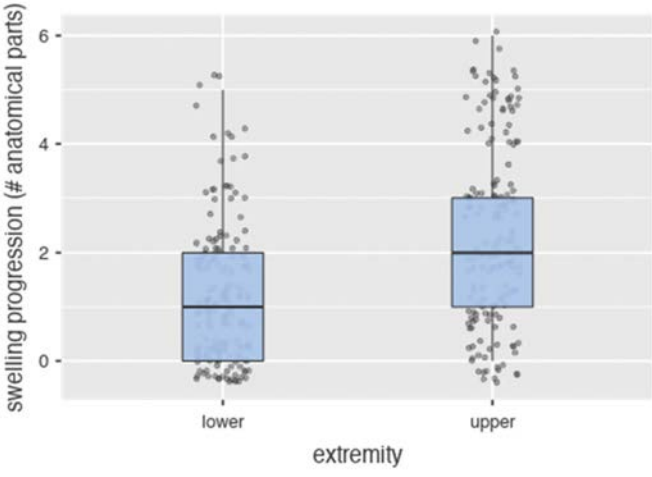

Figure 2(#155). Progression of swelling by extremity. Only discrete values included, no values were less than 0.

late evening for LE. There was no significant difference in time to initial swelling [1 (IQR: 1, 1) hours for LE and 1 (IQR: 1, 1) hours for UE; p = 0.979] or duration of swelling [2 (IQR: 1, 5.6) hours for LE, 4.3 (IQR: 1, 7) hours for UE, p = 0.147] based on extremity bitten. However, swelling progressed across a median of 2 (IQR: 1, 3) anatomical sections in UE bites vs 1 (IQR: 0, 2) section in LE bites (p <0.001). Additionally, LE bites were treated with fewer vials of antivenom [8 (IQR: 4, 10) vs 10 (IQR: 6, 12) (p = 0.004)] (Figure 2).

Conclusions: The results of this study suggest that the swelling due to a copperhead envenomation is similar in onset and duration regardless of location of the bite. However, bites to the upper extremities may progress across more sections of the extremity and as a result are treated with higher doses of antivenom. Clinicians should be aware of the possibility of greater progression with upper extremity bites and health systems should maintain adequate supply of antivenom to ensure treatment of either extremity.

KEYWORDS copperhead, envenomation, swelling

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156. Novel Use of Fomepizole (4-MP) for CYP2E1 Inhibition in Acetaminophen Overdose

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Background: Acetaminophen (APAP) toxicity is a leading cause of acute liver failure world-wide with few treatment advancements over the past 40 years. Fomepizole (4-MP) is a potent Alcohol Dehydrogenase and cytochrome P450 inhibitor with biologic plausibility to treat APAP overdose. To our knowledge, we present the largest case series of 7 patients treated with standard therapy and 4-MP who had no significant liver injury despite persistently elevated APAP levels.

In an APAP overdose, normal detoxification is overwhelmed and APAP is metabolized by CYP2E1 producing NAPQI (N-acetyl-p-benzoquinoneimine), a highly reactive species that drives hepatotoxicity. Standard care is IV N-acetylcysteine (NAC), but there are reports of hepatotoxicity despite treatment. Based on some studies, if IV-NAC is administered less than 8 hours post ingestion, hepatotoxicity can still exceed 5% and if delayed more than 8 hours, hepatotoxicity can be up to 25 percent. 4-MP inhibition of CYP2E1 NAPQI production has been studied in animal models and human hepatocytes. It was found 4-MP inhibits c-Jun-N-terminal Kinase (JNK), which is pivotal in the hepatic inflammatory response to

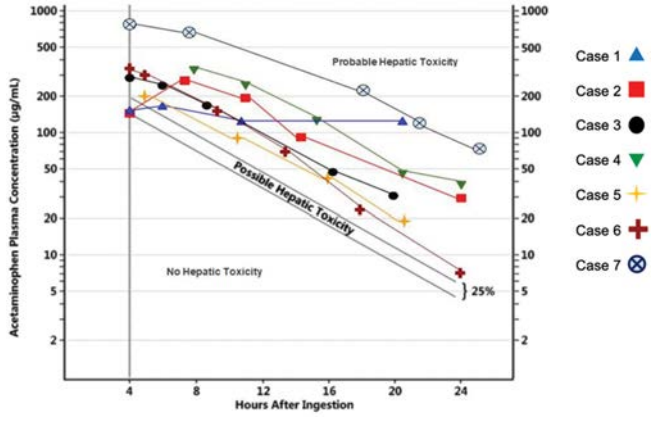

Figure (#156). Yearly mean reported dose of loperamide exposure.

APAP toxicity. We postulate inhibiting NAPQI production and JNK activity contributes to the outcomes in our patients. We add this case to a recently published series of 6 patients from our institution. **Case Report:** The patient was a 45-year-old man presenting after an ingestion of an undetermined amount of APAP. The ingestion +4 hour APAP level was 791 mcg/mL (therapeutic 10-20 mcg/mL), ABG pH 7.12, PCO2 41 mm Hg, and HCO3- 8 mmol/L. Treatment was started with a loading dose of IV NAC 150 mg/kg and an infusion of 12.5 mg/kg/hour. Due to the elevated APAP level and delay in presentation, 4-MP at 15 mg/kg IV adjunctive therapy was given. Ingestion +8 hours APAP level was 691 mcg/mL. NAC infusion was increased to 18.75 mg/kg/hour and renal replacement therapy (RRT) prepared. During RRT, a 2nd dose of 4-MP was given at ingestion +16 hours. RRT was stopped at ingestion +23 hours. Ingestion +28 hours APAP level was 74.5 mcg/ml and a 3rd dose of 4-MP (10 mg/kg) IV given. NAC was discontinued at ingestion +35 hours. Liver enzymes remained normal throughout the treatment and no liver injury was detected by discharge on hospital day 8. We present the graphic data of all 7 patients plotted on the Rumack-Matthew nomogram (see Figure).

KEYWORDS Acetaminophen, Fomepizole, Hepatotoxicity

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157. Characteristics of Adolescent Cannabis-Associated Emergency Department Visits

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Background: As cannabis has been legalized, increases in toddler exposures and adults with intoxication and gastrointestinal disease have been described. Few studies have examined the scope and clinical characteristics of cannabis-related emergency department (ED) visits among adolescent patients.
Objectives: The goal of this study was to describe the characteristics of cannabis-related ED visits in adolescent patients.
Methods: We conducted a prospective cross-sectional study of ED visits related to cannabis use at a single academic pediatric emergency department from September 2018–July 2019. ED providers recorded their answers to the question "Do you think cannabis use was a significant factor leading to today's ED visit?" in the patient's medical record. Patients were selected if between age 12-18 years old and if their provider answered "Yes" to the cannabis question. Descriptive statistics were performed using Microsoft Excel.
Results: 64 patients were included in the study cohort which made up 1.8% of total adolescent ED visits. The mean patient age was 16.7 years and 52% of patients were female. 80% of the patients had a known cannabis exposure upon arrival to the ED. 23% of ED disposition diagnoses were gastrointestinal-related (GI) diagnosis, 19% were trauma-related, 17% were either mental health or "other" related. Only 12.5% of diagnoses were intoxication. Few tests (labs, ECGs) were ordered (mean 4 tests) and 91% of patients were discharged. The average hospital charge per visit was greater than $2400.
Conclusion: The majority of adolescents with cannabis-related ED visits have a known cannabis exposure and most diagnoses are related to GI, trauma or mental-health related conditions that are secondary to cannabis use; fewer visits are due to intoxication. Most adolescent patients complete their evaluation in the emergency department and are discharged.

KEYWORDS Cannabis, Adolescent, Pediatric Emergency Medicine

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158. Novel Psychoactive Substance Screening in an Academic Emergency Department

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Background: Intoxication, or suspected intoxication, is a common presenting complaint in the emergency department and cause for consultation with poison control. Popularity of novel psychoactive substances (NPS) is increasing and raises concern regarding ability to detect these substances after use. Typical toxicologic screening is effective at identifying common substances in circulation, such as opiates, amphetamines, cocaine, benzodiazepines, and barbiturates. However, novel substances can go undetected. At present, clinical toxicology testing does not determine what new substances are being used, whether intentionally or as an additive in other substances. This study aimed to identify new substances in use through advanced toxicological testing.
Methods: Observational study at a single academic emergency department. A convenience sample of patients was enrolled by medical providers when intoxication with NPS was suspected by history or negative/discordant drug screen results. Residual blood, serum/plasma, and urine specimens were sequestered. This study was determined to be exempt by an institutional review board. Samples were analyzed by high resolution mass spectrometry using a continually updated library of novel opioids, synthetic cannabinoids, and other NPS ($n > 800$). Deidentified results were communicated to public health officials and medical staff.
Results: Nine patients have been enrolled in the study. From those patients, we identified 52 substances either by parent compound or metabolite. All nine patients tested positive for at least one NPS, and in total five NPS were identified during this study. The most frequently identified substance was 5F-MDMB-PICA, a synthetic cannabinoid, found in 78% of patients. Methamphetamine was also noted in 22% of patients and benzodiazepines were noted in 44% of patients. Other less recognized psychoactive substances that were identified included 4F-MDMB-BINACA (synthetic cannabinoid), alpha-PHP/PiHP (stimulant), and clonazolam (benzodiazepine). 67% of patients had evidence for multiple substances in either their system. Of all substances identified, only 17 (33%) would likely be detected by routine toxicologic screening at the study location. See Table 1.
The most common clinical effect at presentation was overt psychosis, noted in 67% of patients. 22% presented with CNS depression and received naloxone. 44% were agitated, two of which received antipsychotics. Only one agitated patient received benzodiazepines. All patients were poor historians and two were completely unable to provide drug use history. No patients died. A summary of these clinical effects and therapies is shown in

Table 1(#158). Clinical toxidromes and therapies.

Clinical Effects	Number of Patients	Treatment	Number of Patients
CNS Depression	2	Naloxone	2
Psychosis	6	Antipsychotic	2
Agitation	4	Benzodiazepine*	1
		Intubation	1

*Administered as part of a sedation combination

Table 2.
Conclusions: NPS are increasingly available and can be expected to be in more frequent usage. Standard toxicologic screening is insufficient to detect the continuously evolving array of NPS and therefore it is often unknown to clinicians what agents a patient has used, expected clinical effects, and optimal management. In this study, there were many NPS identified that would not typically be found on standard screening, with synthetic cannabinoids being most frequently identified. All patients included in the study were positive for NPS. Ongoing surveillance for NPS is needed to inform efforts for law enforcement, public health, and medical professionals.

KEYWORDS Toxicology, Drug abuse, Novel drugs

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159. Outcomes after failure to follow guidelines to hold metformin after IV contrast CT

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Background: Current guidelines by the American College of Radiology suggest holding metformin for 48 hours after receiving IV contrast to avoid the risk of metformin-associated lactic acidosis (MALA) should the patient develop contrast-associated acute kidney injury (CA-AKI), and have a repeat creatinine level drawn before restarting. However, there is a paucity of data on outcomes of patients who do not hold their metformin, and the recommendation to do so is made inconsistently at the time of ED discharge. We sought to assess the risk of MALA in patients who received IV contrast but were not instructed to hold the medication after a IV contrast study in the emergency department. **Methods:** A retrospective chart review of all patients who received an IV contrast CT scan in the emergency department, were taking metformin and were discharged home was performed. Age, gender, baseline GFR, metformin dose, discharge instructions, and any repeat chemistry done within 72 hours of discharge and any admission within 7 days of discharge for acute renal failure, metabolic acidosis, or lactic acidosis was obtained. The results were abstracted by the primary author. This study met the qualifications for exempt review by the IRB. **Results:** 180 charts were identified; 12 were excluded due to incomplete information (lack of discharge instructions). 150/168 (89%) were male with a median age of 58.5 years (range, 24-98 years), and 71 (42%) were African-American. The median GFR at time of CT was 68 (range, 45-160), with serum creatinine median level 1.1 mg/dL (range, 0.5-1.6 mg/dL). The median daily dose of metformin was 1230 mg (range 500-2000 mg); 86 patients were on extended-release metformin (ER-metformin) and the remainder on standard dosing. 36/168 (21%) had specific discharge instructions to hold their metformin for 48 hours and have their creatinine repeated before restarting. 39/168 (23%) had a creatinine drawn within 72 hours of discharge outside of a repeat ED visit. The median increase in serum creatinine in this group was 0.1 mg/dL (range, -0.2-0.3 mg/dL). 44/148 did have a repeat ED visit within 7 days of their CT scan and had a repeat creatinine performed. The median increase in creatinine in this group was 0.2 mg/dL (range, -0.3-1.6 mg/dL), with one patient noted to have a clinically significant rise in creatinine. 1 patient (0.5%) developed lactic acidosis with a lactate of 18 mmol/L, though he also had ischemic bowel, so direct attribution to metformin is unclear. There were no differences in rate of CA- AKI or risk for MALA in the stopped vs continued metformin groups. **Conclusion:** In this study of patients on metformin discharged from the ED after an IV contrast CT scan, a minority of patients were instructed to hold their metformin for the recommended period and have their creatinine repeated. However, there was no significant difference between the groups in terms of development of CA-AKI or MALA. The necessity of holding metformin and having creatinine repeated is unclear and larger studies to confirm these findings are recommended.

KEYWORDS medication safety, metformin, lactic acidosis

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160. Renal dosing adjustments in antibiotic prescriptions by emergency department pharmacists

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Background: Prescribing medications in the elderly population is fraught with concerns over polypharmacy, drug-drug interactions, and physiologic changes with aging. Renal dosing adjustments for discharge prescriptions are not commonly addressed in the emergency department. Of common discharge prescriptions for elderly patients from our emergency department, antibiotics are the most commonly encountered class of medications that may require renal dosing adjustment. We sought to explore the incidence of antibiotic prescriptions with missed renal dosing adjustment in an elderly population.
Methods: The setting was a 28,000 visit Veterans Affairs emergency department with 37% of our volume comprising adults age 65 years and older. During a 3-month study period (April-June 2018), all discharge emergency department antibiotic prescriptions for patients aged 65 years and older were reviewed. The charts were reviewed for diagnosis, medication(s) prescribed, and most recent creatinine results. Renal dosing adjustment suggested by pharmacy (either through a note or flagged order) was identified. All charts were abstracted by the primary author. The study met criteria for exempt review by the Institutional Review Board.
Results: A total of 868 outpatient antibiotic prescriptions were written during the study period. The most conditions receiving antibiotic prescriptions were: lower respiratory tract infection, 33%; urinary tract infection, 30%; upper respiratory tract infection, including pharyngitis and otitis media, 14%; cellulitis, 14%; gastrointestinal, including diverticulitis, 9%. The prescribed antibiotics were: azithromycin, 168 (19.3%); doxycycline, 160 (18.4%); cephalexin, 158 (18.2%); trimethoprim-sulfamethoxazole, 140 (16%); ciprofloxacin, 112 (13%); amoxicillin-clavulanate, 90 (10.3%); metronidazole, 18(2.3%); clindamycin 16 (2.1%); nitrofurantoin, 6 (0.6%). Of these prescriptions, cephalexin, trimethoprim-sulfamethoxazole, ciprofloxacin, amoxicillin-clavulanate, and nitrofurantoin all had several instances were renal dosing adjustment was required, resulting in decreased dosing or frequency of the medication compared to the original prescription. The dosing changes based on renal function affected 50/ 158 cephalexin prescriptions (31.6%), 44/140 trimethoprim-sulfamethoxazole prescriptions (31.4%), 38/112 ciprofloxacin prescriptions (34%), 6/90 amoxicillin-clavulanate (0.7%), and 3/6 nitrofurantoin (50%). The most common changes were reduction in dose frequency (55%), reduction in dose (50%), or discontinuation of antibiotic (0.3%, all nitrofurantoin). For homegoing prescriptions filled through the pharmacy, dose adjustment was made at the time the prescription was verified by the pharmacist; for discharge

medications dispensed from the ED after hours, the ED pharmacist reviewed all prescriptions the following day and contacted both patient and ED provider on duty with any needed dose adjustments. 72% of discharge prescriptions were ordered through the pharmacy and 28% were dispensed from the ED and received contemporaneous or next-day pharmacist review.
Conclusion: Renal dosing adjustment was common in home-going antibiotic prescriptions in elderly patients. As need for change in dose or frequency, or both, varies based on GFR and antibiotic, use of a pharmacy verification process is recommended, preferably hospital based as data such as most recent GFR will be available.

KEYWORDS pharmacist, renal clearance, medication safety
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161. Factitious Metabolic Disorder from Albuterol Abuse in a Patient With DNR Status

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Introduction: Munchausen Syndrome (factitious disorder) using beta-adrenergic agonists has been published before in the literature. However, awareness of this disorder and its clinical manifestations is frequently inadequate. We report a case of factitious metabolic disorder committed via albuterol abuse complicated by the patient having an underlying DNR order.
Case: The patient was a 34 year old female with frequent ED presentations and admission for episodes of profound hypokalemia and lactic acidosis. She had been diagnosed with a presumed mitochondrial myopathy. Her potassium was typically in the 2.0-25. mEQ/L range and her lactate in a 6.0-80 mg/dL range. This was accompanied by marked tachycardia. Complicating these presentations was the patient asserting that she had a DNR-Arrest order and did not want intubation, cardioversion, or CPR. On the date of presentation for this case, she reported feeling palpitations and "knew her lactate was up." She was tachycardic to 148 (sinus tachycardia) with normal QRS and QTc intervals, blood pressure of 110/89, normal mentation and no psychomotor agitation, dilated pupils, slight resting tremor, and normal perfusion despite a lactate of 6.8 mg/dL.Labs were principally remarkable for hypokalemia (2.1 mEQ/L). She had several urine drug of abuse screens, as well as thyroid levels for additional evaluation of her symptoms, all of which had been negative in the past. Her magnesium was normal. She was treated with IV fluids and potassium repletion, and her vital signs and laboratory parameters gradually normalized. A toxicologist who was involved in her initial care in the ED ordered a serum albuterol level. The level returned from a reference lab 7 days after the initial visit was 76 ng/dl (therapeutic range after a single treatment 1.5-2.0 ng/ml). She was confronted at her next visit (with a similar presentation) and after being medically stabilized was admitted to the psychiatric service.
Conclusion: Surreptitious abuse of beta agonists can cause unexplained tachycardia, lactic acidosis and hypokalemia, and should be considered when confronted with these presentations. In this case, the factitious illness was complicated by the patient having a DNR status, which made her induction of severe hypokalemia even more concerning. Providers should maintain a high degree of suspicion when face with complex and not otherwise easily explained diagnoses.

KEYWORDS factitious, albuterol, hypoklemia
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162. Respiratory Failure in ED Patients with Confirmed Synthetic Cannabinoid Exposure

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Background: Synthetic cannabinoids (SC) are popular, widely-available drugs of abuse that are specifically designed to mimic the desired effects of marijuana. The SC studied to date generally show a greater cannabinoid receptor binding affinity and 2-100 times more potent pharmacologic effects than Δ^9-tetrahydrocannabinol, the primary psychoactive compound in marijuana; however, clinical outcomes following confirmed acute SC overdose are poorly described. Previously it was shown that endotracheal intubation after acute drug overdose occurs in approximately 3.5% of emergency department (ED) patients, but reports of respiratory compromise following SC drug overdose are limited to uncontrolled small case series which lack toxicological or chemical confirmation. We aimed to describe the occurrence of acute respiratory failure (ARF) in ED patients with analytically-confirmed SC exposure, and to investigate any association with ARF compared to non-SC overdose patients as controls.
Methods: This was a convenience cohort of adult (>18 years) ED patients with suspected acute SC drug overdose between 2016-19 at two urban, tertiary-care hospitals. All ED visits with acute drug overdose were screened during the study period, and patients were excluded if there was no waste serum available or if SC drugs were not suspected by treating clinicians based on chart review. Waste serum, if available from specimens drawn as part of clinical care, were analyzed for toxicological confirmation of drug use. Instrumental analysis was performed via liquid chromatography/ quadruple time-of-flight mass spectrometry. The battery of drugs tested for was extensive and included >600 novel psychoactive substances. Clinical data was abstracted by chart review using trained research assistants. Clinical primary outcomes were in-hospital occurrence of ARF, defined as any of the following: (A) tracheal intubation, (B) mechanical ventilation, or (C) naloxone administration. Secondary outcomes included adverse cardiovascular events, ED disposition, and in-hospital mortality. The study protocol was approved by the institutional review board with waiver of consent. Incidence of clinical outcomes for specific SC drugs and those with confirmed non-SC overdose were calculated with 95% CI and compared using chi-squared test with 5% alpha.
Results: Out of 39 ED patients with suspected SC overdose analyzed, there were 17 confirmed SC exposures (10 single-drug, 7 polydrug) and 22 confirmed non-SC overdoses. Confirmed SC drugs were: 5F-MDMB-PICA (N = 8), its metabolite 5OH-MDMB-PICA (N = 7), ADB-FUBINACA (N = 5), AB-CHIMINACA (N = 3), AB-FUBINACA (N = 1), AB-PINACA (N = 1), and 4F-MDMB-BINACA

(N = 1). Final ED disposition was the following: 6% ICU; 11% floor; 83% medically cleared for psychiatric evaluation. Overall incidence of ARF was 15.4% (CI 6-31), and there were no cardiovascular events or deaths. Confirmed SC drug overdose was associated with ARF compared to confirmed non-SC overdoses (29.4% vs. 4.5%, p = 0.033). Naloxone infusion was utilized for 5F-MDMB-PICA overdose in two patients with confirmed absence of opioids.

Conclusions: Confirmed SC drug overdose was associated with ARF compared to non-SC overdoses in adult ED patients. Limitations include convenience sampling and small sample size. Treatment of 5F-MDMB-PICA with naloxone infusions is novel but requires further study to assess efficacy.

KEYWORDS Synthetic Cannabinoid, Respiratory Failure, quadrupole time-of-flight mass spectrometry

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163. Is Mg/Kg a Reliable Triage Strategy for Dextromethorphan Exposure in Children?

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Background: Dextromethorphan (DXM) is in hundreds of over-the-counter (OTC) medications and is common in many homes. Poison centers frequently receive calls regarding pediatric DXM exposures, making it imperative to have a reliable triage strategy to determine appropriate level of care. Many poison centers have set their max tolerated dose (MTD) for referral at >7.5 mg/kg based on a consensus guideline published in 2007, while others have higher MTDs. Pediatric DXM exposures were evaluated to assess the appropriateness of the existing triage strategy at one poison center (>10 mg/kg immediate-release, >20 mg/kg extended-release) as a guide to recommendations for level of care.

Methods: Archived Toxicall® records were searched over a 3-year period (January 2017- December 2019 for accidental pediatric (0-5 years) DXM exposures, with or without expectorant, that were unintentional-general or unintentional-therapeutic error. Only cases followed to a known outcome were included in the analysis. Patients were divided into 2 groups: Home-Managed and ED-Evaluated (SPI-Referred to ED and Self-Referred to ED). The amount of DXM ingested in mg/kg was evaluated and exposure scenarios were inspected for insight regarding effect on triage and outcome.

Results: There were 193 cases that met inclusion criteria: 174 Home-Managed, 19 ED-Evaluated (7 SPI-Referred and 12 Self-Referred). DXM dose in mg/kg was calculated in 177/193 (91.7%) cases; however, many of these were rough estimates due to spills or other inconsistencies. The overall range of mg/kg DXM varied widely from 0.1 mg/kg to 52.3 mg/kg (median 2.2, IQR 0.8-4.9 mg/kg). Most SPI-referred cases had vague/unknown histories of ingestion.

Of the 174 Home-Managed patients, 38 had minor outcomes (21.8%). Of the 19 patients evaluated in an ED, 4 had minor outcomes (21.1%) while 7 (36.8%) had moderate outcomes. There were no major outcomes in either groups. Of the total cases in both groups, 180 (93.3%) had either no effect or only minor outcomes. Four patients were admitted to the hospital.

In Home-Managed patients, the most common symptoms recorded in cases with a minor outcome were drowsiness (12), vomiting (7), dizziness/vertigo (3), ataxia (3). In ED-Evaluated patients there were no minor symptoms that occurred in multiple patients; the most common symptoms recorded in cases with a moderate outcome were mydriasis (4), tachycardia (3), hallucinations (3), erythema (3), vomiting (3), nystagmus (3), ataxia (2), and drowsiness (2).

Conclusion: Since most pediatric cases involve vague histories with spills or unknown bottle count, it can be difficult to determine an accurate amount ingested. Unnecessary ED referrals can be avoided by using clinical expertise instead of worst-case scenario calculations. The majority of cases reviewed were benign with either no symptoms or only minor outcomes, including those evaluated in the ED. The current mg/kg strategy was adequate but DXM triage may be better structured to guide SPIs to observe these cases at home with follow-up at 1, 3, and 6 hours (if ER formulation), and base ED referral on the development of concerning symptoms such as hallucinations, significant ataxia or CNS depression, and symptoms intolerable to the child or caretaker.

Table (#163).

	Home-Managed	ED-Evaluated	Total Cases
Number of Cases	**174**	**19**	**193**
No Effect	130 (74.7%)	8 (42.1%)	138 (71.5%)
Unrelated Effect	6 (3.4%)	0	6 (3.1%)
Total Symptomatic	**38 (21.8%)**	**11 (57.9%)**	**49 (25.4%)**
Minor Outcome	38 (21.8%)	4 (21.1%)	42 (21.8%)
Moderate Outcome	0	7 (36.8%)	7 (3.6%)
Major Outcome	0	0	0
Death	0	0	0

KEYWORDS pediatric, dextromethorphan, triage

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164. NAC Use and/or Abuse in Rhabdomyolysis Patients?

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Background: Because the history is often incomplete or unreliable in poisoned patients, NAC therapy is often empirically initiated based on laboratory findings suggestive of liver injury such as elevated serum levels of aspartate aminotransferase (AST) or alanine aminotransferase (ALT). These enzymes also occur in skeletal muscle and several studies report that transaminases are commonly elevated in rhabdomyolysis. The aim of this study is to examine the incidence of NAC utilization in patients reported to our regional poison center (RPC) with elevated transaminases secondary to rhabdomyolysis without acetaminophen toxicity as compared to acetaminophen poisoned patients with concomitant rhabdomyolysis.

Methods: Records from our RPC were retrospectively queried for patients treated with NAC over a two-year period (January 1, 2018–December 31, 2019). Inclusion criteria was a documented creatine kinase (CK) of 1000 U/L or greater. Age, gender, coingestants, possible etiologies of rhabdomyolysis, adverse reactions to NAC, and outcome (death or liver transplantation) were recorded. Highest measured concentrations of acetaminophen,

Table (#164).

	No APAP	APAP
CK (units/L)	9,194 (2,862 – 17,375)	4,211 (2,292 – 12,818)
AST (units/L)	1,497 (357 – 4,103)	509 (128 – 2,925)
ALT (units/L)	1,582 (106 – 2,977)	226 (61 – 1,962)
Total bilirubin (mg/dL)	0.9 (0.75 – 1.45)	0.7 (0.4 – 1.13)
INR	1.30 (1.10 – 1.60)	1.4 (1.18 – 1.58)

Highest documented laboratory values - presented as mean (IQR).

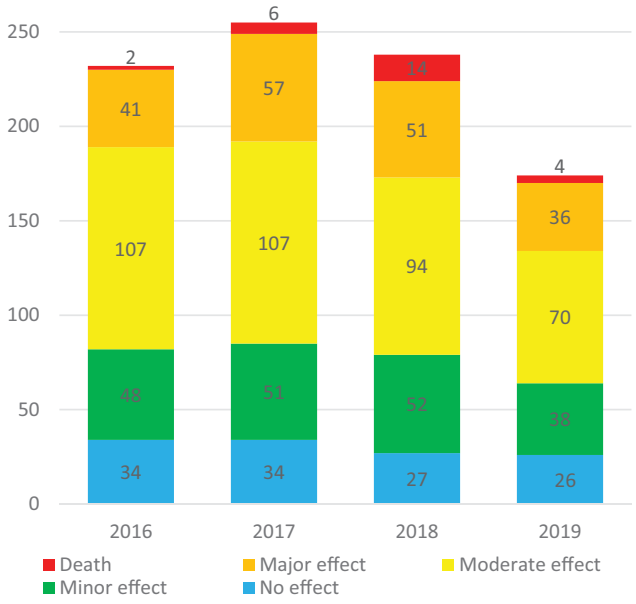

Figure 1(#165). Yearly incidence of loperamide exposure reported to US poison centers, stratified by medical outcome.

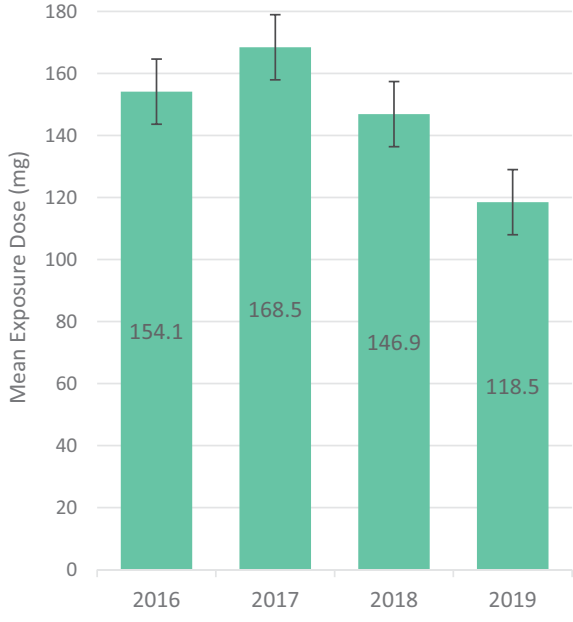

Figure 2(#165). Yearly mean reported dose of loperamide exposure.

CK, AST, ALT, total bilirubin, and INR were compared. Patients were divided into a "no APAP" group with no detectable acetaminophen level and a history not suggestive of acetaminophen exposure, and an "APAP" group, including all other cases. Data were analyzed using descriptive statistics.

Results: During the study period, 1,958 patients were treated with NAC. A total of 102 patients met inclusion criteria. Median age was 45 years (IQR 28-60, range 12-92) and 50% were female. 25 patients (24.5%) met criteria for inclusion in the "no APAP" group. The "APAP" group included 66 patients with either a history of acetaminophen ingestion or a detectable acetaminophen level and 11 patients with no detectable acetaminophen concentration but insufficient history to determine that acetaminophen exposure was unlikely. A comparison of the highest documented laboratory values in the two groups, presented as mean (interquartile range), are presented in Table 1. No patient in the "no APAP" group had a documented total bilirubin greater than 2 mg/dL or an INR greater than 2, compared to 17 patients in the "APAP" group. One patient, in the "no APAP" group, experienced a mild anaphylactoid reaction to NAC, which resolved with diphenhydramine and corticosteroids. One patient in the "no APAP" group died after presenting in multisystem organ failure with myocardial injury and cerebral infarcts. Eleven patients (10.8%) died and none required transplantation.

Conclusions: It is not uncommon for patients with rhabdomyolysis to develop elevated transaminase levels mimicking acetaminophen poisoning. Interestingly, we observed a high proportion (24.5%) of patients treated with NAC who had elevated CK levels but no historical or laboratory evidence of acetaminophen ingestion. Additionally, the median highest documented AST and ALT in this "no APAP" group was greater than in the "APAP" group. None of these patients developed evidence of hepatic synthetic dysfunction. Further research is warranted to better describe this phenomenon.

KEYWORDS N-Acetylcystine, Rhabdomyolysis, Acetaminophen

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165. Impact of 2018 FDA Loperamide Packaging Guidelines on Cases Reported to US Poison Centers

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Background: Loperamide has been misused or abused in large doses to self-treat opioid withdrawal or to obtain a euphoric effect. High dose loperamide ingestion has been associated with significant toxicity, particularly QT prolongation and cardiac dysrhythmia. In January 2018, the United States Food and Drug Administration (FDA) issued an alert advising manufacturers to alter and improve loperamide packaging to a safer form in order to prevent misuse and abuse. In the last quarter of 2019, the FDA formalized changes limiting packages to contain no more than 48 mg with each tablet or pill wrapped in individual doses. This retrospective observational study of National Poison Database System (NPDS) data was performed to evaluate the impact of these regulations on incidence and severity of loperamide abuse and misuse.

Methods: The NPDS was queried for all exposures to loperamide in patients aged 6 years and older from January 1, 2016 to December 31, 2019 coded as abuse, misuse or related to withdrawal. Data abstracted included patient age, sex, date of exposure, estimated amount of loperamide ingested, identity of co-ingestants, and medical outcome. Patients who were not followed for outcome or who were lost to follow up were excluded from analysis of outcome distribution but were included in analysis of ingested dose. Data were analyzed with descriptive statistics.

Results: 1244 cases met inclusion criteria and 345 were excluded due to lack of medical outcome. Median age was 34 (IQR 27-48, range 6-100) and 749 (60%) patients were male while 495 (40%) were female. Incidence of reported exposures by year, stratified by medical outcome, are summarized in Figure 1. Exposures peaked in 2017, the year prior to the first FDA recommendations, and had fallen by 32% by the end of 2019. All medical outcome effects decreased between 2017 and 2019–minor (25%), moderate (35%), major (37%) and death (33%). An estimated average dose of exposure was reported in 852 patients (47.9%) with a decrease of 30% when comparing the peak of 168.5 mg in 2017 to the low of 118.5 mg in 2019. The mean reported ingested dose by year is presented in Figure 2.

Conclusions: Incidence and case severity were relatively similar from 2016 through 2018. We observed a 32% decrease in incidence of reported exposures in 2019. We also observed a decreased mean total dose of exposure in both 2018 and 2019 when compared to the previous year. FDA-imposed limits on loperamide packaging may have contributed to both the decrease in the number of cases reported and total dose of exposure. Other factors, however, may play a role given the limitations of data collected via voluntary reports to poison centers. Further research to monitor the progression of these exposures will be helpful in informing future regulatory policies.

KEYWORDS Loperamide, medication packaging, policy

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166. The Social Networkingman's Blues: Sodium Nitrite as a Method of Suicide Prescribed by Online Communities

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Background: Sodium nitrite is an inorganic, water-soluble salt available in highly pure granular preparations from mainstream, large online marketplaces for use in meat curing. We report a series of four patients with severe methemoglobinemia secondary to sodium nitrite ingestion managed by our regional poison center.
Case Reports: Patient demographics, initial vital signs, hemoglobin and methemoglobin (MetHb) levels, methylene blue dose, and outcome are provided in Table 1.
Case 1: A 17-year-old female was brought to the emergency department (ED) by her sister. In a suicide attempt, the patient ingested "sodium something pills" which she purchased online. She quickly became unresponsive and had "chocolate brown" blood. Prior to methylene blue administration she suffered cardiac arrest. Methylene blue was administered during resuscitation, but efforts were ultimately unsuccessful.
Case 2: A 35-year-old male attempted suicide by ingesting sodium nitrite. EMS found him alert, cyanotic, and in respiratory distress. During transport he became unresponsive and asystolic. Two doses of methylene blue 1mg/kg (75mg) were administered, however, the second dose infiltrated leading to a third dose of 50mg. His blood was described as very dark but a sample adequate for laboratory evaluation was not obtained. Resuscitative efforts were terminated after one hour.
Case 3: A 17-year-old female presented "pale and cyanotic" to the ED 1.5 hours after ingesting 21g sodium nitrite which she purchased over the internet. Additionally, she ingested a half bottle of bismuth subsalicylate to prevent abdominal discomfort or emesis based on recommendations found online. She received one dose of methylene blue and improved over the next hour. Repeat MetHb level two hours post treatment was 5%. She was observed overnight with no re-emergence of methemoglobinemia or evidence of salicylate poisoning.
Case 4: A 24-year-old male presented to the ED via EMS with cyanosis approximately 45 minutes after intentional ingestion of one cup of sodium nitrite powder. He had with him a 2-pound bottle of sodium nitrite purchased from a large, commonly used online marketplace. Methylene blue was administered and over the next hour the patient had several episodes of hypotension with systolic blood pressures as low as 80 mmHg. His cyanosis resolved and a repeat MetHb level one hour after treatment was 10.5%. He was observed overnight with no re-occurrence of methemoglobinemia. He chose sodium nitrite as a method of suicide based on recommendations from a social media group intended as a support group for individuals with depression.
Case Discussion: Patients treated prior to cardiac arrest in our case series improved following a single dose of methylene blue, although variable dosing was used. Neither patient who survived exhibited a re-occurrence of methemoglobinemia following initial antidotal therapy.
Conclusions: Intentional ingestion of sodium nitrite is a contemporary method of suicide being recommended on the internet. It can result in severe methemoglobinemia capable of causing significant morbidity and mortality and is highly responsive to antidotal therapy if treated early.

KEYWORDS Sodium Nitrite, Methemoglobinemia, Social Networking

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167. Pilot Study of Bronchial Hyperreactivity in Two Strains of Mice Exposed to an Over-The-Counter Air Freshener

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Background: Some individuals with asthma and rhinitis report exacerbations with exposure to air fresheners. Investigations in experimental models may shed light on the mechanism and the components that produce the effect. The hypothesis to be tested is that exposure to an air freshener increases bronchial hyperreactivity in mice. Some strains may be more susceptible than others.
Methods: This is a randomized controlled trial in two strains of mice, C57BL/6NJ and BALB/cByj. Six mice of each strain were exposed to a commercially available automobile air freshener by suspending the air freshener in their cages for 45 days. Four of each strain were exposed to room air as control. At the end of the exposure period, mice were anesthetized, tracheotomized, and ventilated with room air. Airway measurements were made with Flexivent® (Scireq®, Montreal). Newtonian resistance (R_n) was measured at baseline, after a 10-second challenge with PBS(vehicle) and after 12 mg/ml aerosolized acetylcholine. A minimum of three baseline measurements were made, while

Table (#166).

Case Number	Demographics	Initial Vitals	Hb (g/dL)	MetHb	Methylene Blue Dose	Outcome
1	17 yo F	SpO2 79%; cardiac arrest	NR	84%	1 mg/kg	deceased
2	35 yo M	BP 90/70, HR 40-59, SpO2 80%	NR	NR	2 mg/kg*	deceased
3	17 yo F	BP 115/74, HR 130-140, SpO2 84%	13.3	>28%	1 mg/kg	survived
4	24 yo M	BP 116/54, HR 140, SpO2 87%	15.3	69%	2 mg/kg	survived

*estimated dose: see case narrative.

measurements were made approximately every 15-20 seconds after PBS and Acetylcholine (Ach) aerosols. Values reported are averages of all measurements with coefficient of determination (COD) ≥ 0.9 for each challenge per individual subject. Comparisons of baseline and post-Ach challenge Rn within each mouse strain and under each condition (exposed or control) were made using Wilcoxon signed rank test. The percent change in Rn was compared across groups and conditions using ANOVA. Significance was set at $p < 0.05$ for all comparisons.

Results: Baseline R_n was similar in the 2 strains of mice across both conditions ($p = 0.13$). With Ach challenge, the R_n increased by 92% in unexposed C57BL/6NJ mice and 155% in exposed C57BL/6NJ mice ($P = 0.20$). With Ach challenge, the R_n increased by 96% in unexposed BALB/cByj mice compared to 138% in exposed BALB/cByj mice ($P = 0.28$). In C57BL/6NJ mice that were exposed to air fresher, the R_n with ACH challenge increased 155% compared to 138% for BALB/cByj mice ($p = 0.21$). The increase in R_n with Ach challenge in exposed animals was not significantly different than that in unexposed animals for either strain of mouse. However, a power analysis of these preliminary results indicate that increasing the group sizes to 11 animals would make the differences seen reach significance.

Conclusion: This preliminary pilot study suggests that a mouse model of air freshener exposure may be an effective way to study bronchial hyper-reactivity from exposure to air fresheners. This model has the potential to elucidate the mechanism of air freshener induced bronchial hyper-reactivity and identify the component(s) that cause bronchial hyper-reactivity. Both of the strains tested show reactivity.

KEYWORDS air fresheners, asthma, bronchial hyperpreactivity

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168. Kratom (mitragynine) adverse events reported to the Food and Drug Administration

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Background: Kratom (Mitragyna speciosa) is a tropical tree that contains compounds that can have opioid-like effects. Mitragynine, an alkaloid abundant in kratom, is considered to be primarily responsible for its effects. People use kratom as a substitute for opium and to treat the symptoms of opioid withdrawal. It is currently legal in the United States (US). Adverse side effects reported with kratom include nausea, vomiting, diarrhea, hallucinations, psychosis, seizures, palpitations, dizziness, agitation, respiratory depression, itching, sweating, dry mouth, constipation, increased urination, anorexia, and weight loss. The objective of this study was to describe kratom adverse events reported to the US Food and Drug Administration (FDA).

Methods: Data were obtained from the FDA Adverse Event Reporting System (FAERS), a national database that contains reports of drug and other biologic product adverse events and medication errors. Reports are coded using the Medical Dictionary for Regulatory Activities (MedDRA), a validated, internationally standardized medical terminology. The FAERS public dashboard was searched for all records added during 2008- 2019 that reported mitragynine (kratom), and the raw data for the records were downloaded. Cases involving exposure to other substances were included in the analyses of the patient demographics but excluded from the analyses of symptoms and outcome.

Results: A total of 487 kratom adverse events were identified, 110 (22.6%) reported by a consumer, 205 (42.1%) by a healthcare professional, and 172 (35.3%) other/not specified. Of the 284 cases with a known event date after 2007, 64 (22.5%) occurred during 2008-2016, 71 (25.0%) during 2017, 104 (36.6%) during 2018, and 45 (15.8%) during 2019. Of the 406 cases with a known patient sex, 317 (78.1%) were male and 89 (21.9%) female. Of the 405 patients with a reported age, 13 (3.2%) were 0-19 years, 139 (34.3%) 20-29 years, 153 (37.8%) 30-39 years, 52 (12.8%) 40-49 years, and 48 (11.9%) 50 years or older; the mean age was 34.5 years (range 0-73 years). No other substances were reported in 204 (41.9%) of the cases. Of these 204 cases, the most frequently reported adverse reactions were 29 (14.2%) toxicity to various agents, 24 (11.8%) drug dependence, 19 (9.3%) vomiting, 12 (5.9%) nausea, 11 (5.4%) diarrhea, and 8 (3.9%) seizure. The reported outcomes were 21 (10.3%) not serious, 6 (2.9%) required intervention, 37 (18.1%) hospitalized, 13 (6.4%) disabled, 18 (8.8%) life threatening, 32 (15.7%) other outcomes, and 118 (57.8%) died.

Conclusion: Most of the kratom adverse event occurred since 2017. The majority of patients were male and age 20-39 years. Most adverse events involving only kratom had serious outcomes. However, these serious outcomes, including deaths, were not necessarily related to the kratom.

KEYWORDS kratom, mitragynine, adverse effects

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169. Cannabidiol adverse events reported to the Food and Drug Administration

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Background: Cannabidiol (CBD) is the second most common active ingredient in marijuana but without psychoactive properties. Cannabidiol is approved for the treatment of certain childhood epilepsy syndromes. CBD has been promoted to treat anxiety, insomnia, bipolar disorder, multiple sclerosis, Parkinson's disease, and schizophrenia. In the United States (US), non-Food and Drug Administration (FDA) approved cannabidiol products are classified as Schedule I drugs under the Controlled Substances Act; marijuana is a Schedule I drug. Cannabidiol is legal in some states. Information on potentially adverse events involving cannabidiol is limited. The objective of this study was to describe cannabidiol adverse events reported to the US FDA.

Methods: Data were obtained from the FDA Adverse Event Reporting System (FAERS), a national database that contains reports of drug and other biologic product adverse events and medication errors. Reports are coded using the Medical Dictionary for Regulatory Activities (MedDRA), a validated, internationally standardized medical terminology. The FAERS public dashboard was searched for all records through 2019 that reported cannabidiol without mention of tetrahydrocannabinol or Cannabis sativa, then raw data for the records were downloaded. Cases involving exposures to other substances were included in analyses of the patient demographics but excluded from analyses of symptoms and outcomes.

Results: A total of 3,470 cannabidiol adverse events were identified, 2,355 (67.9%) reported by a consumer, 1,085 (31.3%) by a healthcare professional, and 30 (0.9%) other/not specified. Of the 2,724 cases with a known event year, 15 (0.6%) occurred during 2009-2016, 21 (0.8%) during 2017, 163 (6.0%) during 2018, and 2,525 (92.7%) during 2019. Of the 292 cases with a known

patient sex, 142 (48.6%) were male and 150 (51.4%) female. Of the 245 patients with a reported age, 98 (40.0%) were 0-19 years, 32 (13.1%) 20-29 years, 24 (9.8%) 30-39 years, 37 (15.1%) 40-49 years, and 54 (22.0%) 50 years or older; the mean age was 31.2 years (range 0-82 years). No other substances were reported in 1,516 (43.7%) of the cases. Of these 1,516 cases, the most frequently reported reasons for use were 776 (51.2%) Lennox-Gastaut syndrome, 348 (23.0%) epilepsy, 103 (6.8%) seizure, and 90 (5.9%) partial seizures. The most frequently reported adverse reactions were 471 (31.1%) seizure, 196 (12.9%) diarrhea, 95 (6.3%) somnolence, 72 (4.7%) fatigue, and 69 (4.6%) decreased appetite. The reported outcomes were 1,011 (66.7%) not serious, 219 (14.4%) hospitalized, 41 (2.7%) died, 2 (0.1%) life threatening, 1 (0.1%) disabled, and 264 (17.4%) unspecified other outcomes.
Conclusion: For most adverse events involving only cannabidiol, the reason for use was epilepsy. The majority did not have serious outcomes. However, the reported adverse events may not have been caused by the drug or another product; it may have been related to an underlying condition, another drug, or other reasons.

KEYWORDS cannabidiol, CBD, adverse effects

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170. Crotalidae polyvalent immune fab (ovine) (Crofab®) adverse events reported to the Food and Drug Administration

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Background: Crotalidae polyvalent immune fab (ovine) (Crofab®) is a sheep derived antivenin indicated for the management of patients with envenomation by North American crotalids (rattlesnakes, copperheads, cottonmouths/water moccasins), which can cause serious morbidity and even death. The most common adverse effects reported with Crofab include urticaria, rash, pruritus, nausea, and back pain. Severe allergic reactions (hives and a rash and pruritus) and recurrent coagulopathy may also occur. The objective of this study was to describe Crofab adverse events reported to the United States Food and Drug Administration (FDA).
Methods: Data were obtained from the FDA Adverse Reporting System (FAERS), a national database that contains reports of drug and other biologic product adverse events and medication errors. Reports are coded using the Medical Dictionary for Regulatory Activities (MedDRA), a validated, internationally standardized medical terminology. The FAERS public dashboard was searched for all records added during 2001-2019 that reported Crofab or Crotalidae polyvalent immune fab (ovine), and the raw data for the records were downloaded. Cases involving exposure to other substances were included. The distribution of Crofab adverse events was determined for various factors related to patient demographics, circumstances of the exposure, symptoms, and outcome.
Results: A total of 571 Crofab adverse events were identified, 73 (12.8%) reported by a consumer, 479 (83.9%) by a healthcare professional, and 19 (3.3%) not specified. Of the 333 cases with a known event month, 9 (2.7%) occurred in December-February, 79 (23.7%) March-May, 164 (49.2%) June-August, and 81 (24.3%) September-November. Of the 387 cases with a known patient sex, 266 (68.7%) were male and 121 (31.3%) female. Of the 326 patients with a reported age, 34 (10.4%) were 0-5 years, 24 (7.4%) 6-12 years, 25 (7.7%) 13-19 years, 193 (59.2%) 20-59 years, 28 (4.9%) 60-69 years, and 22 (6.7%) 70 years or older; the mean age was 36.9 years (range 1-83 years). The most frequently reported adverse reactions were 73 (12.8%) swelling, 68 (11.9%) pain, 63 (11.0%) peripheral swelling, 51 (8.9%) thrombocytopenia, 50 (8.8%) rash, 44 (7.7%) platelet count decreased, 42 (7.4%) coagulopathy, 41 (7.2%) hypotension, 34 (6.0%) erythema, 33 (5.8%) anaphalactic reaction, 32 (5.6%) urticaria, and 31 (5.4%) hypersensitivity. The reported outcomes were 174 (30.5%) not serious, 6 (1.1%) required intervention, 201 (35.2%) hospitalized, 39 (6.8%) disabled, 77 (13.5%) life threatening, 1 (0.2%) congenital anomaly, 242 (42.4%) other outcomes, and 36 (6.3%) died.
Conclusion: Almost half of Crofab adverse events occurred in the summer. The majority of patients were adults and males. The most frequently reported adverse reactions were swelling, pain, coagulopathy, rash, and thrombocytopenia. The majority of adverse events had serious outcomes. However, these serious outcomes, including deaths, were not necessarily related to the Crofab.

KEYWORDS crofab, antivenom, adverse effects

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171. Significant irritant-related injury of borax-containing slime products managed in emergency departments

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Background: Homemade slime is a substance that can be produced at home or at school. One version uses water, borax (sodium tetraborate), and Elmer's glue. Recipes for slime have been around for years. There have been reports of injuries when making or playing with the substance. The objective of this study was to describe slime product exposures reported to United States (US) emergency departments (EDs).
Methods: Data were obtained from the National Electronic Injury Surveillance System (NEISS), a database of consumer product-related injuries collected from the EDs of approximately 100 US hospitals. Slime product-related injuries reported during 2000-2019 were identified by searching the database's two narrative text fields for any mention of "slime" and reviewing the resulting records to determine whether the substance involved in the injury appeared to be a slime product. The distribution of slime product-related injuries was determined for various factors related to patient demographics, injury circumstances, diagnosis, and disposition.
Results: One hundred three injuries related to slime products were identified. One (1.3%) case was reported in 2003, one (1.3%) in 2009, one (1.3%) in 2014, one (1.3%) in 2016, 22 (21.4%) in 2017, 52 (50.5%) in 2018, and 25 (24.3%) in 2019. Fifty-two (50.5%) of the cases suggested that the slime product was homemade, and 9 (8.7%) mentioned that borax was specifically involved in the production of the slime. The distribution of the cases by route was 48 (46.6%) dermal, 24 (23.3%) ingestion, 13 (12.6%) otic, 11 (10.7%) ocular, 2 (1.9%) inhalation/nasal, and 5 (4.9%) unknown route. Of the 54 cases with a reported location where the injury occurred, 44 (81.5%) occurred at home, 7 (13.0%) at school, 2 (3.7%) at a sports or recreational facility, and 1 (1.9%) at public property. Thirty-three (32.0%) of the patients were age 5 years or younger, 61 (59.2%) 6-12 years, 3 (2.9%) 13-19 years, and 6 (5.8%) 20 years or older; 79 (76.7%) of the patients were female and 24 (23.3%) were male. Ninety-eight (95.1%) of the patients were treated and released from the ED. The most commonly reported symptoms were rash (n = 24,

23.3%), foreign body (n = 21, 20.4%), dermal burn (n = 9, 8.7%), dermatitis (n = 7, 6.8%), vomiting (n = 7, 6.8%), dermal pain (n = 3, 2.9%), dermal peeling (n = 3, 2.9%), and ocular pain (n = 3, 2.9%).
Conclusion: Slime product injuries reported to the NEISS increased greatly in 2017 and even more so in 2018. The effects were most likely due to the borax component of the slime and were primarily due to irritation and local corrosive effects. Some of this may be due to large quantities of borax being used in homemade products. Exposures were most likely to occur by dermal, ingestion, and otic routes and occur at home or in school. Patients tended to be children and female and did not need to be admitted to a healthcare facility. Continued surveillance of ED data may be useful to determine whether interest in homemade slime, and the injuries that may result from its production and use, will continue or wane over time.

KEYWORDS sodium tetraborate, National Electronic Injury Surveillance System, homemade slime

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172. Attempted suicide by oleander

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Background: There are two species of oleander. The common pink oleander (*Nerium oleander*) is an evergreen shrub with long, narrow leaves and red, pink, or white flowers. The entire plant contains the cardiac glycosides nerioside, oleandroside, oleandrin, and neriine - steroids that resemble digitalis. The yellow oleander (*Thevetia peruviana*), a close relative of *N. oleander*, also is an evergreen shrub with leaves like *N. oleander*, but with yellow or yellow-orange flowers. The whole plant also is poisonous, containing cardiac glycosides including thevetin A and B, thevetoxin, and peruvoside. The symptoms of oleander poisoning include nausea, vomiting, abdominal pain, dizziness, slow pulse, irregular heartbeat, dilation of the pupils, diarrhea, drowsiness, and coma. Deaths have been reported with oleander ingestion, and the plant has been used to commit attempted murder and suicide. The objective of this study was to describe attempted suicides involving oleander reported to poison centers.
Methods: Cases were oleander ingestions reported to a large, statewide poison center network during 2000-2018 where the exposure reason was intentional-suicide. Ingestions involving substances in addition to oleander were excluded. The distribution of cases was determined for various factors related to patient demographics, exposure circumstances, management, and outcome.
Results: Fifty-five oleander ingestions met the study criteria. The plant part ingested was 30 (54.5%) leaf, 3 (5.5%) flower, 1 (1.8%) bark, 1 (1.8%) seed, 2 (3.6%) multiple parts, and 18 (32.7%) unknown. The mean patient age was 39 years (range 14-74 years); 30 (54.5%) of the patients were age 30-49 years. Twenty-nine (52.7%) of the patients were male and 26 (47.3%) female. Forty-nine (89.1%) of the ingestions occurred at the patient's own residence, 2 (3.6%) public area, 1 (1.8%) other residence, and 3 (5.5%) unspecified other/unknown location. The patient was already at/en route to a healthcare facility in 36 (65.5%) of the cases, referred to a healthcare facility in 18 (32.7%), and managed at an unspecified other site in 1 (1.8%). Of the 54 patients managed at a healthcare facility, 11 (20.4%) were treated/evaluated and released, 12 (22.2%) admitted to a critical care unit, 5 (9.3%) admitted to a non-critical care unit, 14 (25.9%) admitted to a psychiatric facility, 2 (3.7%) did not arrive at the facility, and 10 (18.5%) were lost to follow-up. The distribution by medical outcome was 13 (23.6%) no effect, 11 (20.0%) minor effect, 12 (21.8%) moderate effect, 2 (3.6%) major effect, 4 (7.3%) not followed-minimal effects possible, 11 (20.0%) unable to follow-potentially toxic, and 2 (3.6%) death. The most common reported clinical effects were vomiting (n = 17, 30.9%), nausea (n = 14, 25.5%), bradycardia (n = 7, 12.7%), abdominal pain (n = 5, 9.1%), and drowsiness/lethargy (n = 5, 9.1%). The most frequently reported treatments were IV fluids (n = 20, 36.4%), activated charcoal (n = 22, 40.0%), cathartic (n = 10, 18.2%), and antiemetic (n = 7, 12.7%).
Discussion: Most of the patients who attempted suicide with oleander were in their 30s-40s and male. Leaves were the most frequently reported plant part used. Almost half (49%) of the cases resulted in serious outcomes, including 2 deaths.

KEYWORDS oleander, flower, suicide

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173. Emergent management of W-18 synthetic opioid intoxication

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Background: W-18 (4-chloro-N-[1-[2-(4-nitrophenyl)ethyl]-2-piperidinylidene]-benzenesulfonamide) is a synthetic opioid analog similar to fentanyl originally described in 1984. Although initially shown to be a potent opioid receptor agonist, subsequent biochemical studies revealed no significant inhibition of κ-, μ-, or δ-opioid receptors. Non-opioid receptors, including various serotonin receptor subunits and benzodiazepine receptors, were bound with low affinity. According to *in vivo* and murine studies, W-18 is expected to have less analgesic effect, similar euphoria, and low naloxone sensitization compared to other synthetic opioids. We report a case of purposefully purchased and abused W-18 that resulted in opioid toxicity.
Case Report: A 25-year-old male with a past medical history significant for intravenous (IV) drug use, hepatitis C, methicillin-resistant *Staphylococcus aureus* (MRSA) bacteremia, alcohol abuse, and seizure disorder presented to the Emergency Department (ED) after being found unresponsive at home. The patient reported injecting with a friend when he began feeling sick. He tried to call for help but was unable to recall if he or his friend contacted emergency medical services (EMS) or any of the ensuing events. EMS reported the patient was unresponsive with agonal respirations and administered naloxone 4 mg intranasally followed by naloxone 2 mg IV with a positive response. Upon arrival to the ED, the patient was initially somnolent but later admitted to injecting fentanyl and a powdery substance called W-18. Per EMS, other subjects on the scene also reported W-18 use.
In the ED, physical examination revealed sluggish, dilated pupils to 5 mm bilaterally. Vital signs: HR 118, BP 138/82, RR 14, SpO2 100% on room air, T 36.5 °C. The urine drug screen was positive for amphetamines, benzodiazepines, and cannabinoids. The serum alcohol level was negative. Given the team's unfamiliarity with W-18, the patient did not receive additional boluses of naloxone but was instead proactively started on a naloxone continuous infusion at a rate of 0.4 mg/hr for 8 hours to ensure the respiratory rate remained above 8 breaths/min and oxygen saturation above 95%. The patient's vitals were maintained above the set parameters throughout ED management and 8 hours after presentation.
The patient was admitted to the intensive care unit for management of unintentional overdose. The following day the patient

tolerated discontinuation of continuous naloxone and was discharged.
Final analysis of the patient's blood detected amphetamines, benzodiazepines, and cannabinoids at unknown concentrations. Confirmatory analysis of W-18 intoxication via synthetic opioid urine drug screen was made impossible due to the patient's urine sample being discarded.
Case Discussion: This case is concerning given the novelty of the injected agent with little literature to describe its effects in humans. Users may not understand its effects or the implications of its naloxone insensitivity. In this case, the patient expected a slight euphoria rather than the resultant respiratory depression requiring hospitalization.
Conclusions: Limited information regarding W-18 and its effects are available in scientific literature with little information regarding its management with naloxone. This case report describes the successful management of possible W-18 intoxication with naloxone.

KEYWORDS opioid, synthetic, abuse
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174. Severe Methanol Toxicity Requiring Hemodialysis Resulting from Recreational Huffing of Lacquer Thinner

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Background: Methanol is a toxic alcohol that can result in severe morbidity and mortality following exposure. The typical exposure is via ingestion, and toxicity resulting from inhalation is rarely reported.
Case Report: This is a single patient case report. A 54-year-old male patient with a history of alcohol and inhalant abuse presented to the ED for evaluation of jaw and chest pain. He had been huffing lacquer thinner to treat his discomfort. The Safety Data Sheet (SDS) of the lacquer thinner was notable for methanol, acetone, toluene, and 2-butoxyethanol. His physical exam was unremarkable while initial blood work revealed a bicarbonate level of 15 mMol/L, an anion gap of 19.5 mEq/L, an undetectable ethanol level, and a normal creatinine. Fomepizole was empirically administered, and he was admitted for observation. Overnight, the patient developed encephalopathy and was transferred to the ICU. By morning, the methanol level returned elevated at 124 mg/dL with an acetone level of 37 mg/dL. The patient underwent 7 hours of hemodialysis until his methanol level was 20 mg/dL and acetone was 8 mg/dL. Levels the following day were undetectable. Fomepizole was continued throughout dialysis. The patient developed no adverse sequelae from his exposure. His cardiac evaluation was unremarkable.
Discussion: Unlike other toxic alcohols, methanol can result in systemic toxicity from inhalational exposure. If not considered, this route of exposure can easily be overlooked and may result in significant morbidity and mortality. Methanol toxicity via inhalation has been documented in both the recreational and occupational settings due to exposure to industrial solvent fumes, particularly carburetor cleaners. Treatment is the same as for methanol toxicity due to ingestion, with particular focus on inhibition of alcohol dehydrogenase and hemodialysis. This case serves as a reminder to consider methanol intoxication in patients with a history of huffing solvents. If available, a SDS can be particularly helpful in making this diagnosis.
Conclusion: Huffing methanol products can lead to significant methanol toxicity requiring fomepizole and hemodialysis. Scrutiny of a product's SDS is important to exclude methanol exposure.

KEYWORDS inhalational methanol toxicity, lacquer thinner, hemodialysis
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175. Massive Baclofen Overdose Due to Dosing Error in a Pediatric Patient

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Background: Baclofen is a GABA B agonist that is routinely prescribed in pediatric patients for management of spasticity. Dosing of oral baclofen solutions can be confusing to caregivers and may lead to inadvertent overdoses. We describe a case of massive baclofen overdose due to dosing errors occurring over a 24-hour period.
Case Report: A 2-year-old boy with a history of metachromatic leukodystrophy presented to the emergency department with a change in mental status. He was prescribed baclofen for spasticity and was taking 2.5mg (0.25mL) three times a day (TID). The night prior to presentation his mother had been instructed to increase the dose to "5" TID, which the mother interpreted to be 5mL TID, rather than the 0.5mL (5mg) dose that was intended. The patient had received three doses of 50 mg of baclofen prior to presentation, which amounted to a 10-fold overdose per administration. In the emergency department, the patient was minimally responsive and withdrawing from pain in his upper extremities with little spontaneous movement. The patient was on BiPAP for 16-18 hours daily at baseline and was saturating normally with preserved respiratory drive. Venous blood gas revealed no respiratory acidosis, and his laboratory evaluation was otherwise unremarkable. He was admitted to the PICU for close observation on home BiPAP settings. Following admission to the PICU, he developed bradypnea and required additional support with an oropharyngeal airway. He gradually returned to baseline and was transferred out of the PICU two days later. Baclofen was subsequently restarted, and dosing instructions were carefully reviewed with the mother. Baclofen level was drawn at presentation and was markedly elevated at 1.3 mcg/mL (therapeutic range 0.08-0.4 mcg/mL).
Discussion: Baclofen is a GABA B agonist that is prescribed to pediatric patients for management of spasticity. Due to the presence of both presynaptic and postsynaptic GABA B receptors, patients can present with both agitation and sedation in overdose; however, sedation tends to predominate in massive overdose. Patients can also present with hypertension, bradypnea or apnea, seizures, and diminished reflexes. Our patient developed bradypnea requiring more aggressive ventilatory support with an oropharyngeal airway, but he otherwise had a benign clinical course. The formulations and dosing regimens of baclofen can be confusing to caregivers, and practitioners who prescribe baclofen to pediatric patients should ensure that dosing is reviewed to avoid inadvertent overdoses in the outpatient setting.
Conclusion: Confusion regarding baclofen dosing can result in inadvertent overdoses. We highlight the case of a massive baclofen overdose in a pediatric patient due to a dosing error who required PICU admission for observation and respiratory support.

KEYWORDS baclofen overdose, medication error, pediatric patient

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176. Does time to treatment after Crotaline envenomation predict amount of antivenom used to achieve initial control?

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Background: Timely crotalidae polyvalent immune Fab (FabAV) administration is recommended after clinically significant Crotaline envenomation with the immediate goal of achieving initial control (IC). Few studies have examined whether time to treatment after envenomation affects the achievement of IC, although one study found that early time to treatment led to faster overall recovery. Therefore the purpose of this study was to determine whether time to treatment after Crotaline envenomation predicts the dose of antivenom required to achieve IC. A secondary aim was to determine whether treatment after six hours of envenomation decreased the odds of achieving IC with the first dose of FabAV.

Methods: A retrospective cohort study was conducted using data collected prospectively from three US regional poison centers. Cases were included if the subject was envenomated by a rattlesnake, copperhead, cottonmouth, or unknown Crotaline snake and treated with FabAV. Linear regression was used to model the relationship between time to treatment after envenomation and the dose of antivenom used to achieve IC of venom effects, adjusting for subject age, sex, and snake type. Fisher's exact test was used to test the association between treatment within 6 hours and achieving IC with the first dose of FabAV.

Results: A total of 51 patients were included in the analysis. The majority of patients were bitten by rattlesnakes (n = 19), followed by copperheads (n = 15), unknown Crotaline snakes (n = 11) and cottonmouths (n = 6). An average of 6.6 vials (SD =2.83 vials) of antivenom was required to achieve IC. Mean time to treatment was 4.35 hours (SD =3.56 hours). After adjusting for covariates, no significant association between time to treatment and antivenom required to achieve IC was observed (p = 0.21). Patients treated after 6 hours of envenomation were as likely to achieve IC with the first dose of antivenom as those treated within 6 hours (80.0% and 64.3% of patients respectively; OR =0.45, 95% CI 0.08, 2.40).

Conclusions: These findings suggest that a delay in treatment after Crotaline envenomation may not significantly impact the ability to gain initial control of signs and symptoms with FabAV. This study did not examine other outcomes that are known to be improved by early treatment, such as limb function. Follow-up analyses with a larger sample should be performed to understand the factors associated with achieving IC, including time to antivenom treatment. Furthermore, future studies should be conducted to model the effect with other antivenoms including Crotalidae Immune F(ab')2.

KEYWORDS Crotaline envenomation, Antivenom, Initial control

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177. Essential oil poisonings: Epidemiology and outcomes over a ten-year period

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Background: Essential oils (EOs) are concentrated plant extracts used for medicinal, cleaning, and other household purposes and are among the top 20 substance categories most frequently involved in pediatric exposures reported to US poison centers. There is a common misconception that EOs are safe by virtue of being "natural," although many may be toxic when misused. The purpose of this study is to describe the epidemiology of EO exposures over a ten-year period in pediatric and adult populations and compare medical outcomes across EO types.

Table 1(#177). Known outcomes of pediatric (<12 years of age) exposures by essential oil type.

	Allspice Oil (n = 926)	Cinnamon Oil (n = 3,460)	Clove Oil (n = 3,095)	Combination Oil (n = 750)	Eucalyptus Oil (n = 4,492)	Lavender Oil (n = 1,962)	Lemon Oil (n = 405)	Lemongrass Oil (n = 330)	Peppermint Oil (n = 3,171)	Tea Tree Oil (n = 13,599)
Clinically Significant Effect	17 (1.84%)	80 (2.31%)	69 (2.23%)	10 (1.33%)	115 (2.56%)	21 (1.07%)	8 (1.98%)	5 (1.52%)	81 (2.55%)	284 (2.09%)
Minor Effect	313 (33.80%)	1,933 (55.87%)	1,296 (41.87%)	244 (32.53%)	1,504 (33.48%)	571 (29.10%)	146 (36.05%)	171 (51.82%)	1,653 (52.13%)	4,073 (29.95%)
No or Unrelated Effect	596 (64.36%)	1,447 (41.82%)	1,730 (55.90%)	496 (66.13%)	2,873 (63.96%)	1,370 (69.83%)	251 (61.98%)	154 (46.67%)	1,437 (45.32%)	9,242 (67.96%)

Table 2(#177). Known outcomes of adult (≥12 years of age) exposures by essential oil type.

	Allspice Oil (n = 135)	Cinnamon Oil (n = 1,104)	Clove Oil (n = 843)	Combination Oil (n = 123)	Eucalyptus Oil (n = 1,494)	Lavender Oil (n = 441)	Lemon Oil (n = 142)	Lemongrass Oil (n = 101)	Peppermint Oil (n = 1,134)	Tea Tree Oil (n = 4,252)
Clinically Significant Effect	9 (6.67%)	110 (9.96%)	79 (9.37%)	8 (6.50%)	122 (8.17%)	30 (6.80%)	8 (5.63%)	9 (8.91%)	54 (4.76%)	226 (5.32%)
Minor Effect	64 (47.41%)	679 (61.50%)	488 (57.89%)	61 (49.59%)	731 (48.93%)	238 (53.97%)	75 (52.82%)	60 (59.41%)	684 (60.32%)	1,917 (45.08%)
No or Unrelated Effect	62 (45.93%)	315 (28.53%)	276 (32.74%)	54 (43.90%)	641 (42.90%)	173 (39.23%)	59 (41.55%)	32 (31.68%)	396 (34.92%)	2,109 (49.60%)

Methods: This retrospective cohort study investigated EO exposures reported to the National Poison Data System from January 1 2009 to December 31 2018. Cases were identified using EO generic codes. Products were categorized into EO type and the ten most common EO types were analyzed. Cases with unspecified or multiple products, unknown age, and confirmed non-exposures were excluded. Cases were analyzed by route, exposure reason, and medical outcome for pediatric (<12 years) and adult (≥12 years) populations. For cases followed to a known outcome, outcomes were collapsed into three categories: No or Unrelated Effect, Minor Effect, or Clinically Significant Effect (Moderate Effect, Major Effect, or Death). Outcomes were compared by EO type for both age groups using Chi-Square tests.
Results: Cases involving the ten most common EOs (n = 98,495) accounted for 73.6% of all EO exposures and included tea tree, eucalyptus, peppermint, cinnamon, clove, lavender, allspice, combination, lemon, and lemongrass oils. The majority of cases (73.0%) were pediatric. Most pediatric cases (94.6%) were unintentional-general exposures, while unintentional-misuse (34.6%) and unintentional-general (34.1%) were the most common exposure reasons in adults. The most common route was ingestion for pediatric (88.6%) and adult (69.4%) cases. Most products were liquid formulations, although 4.6% were reported as solids, powders, or patches. The majority of pediatric (55.2%) and adult (63.2%) cases were not followed to a known outcome. One percent of pediatric and 2.5% of adult cases experienced a clinically significant effect, while 16.5% and 18.8% involved a minor effect, respectively. Two fatalities were reported – one involving a eucalyptus product and the other a cinnamon product. Severity of outcome varied significantly by EO type for both age groups ($p < 0.001$). Eucalyptus (2.6%), peppermint (2.6%), and cinnamon (2.3%) oil exposures had the highest proportion of clinically significant outcomes in pediatric cases (Table 1). Cinnamon (10.0%), clove (9.4%), and lemongrass (8.9%) had the highest proportion of clinically significant outcomes in adults (Table 2).
Conclusions: A total of 98,495 single product exposures involving the ten most common EOs were reported to US poison centers over a ten-year period, the majority involving children <12 years. A limitation of this study is that EO generic codes may include substance formulations other than liquids. While most exposures involved no or unrelated effects or were not followed to a known outcome, adult exposures and some types of EOs involved a higher proportion of clinically significant outcomes. These differences suggest that some EOs may pose a different risk and further investigation into the safety of specific products may be warranted.

KEYWORDS Essential oils, Poisoning, Medical outcome

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178. Triprolidine pediatric exposures reported to United States poison centers: 2000-2019–Save yourself a 'trip' to the emergency department

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Introduction: Triprolidine is a first-generation antihistamine that features a fast onset of action and short duration. Triprolidine is commonly available as a pediatric formulation at 0.625 or 0.938 mg/mL in a 30 mL bottle. Calls to poison control centers regarding triprolidine therapeutic errors or exploratory ingestions often result in hospital evaluation due to concern for antihistaminic and anticholinergic toxic effects. There is little formal guidance for poison specialists to use as referral criteria for home management, hospital referral, or disposition. The study objective was to use a national poison database to describe the outcomes of pediatric exposures to triprolidine.
Methods: This study describes pediatric (5 years and younger) single-substance exposures of liquid triprolidine formulations reported to US poison control centers during 2001 to 2019 from the National Poison Data System (NPDS). This includes unintentional misuse, general, and therapeutic error exposures. The distribution of cases was determined for various factors relating to patient demographics, exposure circumstances, management, and outcome. We used descriptive statistics to analyze the data.
Results: Of 1045 total triprolidine ingestions reported, 620 (59.3%) were reported as general exposures and 419 (40.10%) as therapeutic errors. There were 420 children aged 0-2 years and 625 children between the aged of 3-5 years, with 515 (49.3%) being female. Most exposures were acute (968, 92.7%) and occurred in the home (1033, 98.9%). The patient was managed on site in 70.9% of the cases, already at or en-route to a healthcare facility in 20.9%, and referred to a healthcare facility in 7.5% of cases. The distribution by medical outcome was 36.8% no effect, 5.9% minor effect, 1.2% moderate effect (mostly drowsiness that resolved in under 8 hours; also, 1 admission that featured tachycardia that resolved with IV fluids), 52.4% not followed – no or minimal effects possible, 3.6% unable to follow – potentially toxic, and 4.5% unrelated effect. No major clinical effects or deaths were reported. Of 458 cases reported to a known outcome, the most frequently reported clinical effects were drowsiness, lethargy, or mild CNS depression (69, 15%), tachycardia (13, 2.84%), agitation (11, 2.4%), and vomiting (6, 1.3%). Three of the four ICU admissions were asymptomatic. Of four non-critical admissions, one had tachycardia, and one reported agitation not known to be related. The most common overall treatments were dilution (29%) and food (12.9%). Among patients en-route or referred to the hospital (296), treatments included activated charcoal (4.1%), benzodiazepines (2.3%), and IV fluids (1.0%).
Discussion: Most reported triprolidine exposures (93.8%) resulted in no effects, minimal effects possible, or unrelated effects. The most frequently reported clinical effect was drowsiness, consistent with a first-generation antihistamine. No patient required aggressive intervention; seven of eight admitted patients were asymptomatic, and all patients recovered with no clinical sequelae; yet over 28% of exposures were already at, en-route to, or referred to a healthcare facility. There were no seizures, arrhythmias, or fatalities. Triprolidine appears to be a safe medication that allows home observation after exposure.
Conclusion: Pediatric exposure to triprolidine resulted in mostly minor drowsiness that warrants home observation.

KEYWORDS triprolidine, antihistamine, pediatric

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179. What is the clinical course of severe benzonatate poisonings

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Background/Objectives: Benzonatate is a commonly prescribed cough medication with over 3 million prescriptions per year in 2016. It is known that acute overdose of a small number of capsules can be lethal. This was a descriptive study using the National Poison Data System (NPDS) fatalities module in combination with a systematic review to describe the course of severe poisoning and deaths from benzonatate.
Methods: The NPDS was queried from 2000–2018 for benzonatate fatalities. Fatality abstracts were requested and cases were included if the relative contribution to fatality was undoubtedly

Table 1(#179). Clinical Effects and Treatments of Benzonatate Poisonings.

	All Patients (n = 36)	Lived (n = 13)	Died (n = 23)
Age, median (IQR)	17 (11 – 29)	20 (15 – 53)	16 (11 – 26)
Age, mean (SD)	20 (13)	22 (15)	17 (12)
Male, n (%)	N = 34	N = 11	
	12 (35.3)	6 (54.5)	6 (26.1)
Time to onset	N = 16	N = 7	N = 9
<5 minutes	9 (56.3)	3 (42.9)	6 (66.7)
≤30 minutes	3 (18.8)	3 (42.8)	–
>30 minutes	4 (25.0)	1 (14.3)	3 (33.3)
Clinical effects			
Seizures	24 (66.7)	11 (84.6)	13 (56.5)
Status epilepticus	6 (16.7)	2 (15.4)	4 (17.4)
Dysrhythmias, any	24 (66.7)	6 (46.2)	18 (78.2)
Asystole	12 (33.3)	–	12 (52.2)
Pulseless electrical activity	4 (11.1)	–	4 (17.4)
Ventricular tachycardia	4 (11.1)	2 (15.4)	2 (8.7)
Ventricular fibrillation	8 (22.2)	3 (23.1)	5 (21.7)
Other	2 (5.6)	1 (7.7)	1 (4.3)
Cardiac arrest	29 (80.6)	6 (46.2)	23 (100)
ROSC	23 (63.9)	6 (46.2)	17 (73.9)
Tachycardia	17 (47.2)	6 (46.2)	11 (47.8)
Hypotension	18 (50.0)	4 (30.8)	14 (60.9)
Treatments performed			
Activated charcoal	5 (13.9)	3 (23.1)	2 (8.7)
Gastric lavage	3 (8.3)	2 (15.4)	1 (4.3)
Vasopressors	20 (55.6)	5 (38.4)	15 (65.2)
Benzodiazepines	11 (30.6)	4 (30.8)	7 (30.4)
Sodium Bicarbonate	13 (36.1)	3 (23.1)	10 (43.4)
Intravenous fluids	18 (50.0)	3 (23.1)	15 (65.2)
Intravenous lipids	6 (16.7)	1 (7.7)	5 (21.7)
Intubation	26 (72.2)	7 (53.8)	19 (82.6)
CPR	28 (77.8)	6 (46.2)	22 (95.7)

responsible or probably responsible for the death and the only clinically relevant exposure was benzonatate. Two independent authors performed searches of Pubmed, Cochrane, Embase, and Google scholar for combinations of benzonatate and "poisoning," "overdose," and "toxicity." Additionally, references of relevant articles were searched for additional studies. The only limitation on the type of article was English language. Articles were included if they described the clinical course of at least one patient suffering from poisoning from benzonatate. Studies and articles that provided only coded data were excluded from analysis unless they described individual severe cases. Both authors independently reviewed titles and abstracts of each article and determined which were to be included for review. Both authors extracted data from each article and fatality abstracts. Discrepancies were resolved through discussion.

Results: Seventeen cases from NPDS met the inclusion criteria. A total of 63 articles were screened for inclusion, and 18 met the inclusion criteria with a total of 19 cases, leaving the final number of patient cases to 36. The majority patients were young [17 (11–29), median (IQR)], female (22), and mostly intentional self-harm exposures (28) with a rapid onset of toxicity of <5 minutes (9). Most common symptoms included cardiac arrest (29), seizures (24), and dysrhythmias (24). Specific dysrhythmias included asystole, pulseless electrical activity, ventricular tachycardia, and ventricular fibrillation. Treatments included intubation (26), cardiopulmonary resuscitation (28), vasopressors (20) and others seen in Table 1. Six patients received intravenous lipid emulsion therapy, one of which survived. Return of spontaneous circulation was achieved in 23/28 patients, but most had significant neurologic deficits or other end organ damage and 5 survived with a good neurologic outcome. Patients who survived had resolution of cardiovascular symptoms within 2 hours and most were extubated within the day. Some had prolonged hospitalization due to aspiration.

Conclusions: Intentional acute ingestions of benzonatate cause significant toxicity with a rapid onset of effect. Interventions performed were generally supportive in nature. Duration of directly toxic effects is short, but dramatic with neurologic devastation and patients who are resuscitated often still have a poor outcome.

KEYWORDS Overdose, Critical Care, Cardiotoxicity

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180. Evaluation of Perampanel Exposures Reported to the National Poison Data System (NPDS)

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Background/Objectives: Perampanel is a newer antiepileptic agent that was approved in 2012 for use in adults with partial onset seizures. The mechanism is unique among antiepileptic agents as it inhibits glutamate activity on AMPA (alpha-amino-3-hydroxy-5-methyl-4-isoxazole propionic acid) receptors. Currently, there are few published case reports describing acute overdose. Reported symptoms included prolonged central nervous system depression, respiratory depression, and aggressive behavior requiring chemical and physical restraints. Recently, approval was expanded for more types of seizures and for use in children making it more available. This study was undertaken to describe acute perampanel exposures reported to NPDS.

Methods: This is a retrospective observational study of all single-substance perampanel ingestions from January 2014 to December 2019 reported to NPDS. The primary objective was to describe the clinical effects of perampanel exposures. Secondary outcomes include evaluation of management and investigation of the dose effect relationship for purpose of triaging acute unintentional exposures.

Results: A total of 138 exposures were reported to NPDS since the release of the agent with a steady increase every year from 6 cases in 2014 to 39 in 2019. Median age was 20 years (IQR 10–38) with 68 (49.3%) males. The reason for exposure was most commonly therapeutic error (80, 58.0%), followed by exploratory ingestion (24, 17.4%), and suicidal ingestion (14, 10.1%). A total of 6 (4.3%) patients developed major effects, 20 (14.5%) moderate, 32 (23.2%) minor effects and 22 (15.9%) no effect. An additional 54 (39.1%) cases were not followed, mainly assessed as minimal clinical effects possible. The majority of patients were managed at home (63, 45.7%). Of those that were in a healthcare facility (HCF) (n = 72), most were treated/evaluated and released (31, 43.1%), followed by admission to a non-critical care unit (20, 27.8%), and critical care unit (13, 18.1%). Most frequently reported symptoms were drowsiness (27, 19.6%), agitation (20, 14.5%), ataxia (13, 9.4%), and confusion (12, 8.7%). The most common therapies provided in a HCF were IV fluids (22,30.6%), followed by benzodiazepines (14, 19.4%), then other types of sedation (9, 12.5%). Five patients were intubated, one of whom required vasopressors. As there were only 24 unintentional exposures in children <6 years with 16 reported doses, a dose cut off for moderate/major effects could not be established. The lowest reported dose to cause moderate/major effects was 2 mg in a 21-year-old.

Conclusions: Reported exposures of perampanel have increased. While drowsiness, agitation, ataxia and confusion were the most commonly reported symptoms, almost 4% of patients received potentially life-saving interventions.

KEYWORDS Poison Center, Overdose, perampanel

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181. Should we be concerned about acute unintentional exposures of chloroquine and hydroxychloroquine in children?

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Background: The use of chloroquine (CQ) and hydroxychloroquine (HCQ) has been revitalized since the SARS-CoV-2 disease (COVID-19) pandemic. Deaths due to intentional exposure to chloroquine compounds quickly emerged and poison control centers acted rapidly to disseminate information on the dangers of these compounds, especially in the pediatric population where older case reports describe fatalities due to unintentional ingestion. However, no formal evaluation has been completed assessing risk of severe outcomes and death.
Methods: This is a retrospective observational study of acute unintentional ingestions of chloroquine and hydroxychloroquine from 2000–2019 in children <6 years reported to the National Poison Data System. The primary objective was to describe the clinical effects and outcomes of acute unintentional exposures. Secondary outcomes were to investigate if a dose response relationship exists for the purpose of triaging.
Results: A total of 1143 exposures were included in the final analysis, 120 CQ and 1023 HCQ with a marked increase in exposures since 2009. Median age of exposure was 2 (IQR 1.5–2) with an equal gender distribution (males, 50.7%). The majority of patients were managed in a healthcare facility (845, 73.9%); most were treated and released from the emergency department (647, 56.6%), followed by admission to a critical care unit (96, 8.4%), and non-critical care unit (79, 6.9%). An additional 293 (25.6%) were managed at home and 5 (0.4%) at other sites. Most children had no effects (984, 86.1%) or minor effects (126 (11.0%); 26 (2.3%) developed moderate or major effects, and 7 (0.6%) were unable to be followed; no deaths were reported. Critical care admissions (16, 13.3%; 80, 7.8%) and moderate/major effects (5, 4.2%; 21, 2.1%) appeared to be higher in the CQ group compared to the HCQ group respectively, albeit not statistically significant. The most common symptoms included vomiting (76), nausea (11), tachycardia (11), drowsiness/lethargy (8), and diarrhea (6), which were consistent between both agents with the exception of drowsiness/lethargy only reported with HCQ. Of the patients who had moderate or major effects, symptoms included vomiting (7), electrolyte abnormalities (4), tachycardia (4), conduction disturbances (3), and hypotension (3). Treatments included gastrointestinal decontamination (437, 38.2%) in 418 patients, frequently activated charcoal (396, 34.6%). Three patients required intubation and mechanical ventilation, all CQ exposures. A total of 893 doses were available for analysis, however no dose effect relationship could be established. The median dose of patients with minor/no effect compared with moderate/major effects was found to be 9.8 mg/kg (IQR 5.8–13.6) vs 6.7 mg/kg (IQR 5.1–8.1) CQ base activity, respectively.
Conclusions: Acute unintentional exposures to CQ and HCQ can be serious, but severe outcomes are uncommon. This may be due to the high degree of concern regarding these agents, as well as the use of decontamination. Although CQ appears to be more toxic than HCQ, a dose effect relationship could not be established.

KEYWORDS COVID-19, pediatric, Chloroquine

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182. Isolated perampanel overdose presenting with lethargy for 48 hours

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Background: Perampanel is a newer antiepileptic with a unique mechanism of action and a sparsity of literature on overdose. This medication is a non-competitive α-amino-3-hydroxy-5-methyl-4-isoxazole-propionate (AMPA) glutamate receptor antagonist generally prescribed as an adjunctive agent for partial and generalized tonic-clonic seizures in patients 12 years of age or older. It was initially approved by the US Food and Drug Administration in 2012 and classified as a schedule III controlled substance by the US Drug Enforcement Agency. Common adverse events noted at therapeutic doses include dizziness, somnolence, headache, fatigue, irritability, and ataxia. A number of psychiatric adverse events have also been noted including irritability, insomnia, anxiety, depression, and aggression.
Case: We report the case of a 22 year old woman with epilepsy and cerebral palsy with a reported intentional ingestion of 120 mg of perampanel. She presented with severe lethargy but was oriented and able to answer questions. Vital signs, labs, and imaging were unremarkable. She was admitted to the ICU where her symptoms persisted and gradually improved over 48 hours of observation.
Discussion: We can reasonably anticipate that perampanel overdose, as a result of suicide attempt or recreational misadventure, will increase in incidence as the drug is more widely prescribed. A limited number of cases have been previously described in the literature. Of these, 2 cases are notable for coma and stupor followed by prolonged cognitive and cerebellar impairment lasting up to 2 weeks in adults ingesting over 200 mg of perampanel. The prolonged central nervous system effects of perampanel is attributed to its long half-life of 105 hours. Another 3 cases are notable for stupor lasting several days after smaller 40 to 60 mg though these cases are complicated by polypharmacy. An additional 2 cases describe exploratory ingestions in pediatric patients with lethargy and ataxia lasting 6 to 20 hours.
Conclusion: We report the first case to our knowledge of an intentional overdose in an adult resulting in moderate symptoms of relatively brief duration after ingesting 120 mg of perampanel. This case report provides an additional datapoint for prognosticating the clinical course of future patients.

KEYWORDS Permpanel, FYCOMPA, Antiepileptic

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183. Two Cases of Unintentional Alpha-Lipoic Acid Poisoning in Adults

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Background: Alpha-Lipoic Acid (ALA) is a nutraceutical product in the United States. ALA and its reduced form, dihydrolipoic acid (DHLA), are antioxidants and function as reactive oxygen species scavengers, metal chelators, and as a cofactor in several enzyme systems including the citric acid cycle. A very small number of published case reports currently exist in which patients

have developed delirium, agitation, lethargy, seizures (often refractory), thrombocytopenia, coagulopathy, lactic acidosis, rhabdomyolysis, multiorgan failure, and in one case, ventricular fibrillation and death. Previously reported cases have highlighted unintentional oral exposures predominantly in children and suicide attempts; we report two additional cases, unique in the route of exposure (injection) in one as well as the age (an elderly female) in the other.

Case Reports: Case 1) A 31-year-old woman presented to the ED with complaints of headache, abdominal pain and cramping, and diarrhea. She had been receiving infusions of ALA with glutathione, B vitamins, vitamin C, and magnesium for weight loss and on presentation had suspected disseminated intravascular coagulation (DIC) with possible infection including smudge cells on blood smear, WBC of 22,900, PT of 14.9 sec, INR 1.4, fibrinogen 168 mg/dL, AST 119 U/L, ALT 71 U/L, Hgb 10.8 g/dL, Hct 32.6%, and platelet count which was 44,000 initially, reaching a low of 10,000 by day 2, alongside a d-dimer level of 930 ng/mL. Her vitals were within normal limits. She received platelets and antibiotics, improved with supportive care, and was discharged on day 4.

Case 2) A 78-year-old woman called EMS with complaints of nausea, vomiting, and weakness after ingesting five of her husband's ALA 600 mg thinking they were her medications. In the ED, she developed flushing, confusion, hypertension (160/127), Hgb 10.2 g/dL, lactate 3.4 mMol/L, anion gap 18, and HCO3 of 17 mEq/L. She received ondansetron, promethazine, and IV fluids, improved by the next day, and was discharged.

Case Discussion: The first patient presented with headache, gastrointestinal symptoms, and DIC after exposure to ALA. While some of these findings could be attributed to infection or other components of her infusion, thrombocytopenia and coagulopathy have been noted in other case reports of ALA toxicity. The second patient is an older adult with exposure due to therapeutic error, and developed gastrointestinal followed by neurologic symptoms. As noted in other published case reports, GI symptoms preceded neurologic and hematologic effects in both cases. Our cases add to the literature in describing a novel route of administration as well as an experience in the elderly population. Both also highlight the narrow therapeutic index separating ALA's purported benefits and toxic effects.

Conclusions: These two unique cases describe toxicity associated with injecting ALA and an unintentional overdose in a patient over the age of 75. These cases add to the very limited literature that currently exists and provide toxicologists and poison specialists with insight into the clinical course and outcomes associated with an unintentional toxic exposure to ALA.

KEYWORDS Alpha-Lipoic Acid, ALA, Unintentional

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184. Pediatric Ingestion of Expanding Polymer Beads Requiring Surgical Intervention

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Background: Expanding polymer beads, or water beads, are a children's toy composed of a superabsorbent polymer, which swells to many times its initial size when soaked in water. In 2012 the product Water Balz was recalled after causing intestinal obstruction. However, several other brands remain on the market. An in vitro study of Orbeez® brand water beads showed expansion of these beads up to 1 cm in diameter, though less in simulated gastric fluid. No clumping was observed and the authors concluded there was little risk of obstruction. A poison center study of Orbeez® showed frequent exposures, but no major outcomes among pediatric ingestions. We were able to identify two published cases of intestinal obstruction requiring endoscopy or surgical intervention, and we present another case of expanding polymer bead ingestion requiring surgical intervention.

Case Report: The mother of a 17 month old male called the poison control center at 1000 when she found the child with evidence of vomiting during the previous night. Orbeez® brand expanding polymer beads were seen in the vomitus which were presumed to have been ingested the day before. The mother was instructed to have the child evaluated in the emergency department if vomiting continued. After the child had several more episodes of dark-colored emesis, he was taken to the emergency department and found to be pale, dehydrated, and unable to tolerate oral intake. An abdominal x-ray showed a fair amount of colonic stool, but no clear evidence of obstruction. The child was treated with ondansetron, IV fluids, and a suppository without improvement. The child was then transferred to the nearest children's hospital for further observation. The child had multiple bowel movements containing visible beads, but vomiting continued with any attempts of oral intake. On hospital day three, abdominal distension was noted and the child was taken to the operating room for esophagogastroduodenoscopy due to refractory symptoms. A bead was seen obstructing the duodenal bulb, but was unable to be removed. A laparotomy was then performed which revealed an additional swollen bead in the mid jejunum and another in the proximal ileum. All three obstructing beads were removed through a single jejunotomy site. The child subsequently improved and was discharged on hospital day five.

Case Discussion: Expanding polymer beads are often marketed as safe and non-toxic. Because ingestions are common and rarely result in serious effects, it is easy to disregard potential dangers. Referral to an emergency department or hospital admission may be avoided due to perceived safety. This case demonstrates the possibility of major effects and occasional need for imaging, endoscopy, or surgical intervention.

Conclusions: Pediatric ingestions of expanding polymer beads can frequently be managed at home. However, children with persistent vomiting, abdominal pain, or poor oral intake should be evaluated for potential intestinal obstruction.

KEYWORDS expanding polymer beads, pediatric toxicology, toys

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185. Severe Methemoglobinemia and Death from Intentional Sodium Nitrite Ingestions

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Background: Sdium nitrite is a ubiquitous chemical in both the manufacturing and food industry. It has been commonly used as a food preservative, specifically to prevent microbial growth and add a pink color to preserved meat, fish and cheese. Additionally, it is used as an anti-corrosive, in woodworking and in rubber manufacturing. It was previously a mainstay of therapy for cyanide toxicity when combined with sodium thiosulfate in the Lilly Cyanide Antidote Kit. It is an odorless white crystalline powder easily confused with table salt. Published exposures mainly describe inadvertent ingestions, but rarely, sodium nitrite has been used in intentional overdoses for the purpose of suicide.

Case Reports: Between May and November of 2019, the California Poison Control System (CPCS) consulted on five patients after intentional ingestions of sodium nitrite resulting in two cases of severe toxicity and three fatalities. No cases of intentional sodium nitrite ingestion had been reported to the CPCS over the preceding five year period. In all cases the product was acquired from online vendors.
Case 1. An eighteen-year-old man intentionally ingested approximately 15 grams of powdered sodium nitrite dissolved in dimethyl sulfoxide in a suicide attempt.
Case 2. A sixteen-year-old girl intentionally ingested approximately 60 grams of powdered sodium nitrite (99.6% by weight) dissolved in water in a suicide attempt.
Case 3. A twenty-seven-year-old man presented after an intentional ingestion of 15 grams of sodium nitrite mixed with water.
Case 4. A sixteen-year-old girl presented after an intentional ingestion of an unknown amount of sodium nitrite.
Case 5. A twenty-five-year-old man presented after intentionally ingesting 113 grams of sodium nitrite dissolved in water.
Discussion: Nitrites induce toxicity through the oxidation of ferrous iron (Fe2+) to ferric iron (Fe3+) in hemoglobin, producing methemoglobin. Blood containing methemoglobin is classically described as "chocolate brown" in appearance and is often recognized as an abnormality at the time of phlebotomy. Methemoglobin is unable to bind oxygen resulting in a functional anemia, diminished oxygen delivery to the tissues, and the development of lactic acidosis. The oxidizing effects of sodium nitrite can also independently induce hemolysis, further impairing oxygen delivery. Finally, nitrites also act as potent vasodilators in the peripheral vasculature which can produce vasodilatory shock. The lethal dose of sodium nitrite is reported to be approximately 1 gram. Treatment focuses on supportive care and the administration of the IV antidote methylene blue, which effectively reduces methemoglobin to functional hemoglobin. Alternative treatments include RBC or exchange transfusions to replace dysfunctional hemoglobin.
Conclusion: Massive ingestions of sodium nitrite, as in the cases described above, will likely require early and aggressive interventions, including higher starting doses of methylene blue, with possible need for repeated dosing, and consideration of RBC or exchange transfusion.

KEYWORDS Sodium Nitrite, Methemoglobinemia, Methylene Blue

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186. Does sodium zirconium cyclosilicate bind lithium? An in-vitro study

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Background: The AAPCC NPDS reported 7055 lithium carbonate exposures and three deaths in 2018. Lithium toxicity may warrant hemodialysis, which may not be immediately available in some settings. Sodium zirconium cyclosilicate (SZC, *Lokelma*®) is an oral potassium binding agent used for hyperkalemia. It is unknown whether SZC binds lithium (Li+).
Objective: To determine whether SZC will bind Li + ions *in-vitro* at a concentrations of clinical interest (>/= 2.5 mmol/L).
Methods: We added variable volumes of normal saline (NS) to 6 mL lithium-heparin (LiH) blood collection tubes to target [Li+] of >/= 2.5 mmol/L. Addition of 0.5, 1, 2, 3, 4, and 5 mL of NS to LiH tubes produced apparent [Li+] of 5.78, 2.84, 1.34, 0.76, 0.61, and 0.51 mmol/L, respectively. We identified 0.5, 0.75, and 1 mL as our target volumes for the rest of the study. We added 5 mg, 10 mg, 25 mg, 50 mg and 250 mg of SZC to 50 mL of NS in conical tubes. These created SZC concentrations of 0.1 mg/mL, 0.2 mg/mL, 0.5 mg/mL, 1 mg/mL, and 5 mg/mL. We vortex mixed the SZC suspensions, and pipetted aliquots of 0.5 mL, 0.75 mL and 1 mL of each SZC suspension into the LiH Vacutainer tubes (two tubes for each concentration). We placed the tubes on a rocker panel for 10 minutes, and centrifuged for 5 min at 4400 rpm. We pipetted 350 µL of the supernatant from each into 1.5 mL microcentrifuge tubes and measured Li + and sodium (Na+) using a Roche 9180 Electrolyte Analyzer with an ion selective electrode.
Results: Increasing concentrations of SZC had no effect on Li + concentrations. (Table 1 and Figure 1).
Conclusion: Sodium zirconium cyclosilicate does not reduce the lithium concentrations in this in-vitro model.

KEYWORDS lithium poisoning, potassium binder, sodium zirconium cyclosilicate

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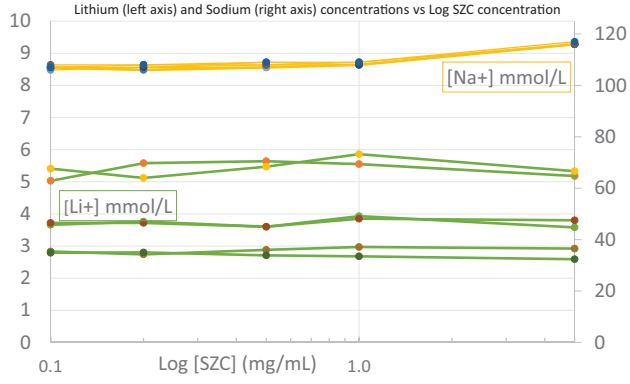

Figure 1(#186).

Table 1(#186).

Volume	0.5 mL				0.75 mL				1.0 mL			
	1		2		1		2		1		2	
Run	Na+	Li+	Na+	Li+	Na+	Li+	Na+	Li+	Na+	Li+	Na+	Li+
SZC mg/mL	mmol/L		mmol/L		mmol/L		mmol/L		mmol/L		mmol/L	
0	120	5.99	119	5.62	121	3.78	120	3.82	121	3.00	121	2.69
0.1	107	5.03	107	5.41	106	3.66	107	3.72	108	2.83	107	2.79
0.2	106	5.58	107	5.12	107	3.76	107	3.72	108	2.74	108	2.80
0.5	107	5.64	107	5.47	109	3.60	108	3.60	108	2.88	109	2.71
1.0	108	5.55	108	5.86	108	3.93	108	3.85	109	2.97	109	2.68
5.0	116	5.18	116	5.33	116	3.58	116	3.80	116	2.92	117	2.59

187. Physostigmine Use to Treat Anticholinergic Toxidrome in Pediatric Patients as Reported to the National Poison Data System

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Background: Despite recent evidence in adults of the safety of physostigmine (physo) for antimuscarinic toxicity, its use in the pediatric population is rare. It is thought that a contributing factor for this is the lack of data on efficacy or safety in the pediatric population. We sought to establish the prevalence of pediatric anticholinergic toxicity and physostigmine administration in cases reported to the National Poison Data System, as well as determine the prevalence of exposure types and determine the difference in outcomes.
Methods: This retrospective cohort study utilizes data from the National Poison Data System (NPDS) with the purpose of characterizing physostigmine use in pediatric anticholinergic toxicities. We searched the NPDS using specific xenobiotics of interest using available literature to stratify based on potency. These data were split into four cohorts: no therapy, benzodiazepine (benzo) therapy only, physostigmine therapy only, and combination therapy with physostigmine and benzos. These were analyzed for outcomes based on the NPDS outcome classifications of Minor, Moderate, Major, or Death.
Results: We included 81,969 cases from the NPDS (Table 1). Of the 3,830 cases that received specific treatment, 3,323 (86.8%) received only benzodiazepines, 436 (11.4%) received both benzodiazepines and physostigmine, and 71 (1.9%) received physostigmine alone (Table 2). No mortalities were reported in any cases that received physostigmine. Three mortalities were reported in the benzodiazepine treatment group, and two mortalities were reported that received neither therapy.
Conclusion: More recent inquiries into the safety of physostigmine show a much more favorable safety profile than previously considered. The incidence of anticholinergic toxicity has increased over time in pediatric patients, as has the overall severity of illness in patients who have been treated with benzos alone or supportive care (Figure 1). The rates of benzo treatment are also increasing over time. The same cannot be said for

Table 1(#187). Demographic Descriptions by Therapy Group.

	No Treatment (n = 105761)	Benzos Only (n = 3407)	Benzos + Physo (n = 219)	Physo Only (n = 79)
Gender				
Male	51,485	1,136	90	27
Female	54,141*	2,271	126	52
Age				
0-6 years	75,836	336	14	8
7-12 years	10,666	231	17	5
13-18 years	19,243	2,840	188	66
Mean+/-SD	5.86+/-5.13	14.18+/-4.16	14.42+/-3.47	14.0+/-4.1
Median (Years)	3.0	15.0	15.0	15.0

*Includes 10 pregnancies. 135 cases were of UNKNOWN gender.

Table 2(#187). Medical Outcomes by Therapy Group.

	No Treatment	Benzos Only	Benzos + Physo	Physo Only
Minor	15,600	381	9	6
Moderate	6,144	2,490	171	53
Major	268	449	38	12
Death	2	3	0	0
Incomplete Data	55,361	50	0	6
Effect w/ unclear association to ingestion[α]	908	15	1	2

Note: For No Treatment, there were 367 confirmednon-exposures
α Effects experienced by these cases were unrelated to the ingestion.

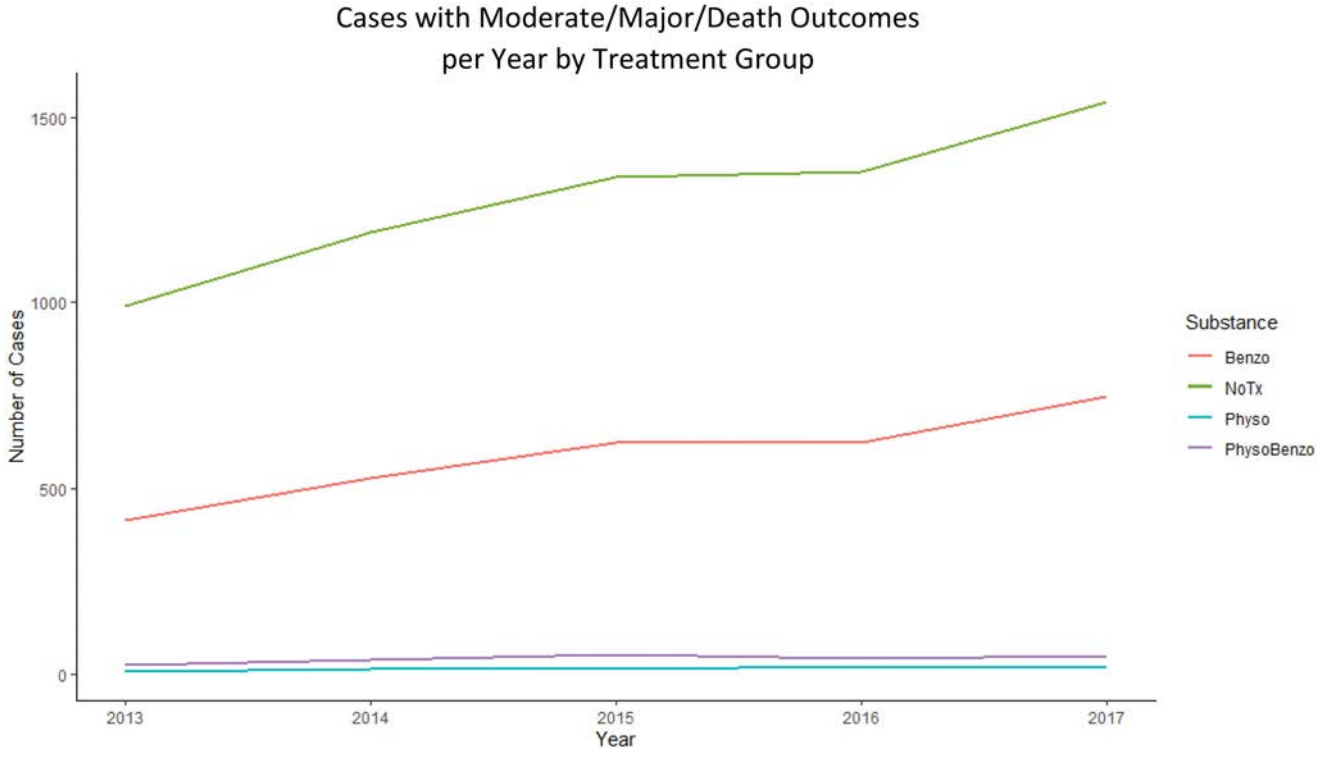

Figure 1(#187). Cases with moderate/major/death outcomes per year by treatment group.

Admission Day	1			2														3								
Time		16:00	21:35		01:00	02:00	03:00	04:00	05:00	08:27	13:34	16:00	17:34	17:40	18:20	21:36	23:04		00:19	00:32	03:06	03:26	03:55	07:12	08:47	14:13
Event		Reported Time of Ingestion	Patient Arrives to ED		HIE Starts	HIE Increase	HIE Increase	HIE Increase	HIE Increase	Intubation ECMO Starts HIE Increase	HIE Decrease	HIE Stops	Initial Hypoglycemia Episode	Initial Dextrose Bolus Given	Dextrose Infusion Start	Hypoglycemia GIR Increase	Hypoglycemia GIR Increase		Hypoglycemia GIR Increase	Labs	Hypoglycemia	Labs	Normoglycemia	Hypoglycemia	GIR Increase	GIR Decrease
Insulin Infusion Rate (units/kg/hr)			0		0.5	1.5	3	4	5	6	5	0	0	0	0	0	0		0	0	0	0	0	0	0	0
Glucose Infusion Rate (GIR; mg/kg/min)			0		0	0	0	0	0	0	0	0	0	0	1	2	2.4		4.8	4.8	4.8	4.8	4.8	4.8	6.7	2.3
Epinephrine Infusion Rate (mcg/kg/min)			0		0.8	0.8	1.4	1.6	1.6	1.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Norepinephrine Infusion Rate (mcg/kg/min)			0.2		1.2	1.2	1.6	1.6	1.6	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.45	0.45	0.4	0.35	0.35	0.25
Vasopressin Infusion Rate (units/min)			0		0	0	0	0	0.04	0.04	0.03	0.03	0.03	0.025	0.025	0.02	0.01		0	0	0	0	0	0	0	0
Insulin Concentration (mcIU/mL)																				>300		106				19
C-peptide Concentration (ng/mL)																				<0.2		<0.2			<0.2	
Glucose (mg/dL)			160		340	287	277	262	309	297	138	89	38	177	100	54	46		44	143	57	125	97	54	109	183
Creatinine (mg/dL)			1.30		1.26		1.54		1.64	1.85		1.24								0.75		0.71			0.61	0.57

Figure 1 (#188).

physostigmine administration- rates of use have remained stagnant, and the severity has not increased. Despite literature supporting the safety profile and the superior efficacy of physostigmine to treat the agitation and delirium of anticholinergic toxidromes, pediatric patients are still more likely to be treated with benzodiazepines alone than with physostigmine. The apparent reticence to use physostigmine in the pediatric population is not supported by literature.

KEYWORDS physostigmine, anticholinergic, pediatric

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188. Persistent Hyperinsulinemia Following HIE: Does ECMO Alter Insulin Pharmacokinetics?

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Background: Extracorporeal membrane oxygenation (ECMO) is a critical intervention for managing poisoned patients with persistent hemodynamic instability. Patients on ECMO often require multiple medications; however, limited data are available describing how ECMO affects drug pharmacokinetics. We present a case of recurrent hypoglycemia and hyperinsulinemia hours after hyperinsulinemia-euglycemic therapy (HIE) was terminated in the setting of ECMO for calcium channel blocker (CCB) toxicity.

Case Report: A 15-year-old, 52.5kg female presented to the emergency department approximately five hours after an intentional polypharmacy ingestion. The patient reported consuming an unknown amount of medications which may have included hydralazine, carvedilol, furosemide, metoprolol, escitalopram, levothyroxine, tramadol, hydrocodone-acetaminophen, cyclobenzaprine, nitroglycerin, levofloxacin, aspirin, and amlodipine. Initial labs revealed undetectable aspirin, ethanol, and acetaminophen concentrations. A urine drug screen was negative. An amlodipine concentration drawn approximately 9 hours after the reported ingestion was 62 ng/mL (reference range 2-25ng/mL). Metoprolol, tramadol, o-desmethyltramadol, furosemide, and cyclobenzaprine were undetectable.

The patient's arrival vital signs at 21:35 included: blood pressure 69/35 mmHg and pulse 100 beats-per-minute. Her initial blood glucose was 160mg/dL (see Figure 1 for the patient's course, select interventions, and labs). She was resuscitated with 2L of 0.9% NaCl, 1g calcium gluconate, 1mg glucagon, and was started on high-dose norepinephrine and epinephrine infusions. HIE was initiated 3 hours after presentation at 0.5 units/kg/hr without a bolus due to hypokalemia. The patient was ultimately intubated and initiated on veno-arterial ECMO approximately 11 hours after presentation due to refractory hypotension. At the time of ECMO cannulation, vasoactive therapies included: 2 mcg/kg/min of norepinephrine, 1.8 mcg/kg/min of epinephrine, 6 units/kg/hr of insulin, and 0.04 units/min of vasopressin. HIE was discontinued on day 2 due to falling patient glucose levels after a total of 72 units/kg of insulin. After discontinuing insulin, the patient experienced recurrent hypoglycemia for 16 hours despite exogenous high dose dextrose infusions.

Case Discussion: Normal elimination half-life of regular intravenous insulin is 5-15 minutes. This patient had persistently elevated exogenous insulin levels and recurrent hypoglycemia for 16 hours after discontinuation of HIE. The persistently elevated insulin concentration and prolonged half-life, despite improvement in renal function, suggests that the ECMO circuit impacted the distribution, metabolism, or elimination of exogenous insulin. Previous

research demonstrates that certain medications such as sedatives, antibiotics, and vasopressors can have altered pharmacokinetics when used with ECMO. However, there is limited information on the use of HIE with ECMO. It is possible that insulin was sequestered in the ECMO circuit leading to prolonged and persistent hypoglycemia. Alternatively, it is plausible that a distally located arterial femoral cannula or ECMO watershed area limited both hepatic and renal metabolism and/or elimination.

Conclusion:ECMO is a critical intervention in the management of hemodynamically unstable patients. Given the increased utilization of ECMO for both poisoned and other critically ill patients, clinicians should be aware that ECMO use may significantly alter drug disposition. Specifically, insulin and its effects may persist hours after its use for HIE in the setting of CCB toxicity.

KEYWORDS Pharmacokinetics, Extracorporeal Membrane Oxygenation, Poisoning

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189. Trends in Adolescent Suicide as Reported to a Regional Poison Control Center

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Background: U.S. suicide rates have increased yearly since 2000. State health department data reveal that youth suicide rates are increasing the fastest of any age group. As of 2018, our state ranks 5th in the nation for age-adjusted suicide rate and 7th in the nation for suicide as a leading cause of death. The purpose of this study is to characterize trends in suicides among adolescents as reported to the state's Poison Control Center (PCC).

Methods: A retrospective descriptive review of PCC data was pulled from January 1, 2009 to December 31, 2019 for intentional – suspected suicide cases. Eligible cases were identified using National Poison Data System (NPDS) coding reason "int – susp suicide," human, patients aged 6 years to 19 years. Nonresident patients were excluded. Data collected and analyzed included age, gender, substance exposure, and outcomes for each year over the study period. Descriptive statistics were used to characterize trends throughout the study.

Results: In total, 12,015 cases of adolescent suicides were reported during the study period. Gender results showed 73.67 % (8852) were female, 26.28% (3158) were male, and 0.04% (5) cases were documented as unknown gender. Patients had mean age of 15.9 (SD =1.964) and median age of 16 (IQR =17-15). Of the total received suicide calls, 96% of the ages involved ages 13-19 years with the largest group at age 16 years (18.9%). The rate of adolescent suicide attempts shows an increase over the time frame of the study. (Fig. 1)

Substance exposures were organized into 3 categories: prescription medications, illicit substances including ethanol, and over the counter (OTC) substances that include OTC medications, household cleaning, and cosmetic products. Over the study period, 50.29% (9618) substance exposures were prescription medications, 46.07% (8810) were over the counter (OTC) products, and 3.64% (696) were illicit substances.

Of the total 12,015 cases reviewed, all outcomes (minor, moderate, major, no effect) increased over time. Both major and minor outcomes cumulative percent rate change increased over time. Major outcomes showed a faster rate of growth when compared to the rate of growth of minor outcomes. (Fig. 2)

Conclusions: This study of trends reported to a regional poison center finds increasing yearly rates of suicide attempts among predominately female adolescents (73.88%) aged 11-19 years. The cumulative percent rate change of major outcomes escalated faster as compared to the cumulative percent rate change of minor outcomes over the 11-year period. The results of this study may represent an increasing population with an increasing potential to develop major outcomes.

KEYWORDS adolescent, suicide, Poison Center

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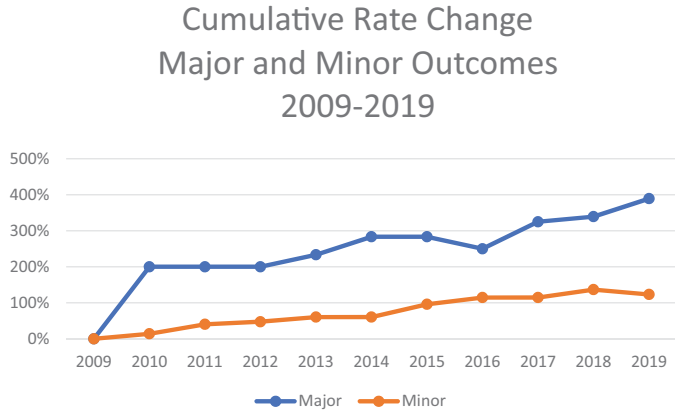

Figure 2(#189). Both major and minor outcomes cumulative percent rate change increased overtime. The cumulative percent rate change of major outcomes rose higher as compared to the cumulative percent rate change of minor outcomes over the study period.

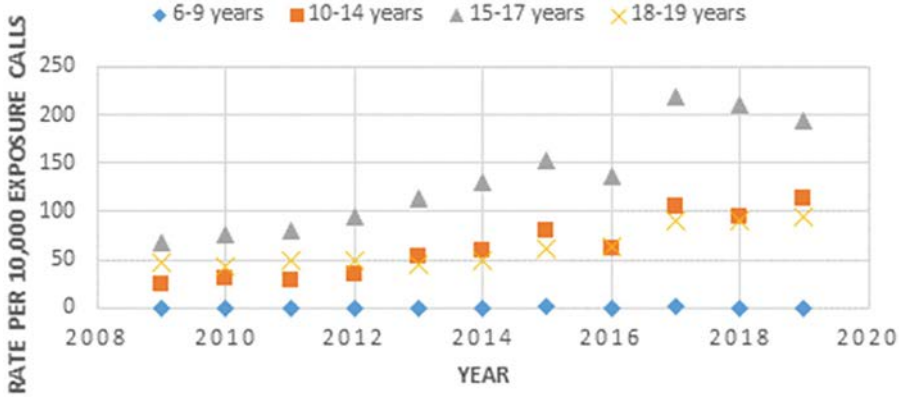

Figure 1(#189) Teen suicide rate change 2009-2019. The rate of adolescent suicide attempts shows an increase over the time frame of the study.

190. Feasibility of PharmD Specialists in Poison Information Placing Lab Orders within the Electronic Medical Record for Antidote Monitoring on Hospitalized Poisoned Patients

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Minnesota Poison Control System

Background: While many U.S. Poison Centers (PCs) are based at hospitals, communication regarding poisoned patients inside the hospital can be inefficient, leading to delays in care or errors. To minimize these inefficiencies, we sought to use our hospital's existing "Pharmacist Scope of Practice" policy to streamline care. The primary goal of this project was to have poison center SPIs who are also pharmacists order labs and levels related to drug therapy monitoring for selected poisoned patients.
Methods: This quality improvement project was deemed exempt by our IRB. Our poison center is based within a level-1 trauma center safety-net hospital with a toxicology laboratory capable of performing all labs noted in Table 1 in the usual course of clinical care, 24 hours a day, 365 days per year. Under our hospital's "Pharmacist Scope of Practice" policy, a pharmacist may place orders including, but not limited to, laboratory tests for serum drug levels, renal function, or any other laboratory test required for appropriate medication monitoring. The initial scope included a limited number of medications (see Table 1). After approval by our hospital's Pharmacy & Therapeutics committee to expand the existing policy to pharmacist-SPIs, the pharmacist-SPI could review the electronic medical record (EMR; Epic®, Verona, WI), and if labs or levels either needed to be ordered or time changed, the pharmacist would contact the team to discuss and offer to make any changes. A note would then be placed in the EMR (template displayed in Table 2), to communicate which labs/levels were ordered and for what time. Cases that used this new policy were collected using the Poison Center's EMR (Toxicall®, Computer Animation Systems, Inc, Aurora, CO) for patients with exposures listed in Table 1.
Results: From June 10, 2019 through December 31, 2019, 33 patients met criteria to have labs ordered by a pharmacist-SPI. Of the 33 eligible patients (24 acetaminophen, 3 salicylates, 3 lithium, 2 toxic alcohols, and 1 iron), labs were ordered for 5 patients (15.2%). Three of the cases were acetaminophen exposures in which APAP, LFT, and INRs were ordered for each patient; 1 aspirin case that trended serial salicylate levels, and 1 lithium case in which lithium levels and BMPs were trended. The pharmacist-SPI extended offers to the treatment team to place lab orders on 6 patients; indicating a success rate of 5/6 (83%) when an offer was made. The one case that the pharmacist-SPI did not enter labs after offering was an APAP case. Three pharmacist-SPIs entered the labs on these five cases.
Conclusion: Though the opportunities were rare and adoption to a new process can take time, when pharmacist-SPIs offered to enter labs for hospitalized poisoned patients, treatment teams commonly accepted. Moving forward, as pharmacist-SPIs get more comfortable with the process, we hope to provide and enter labs for the majority of poisoned patients. Overall, it is feasible for pharmacist-SPIs to enter labs for antidote monitoring in hospitalized poisoned patients at our hospital.

Table 1(#190). Laboratory values allowed for ordering by SPI for antidote monitoring.

Poison	Labs	Goal – determine need for:
Acetaminophen	APAP level, liver function tests, INR	NAC
Toxic alcohols	Ethylene glycol/methanol level, ethanol level, BMP, VBG, serum osmolality	fomepizole
Salicylates	Salicylate level, BMP, VBG	urinary alkalization
Cardiac glycosides	Digoxin level, BMP	digoxin-specific Fab fragments
Lithium	Lithium level, BMP	hydration with IV isotonic crystalloid
Iron	Iron level	deferoxamine

APAP: acetaminophen; INR: international normalized ratio; NAC: n-acetyl cysteine; BMP: basic metabolic panel; VBG: venous blood gas.

Table 2(#190). Note Template for use in Epic® for Pharmacist-SPI ordering of labs on Poisoned Patients.

Poison Center pharmacist has ordered labs for @NAME@ following a potential *(acetaminophen, methanol, ethylene glycol, salicylate, digoxin, lithium, iron)* overdose. The following labs have been ordered for {TIME:"***"}: *(APAP level, LFTs, INR, methanol, ethylene glycol, ASA level, BMP, VBG, digoxin level, lithium level, iron level).*Please contact the poison center with questions regarding these labs.
@ME@

KEYWORDS Antidote monitoring, Drug therapy monitoring, Process improvement

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191. Effect of Pharmacist Education and Intervention on Ketorolac Prescribing in a Large Academic Emergency Department

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Background/Objective: Pharmacists serve many important roles within the emergency department (ED) and frequently provide education on medications to clinicians and patients. A 2016 randomized double-blinded study found that 3 doses of intravenous (IV) ketorolac (10, 15, and 30 mg) provided similar analgesia for acute pain. This demonstrated a potential "analgesic ceiling" effect and suggested that doses lower than 30 mg IV may be effective. After the study was published, we implemented a reduced-dose ketorolac pathway in our institution's ED. Pharmacist education, via an email and active interventions, would be our primary methods to achieve this practice change until electronic medical record updates could be made. The aim

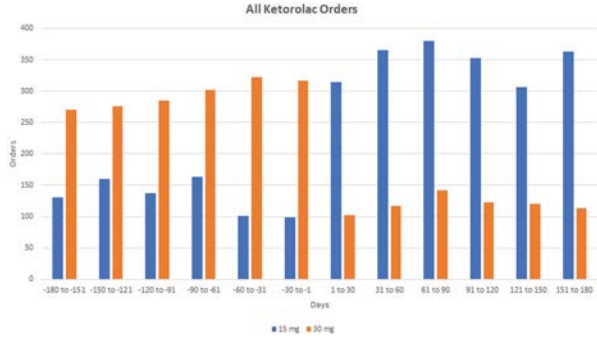

Figure 1(#191). All ketorolac orders during study period.

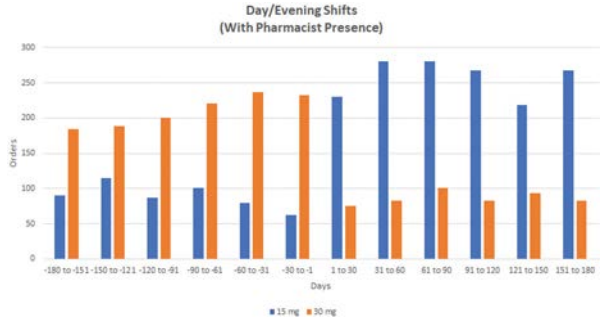

Figure 2(#191). Ketorolac orders placed between 7:00 am and 10:30 pm.

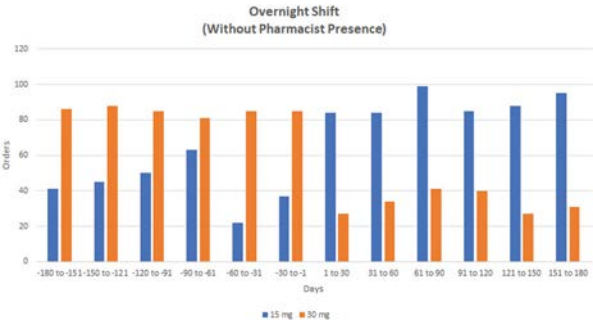

Figure 3(#191). Ketorolac orders placed between 10:30pm and 7:00 am.

of this study was to assess the impact pharmacist education and interventions had on ED clinician prescribing habits of IV ketorolac.

Methods: A retrospective, quasi-experimental study was conducted to evaluate pharmacist education via an email and active interventions on prescribing habits of ketorolac within an ED at a large, academic medical center. This email was sent to all emergency medicine clinicians and contained a concise review of the literature supporting reduced-dose ketorolac and a recommendation to order 15 mg IV (instead of 30 or 60 mg). A dataset containing all administered IV ketorolac orders administered to patients over the age of 18 years in the ED was utilized for analysis. The pre-implementation period was 180 days prior to the email intervention (6/23/2016-12/19/2016) and the post-implementation period was 180 days following the email intervention (12/21/2016-6/18/2017). The date the email was sent (12/20/2016) was excluded to provide a brief washout period. Additional analysis was conducted to assess what part of this process was driving this practice change. In order to compare the effect of the email alone to email plus active intervention by pharmacists, we compared orders placed during the day and evening shifts, when pharmacists were actively present in the ED, with overnight shifts, when pharmacists were not present.

Results: There were 5363 unique IV ketorolac orders placed during the entire time period for 4243 patients during 4597 patient encounters. Of these orders, 54% (n = 2873) were 15 mg orders with the remaining 46% (n = 2490) being 30 mg. Orders were evenly distributed between the pre-implementation (48%, n = 2564) and post-implementation (52%, n = 2799) periods. As expected, during the pre-implementation time period, 30 mg IV doses of ketorolac were most frequently ordered (average 295 orders per 30 days) with many fewer 15 mg orders (average 132 orders per 30 days). In the post-implementation period, a significant change was noted with many more 15 mg orders (average 347 orders per 30 days) than 30 mg orders (average 120 orders per 30 days) ($p < 0.00001$)(Figure 1). When orders were compared between day/evening shifts and overnight shifts, similar significant changes were found as in the overall population ($p < 0.00001$) (Figures 2 & 3).

Conclusion: This study found significant and persistent prescribing practice changes are possible simply through basic email education supported by active intervention by pharmacists.

KEYWORDS Ketorolac, Education, Safety

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192. An increased rate of opioid overdoses presenting to emergency departments during COVID-19

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Background: The SARS-COv-2 (COVID-19) pandemic began in the United States during an ongoing opioid crisis, now primarily fueled by fentanyl and fentanyl analogs. Individuals with opioid use disorder (OUD) are disproportionately susceptible to social isolation, psychiatric co-morbidities, unemployment and less access to pharmacological and counseling services for addiction. The aim of this observational study was to characterize and compare the rates of unintentional opioid overdoses presenting to

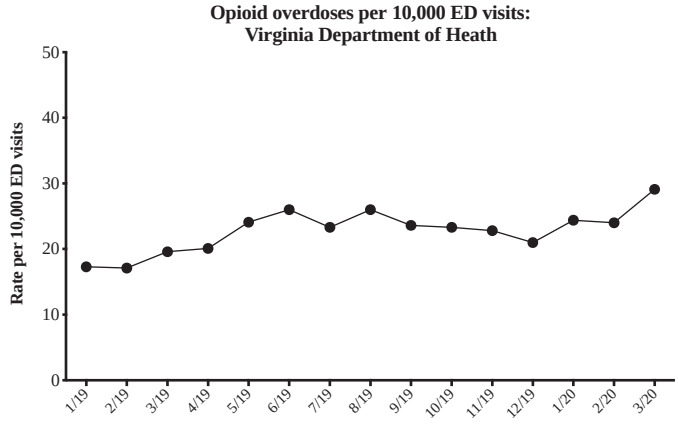

Figure 1(#192).

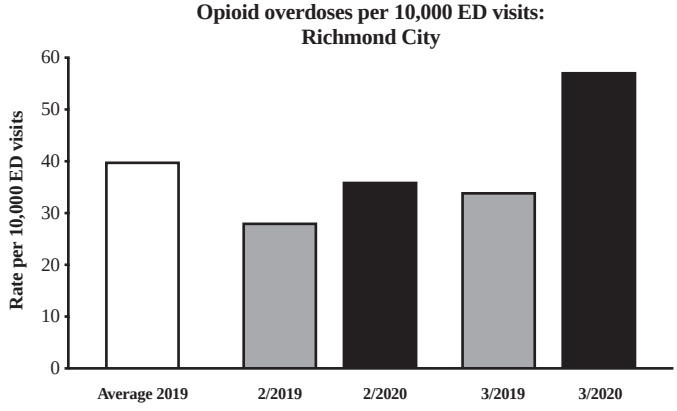

Figure 2(#192).

emergency departments (ED) in the Commonwealth of Virginia during COVID-19.
Methods: From January 2019 to March 2020, publicly available summary data of opioid overdose visits to EDs was obtained from the Virginia Department of Health. Unintentional overdose visits were identified by chief complaint terms and ICD-9 and ICD-10 diagnostic codes. The rate of unintentional opioid overdoses is represented as a mean rate per 10,000 ED visits. The rate is adjusted by using the total number of ED visits in a specific Virginia region or city as the denominator.
Results: In Virginia, the largest magnitude of difference in opioid OD ED visit rates from one month to the subsequent one occurred from February to March 2020 (29%), with an increased mean rate of 24.0 to 29.1, translating to a 21% increase (Figure 1). In addition, compared to March 2019, mean rate of ODs presenting to the ED in March 2020 increased by 48%. Similarly, the rate of ODs presenting to the ED increased by 68% from March 2019 to 2020 in Richmond City (Figure 2). Also, compared to average rate per month in 2019, the rate of opioid OD ED visits grew substantially in March 2020 in Richmond City, from 39.9 to 57.2, translating to a 43% increase. Additional data from April and May 2020 will be available for presentation at the September 2020 virtual meeting.
Conclusions: The initial rates of unintentional opioid overdose visits to EDs in Virginia have increased during COVID-19. Because of the pre-existing vulnerability to morbidity and mortality in OUD patients, clinicians will need to consider innovative ways to improve primary and secondary prevention during the ED visit.

KEYWORDS Opioid use disorder, Unintentional opioid overdose, COVID-19

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193. A 24-hour observation time is hard to swallow: Evidence for 8 hours of observation of methamphetamine stuffers

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Background: Body stuffing is the intentional ingestion, or insertion into another orifice, of an illicit drug in a quickly packaged or unpackaged form with intent to dispose of evidence or to evade arrest. One case series demonstrated a high proportion of severe adverse outcomes in methamphetamine body stuffers and thus we currently recommend 24h observation for these patients. The optimal necessary length of observation is, however, unknown. Here we describe the demographics, clinical characteristics, therapeutic interventions, disposition, and clinical outcomes of methamphetamine stuffers treated at a single institution.
Methods: The Toxicall® database, the EMR utilized by our regional poison control system, was reviewed for all patients with "methamphetamine" listed as a substance, with "intentional misuse or abuse/unknown" listed as a reason for use from 1/1/2007-12/31/2019. Patients of all ages were included if they were identified as having "stuffed" methamphetamine and were treated at our institution, including those who stuffed multiple medications/drugs, if the drugs were unwrapped, or if the method of wrapping was unknown. Patients were excluded if the drug was unknown, duplicate cases, or if outcomes could not be determined. The patient's institutional Epic® chart was then reviewed by the authors to gather demographic and clinical information. This study was approved by the institution's IRB.
Results: 2,300 Toxicall® charts were reviewed, and 200 patients were included in the study. Patients included 128(64.0%) males, with a median age of 29-years-old(17-64). The median time to arrival following stuffing was 60min(0min-6days). Most patients (197;98.5%) reported oral stuffing or ingestion with a median dose of 1g(0.4-18g). On ED arrival, 105(52.5%) patients were tachycardic (HR$\geq$100), 6(3.0%) hyperthermic (T$\geq$38.0 °C), 55(27.5%) agitated, and 4(2%) with seizure. Twenty-one(10.5%) were intubated in the ED, with a median time of intubation to arrival in the ED of 20min(3-480min). One patient was intubated as an inpatient approximately 9 hours after arrival in the ED for somnolence following sedation for agitation. Ninety-three(46.5%) patients required medications for sedation during their ED observation, with a median time first dose of 37min(1-320min). Twenty-two(11.0%) patients developed tachycardia in the ED. The one patient who developed tachycardia at greater than 8h had a HR 107bpm without additional symptoms. Eight(4%) patients developed tachycardia during inpatient observation, not attributed to methamphetamine toxicity. Two(1.0%) patients developed hyperthermia in the ED, both within 2h of arrival and 4(2%) patients developed hyperthermia as inpatients: 2 attributed to infection, and 2 were already intubated for methamphetamine toxicity. Three patients developed agitation or altered mental status (AMS) within 70min of ED arrival, and one patient developed AMS 6h after arrival to the ED. No deaths were identified in our review, and 189(94.5%), had later documented visits at the same or other healthcare facilities.
Conclusions: This review supports an 8h observation time for methamphetamine stuffers, however, these results require external validation.

KEYWORDS Methamphetamine, Stuffer, Observation

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194. The force awakens: Packets, baggies, and delayed toxicosis

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Background: Drug stuffers ingest ill-packaged illicit substances and are commonly incentivised to provide false reports enabling escape from police custody, resulting in a potential bias toward favorable outcomes. We present two cases of markedly delayed severe toxicity in polysubstance stuffers.
Case 1: A 20yo male reported a suicidal ingestion of "$500 worth" of heroin, cocaine, fentanyl, marijuana, and methamphetamine. He was alert and oriented on EMS assessment, but became somnolent shortly after arrival. Presenting laboratory values revealed no alternate etiology of his altered sensorium. Radiodense objects consistent with drug packets were noted in the gastric antrum on presenting radiographs. He was intubated for airway protection after one hour, and admitted to the medical ICU.
The consulting regional Poison Center and toxicology service initiated activated charcoal followed by whole bowel irrigation. Several small baggies were retrieved per rectum on hospital day (HD) 2. Early on the morning of HD3 the patient developed acute, unprovoked agitation, vomiting around his endotracheal tube, tachycardia to 130 beats/min, and hypertension (160s/80s) despite propofol at 80mcg/kg/min. Symptoms were unremitting with increased propofol (140mcg/kg/min), intravenously bolused fentanyl (100mcg) and ketamine (50mg). He received >50mg of lorazepam intravenously over several minutes, eventual paralysis with vecuronium and sedation with midazolam (20mg/hr). ARDS

ensued; repeat abdominal radiograph revealed two persistent packets within the ascending colon. Urine testing on HD3 revealed methamphetamine and amphetamine, suggestive of recurrent or ongoing methamphetamine exposure. Following a complicated course, the patient discharged to an outpatient treatment center on HD15.
Case 2: A 29yo male ingested drug 'rocks' during police detainment and subsequently became unconscious and apneic. He was intubated and given 50mg of activated charcoal. Confirmatory urine testing was positive for methamphetamine and amphetamine.
Following ICU admission, he was hypotensive despite 5L of fluid; norepinephrine infusion provided hemodynamic support through HD4. Hospital course was prolonged by aspiration pneumonia and agitation with weaning attempts. On HD5 he had an episode of charcoal emesis, raising concern for slow GI transit; CT was without evidence of bowel obstruction. On HD7, he became abruptly tachypneic (RR 40s), hypertensive (>200 systolic), tachycardic (>150 beats/min), and febrile (>40 °C). He was treated presumptively for sympathomimetic toxicity from packet rupture with 4mg IV midazolam, 32mg IV lorazepam over 30 minutes, vecuronium bolus and midazolam infusion (10mg/hr), with resolution of vital sign abnormalities. Repeat confirmatory urine testing revealed methamphetamine without amphetamines, verifying recurrent methamphetamine exposure. His hospital course was complicated by MRSA pneumonia and ARDS. He was extubated on HD19 and discharged to acute rehabilitation on HD26.
Discussion: We present two cases of life-threatening sympathomimetic toxicity secondary to delayed rupture of stuffed packets. In both cases, the acute development of sympathomimetic toxicity strongly suggested recurrent exposure. Symptom timing and confirmatory urine testing supported delayed packet rupture.
Conclusion: Evidence guiding the management of drug stuffers remains limited. These cases suggest ongoing risk of delayed rupture and life-threatening toxicity, highlighting the importance of vigilance for a "second packet" phenomenon, even when initial presentation suggests content spillage.

KEYWORDS stuffer, methamphetamine, abuse

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195. Oral chemotherapeutic ingestions reported to a poison center

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Background: Oral chemotherapy/immunomodulation has become a new option for well-selected patients who can manage complex oral regimens. The approach to cancer chemotherapy has changed in recent years, and there are several new oral chemotherapeutics that offer convenience to patients. These medications do have toxicity however, which may be particularly amplified in an overdose.
Methods: This was a retrospective review of all documented oral chemotherapy overdoses reported to the California Poison Control System (CPCS) between January 2009 and December 2019. Inclusion criteria were all ingestions coded as "antineoplastic, monoclonal antibody, or thalidomide" that were evaluated at a healthcare facility. We evaluated generalized outcomes per AAPCC criteria (stratified as death, major, moderate, mild or no effect) as well as specific symptoms and interventions.
Results: There were 314 total cases reported; 169 single-substance ingestions (54%) and 145 cases with co-ingestant(s) (46%). 180 cases were female (57%) and 134 male (43%). Age ranges were as follows: ages 1-10 years old (87 cases); ages 11-19 years old (26 cases); 20-59 years old (103 cases); ages 60 and older (98 cases). The majority of cases were unintentional ingestions (199, 63%). 107 cases were intentional ingestions (34%), and 8 ingestions were unknown (3%).
The most common medication reported was methotrexate, with 140 cases (45%). The next most common medications reported included anastrozole (32 cases); azathioprine (25 cases); mercaptopurine (15 cases); capecitabine (14 cases); and letrozole (14 cases). 74 cases involved various other agents. 138 cases were admitted to the hospital for further care (ICU 63 cases; non-ICU 75 cases). The remainder of the cases were discharged home from the emergency department, left against medical advice or sent directly to psychiatric facility. Single dose activated charcoal was given in 72 cases. 84 of the methotrexate cases received the antidote leucovorin (60% of methotrexate ingestions). 5 of the capecitabine ingestions received uridine (36%). Outcomes included 124 cases with no effect, 87 cases with minor effect, 73 case with moderate effect, 26 cases with major effect, and 4 deaths. Only one death involved a single-substance ingestion (methotrexate).
Conclusion: Although methotrexate is the most common oral chemotherapeutic agent involved in overdoses reported to the CPCS, there are many other oral chemotherapeutics from various drug classes which can lead to toxicity. We found that antimetabolites, tyrosine kinase inhibitors, and aromatase inhibitors are common drug classes involved in overdoses reported to the CPCS. Although deaths are rare, further studies are needed to determine if particular drugs or drug classes warrant more scrutiny.

KEYWORDS chemotherapy, overdoses, poison center

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196. Acute Hypersensitivity Reaction from Administration of Crotalidae Immune F(ab')2 Antivenom

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Background: Each year, poison centers in the United states receive several thousand calls for venomous snake bites. In the western United States, bites are almost entirely from rattlesnakes. Symptoms of rattlesnake envenomation include local tissue damage, hemotoxicity, and less commonly, neurotoxicity. Antivenom reduces these effects, but historically was complicated by both acute and delayed hypersensitivity reactions, which is less frequently observed with Crotalidae polyvalent immune Fab (FabAV). In 2015, the Food and Drug Administration approved Crotalidae immune F(ab')2 for rattlesnake envenomation. We report the case of a 13-year-old male who suffered an acute hypersensitivity reaction from $F(ab')_2$ administered for rattlesnake envenomation.
Case Report: A 13-year-old male was bitten by a rattlesnake in his left anterior shin while walking his dog. The patient presented to the emergency department 1 hour after the bite. Symptoms were initially limited to mild local edema, but then progressed with worsening edema and severe global paresthesias. Complete blood count, coagulation studies, and fibrinogen were within normal limits. Ten vials of $F(ab')_2$ antivenom were administered at an initial rate of 25 cc/hr for 10 minutes before increasing to 250 cc/hr. The patient's paresthesias resolved. During transport to the pediatric intensive care unit (PICU), the patient developed diffuse urticaria, wheezing, and facial edema. The infusion was immediately stopped and diphenhydramine, methylprednisolone, and albuterol nebulizers were administered on arrival to the PICU. Epinephrine was recommended, but not

administered. Approximately 180/250 ccs of $F(ab')_2$ had been administered. The patient's wheezing rapidly improved and his facial edema and urticarial gradually resolved overnight, however his calf circumference increased by 2 cm. Additional $F(ab')_2$ was held and FabAV was ordered from another facility. The patient's edema showed no further progression, labs remained within normal limits, and he was discharged home on hospital day 3.

Case Discussion: Acute and delayed hypersensitivity reactions are a known danger with animal derived antivenom preparations, with anaphylactic and anaphylactoid remaining the most severe. The polyvalent whole immunoglobulin G antivenin showed rates of acute and delayed reaction of near 20% and 50% respectively. The newer FabAV product was designed to reduce immunogenicity by removing the Fc antibody region and animal proteins through use of papain digestion and an affinity chromatography column. Acute hypersensitivity reactions with FabAV are 5-6%. The $F(ab')_2$ product was designed to reduce the delayed hemotoxicity sometimes seen with the smaller FabAV product by using pepsin to cleave off the Fc antibody region, leaving a larger particle of two fab fragments. However, an affinity chromatography column is not used in purification. On initial comparison there are similar rates of adverse events between the $F(ab')_2$ product compared to FabAV antivenom.

Conclusion: The newer FabAV and F(ab')2 products have reduced the occurrence of acute hypersensitivity reactions compared to older whole IgG antivenom. However, patients remain at risk for hypersensitivity reactions when administered animal derived antivenom. Our case highlights the need for ongoing surveillance of the new F(ab')2 product to determine the incidence of acute hypersensitivity reactions when used to treat rattlesnake envenomation in humans.

KEYWORDS Rattlesnake, Antivenom, Anavip

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197. Antidote Availability and Capecitabine Toxicity

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Background: Over 1.5 million new cancers are found in the United States annually, with an increasing number of patients favoring outpatient oral chemotherapeutic treatment when available. As a result, an increasing number of oral chemotherapeutics may be available to Americans suffering a mental health crisis. Some of these agents have antidotes that are lifesaving when administered promptly. We report the case of a 48-year-old female who overdosed on her home chemotherapeutic where antidote administration was delayed.

Case Report: A 48-year-old female with a history of colon cancer presented to the emergency department (ED) 1 hour after taking fifteen tablets of her oral capecitabine with vodka in a suicide attempt. The patient reported one episode of vomiting at home 30 minutes prior to arrival. In the ED, she complained of nausea only. Her vital signs were heart rate of 83 beats per minute, blood pressure of 147/99 mmHg, respiratory rate of 20 breaths per minute, oxygen saturation of 98% on room air, and temperature of 36.9 degrees Celsius. Her exam was otherwise unremarkable. Her serum ethanol level was 0.280 g/dL. Complete blood count, comprehensive metabolic panel, and coagulation studies were within normal limits, and serum acetaminophen and salicylate levels were undetectable. Poison control was contacted and the toxicologist on call recommended uridine triacetate be administered. On follow up call, it was revealed the hospital did not carry uridine triacetate, the oncology service was unsure on how to obtain it, and the nearest tertiary care center also did not carry it. Ultimately, a vendor in the region was contacted and the antidote was delivered for administration 17 hours after the patient's ingestion. The patient completed treatment over five days and was discharged home asymptomatic with planned follow-up labs.

Case Discussion: The fluoropyrimidine chemotherapeutics are uridine analogues that competitively disrupt DNA synthesis. 5-Fluorouracil (5-FU) is used to treat breast and colorectal cancers, but requires intravenous administration due to unreliable oral absorption. Capecitabine is an oral prodrug of 5-flurouracil that is metabolized to 5-FU. Effects from Intentional self-poisoning or accidental overdose with capecitabine can be severe unless ameliorated with uridine triacetate.

Uridine triacetate is an oral antidote used to treat 5-FU or capecitabine toxicity from overdose or critical enzyme deficiency. RNA synthesis is protected through competitive inhibition of toxic 5-FU metabolites. Compared to historical controls, uridine triacetate improved survival from 5-FU or capecitabine overdose from 9.5% to 96%. However, the timing of administration is important. In one comparison, all eighteen patients given the antidote within 96 hours survived compared to only 3 out of eight patients administered the antidote after 96 hours.

Conclusion: Oral chemotherapeutics such as capecitabine offer patients an attractive home alternative to traditional infusions. However, its use may contribute to an increase in accidental and intentional fluoropyrimidine poisonings. Given the effectiveness of uridine triacetate as an antidote, it is imperative that hospitals and physicians understand its importance in managing toxicity and have a plan for rapid procurement and administration in place.

KEYWORDS Overdose, Capecitabine, Antidote

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198. QT prolongation, Torsades des Pointes, and Cardiac Arrest after 4 mg of IV Ondansetron

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Background: Ondansetron is an antiemetic used in approximately 15% of all U.S. emergency department visits from 1995-2009. A 2011 FDA "black-box" warning was issued regarding dose-related QTc prolongation and Torsades des Pointes (TdP), ultimately resulting in elimination of labeled-use of high IV doses (32mg). Ondansetron continues to be the most commonly utilized antiemetic in emergency medicine, typically at lower doses. Cases of TdP from smaller doses (4mg IV) are lacking.

Case Report: A 41-year-old-woman with alcohol use disorder (AUD) on no medications or supplements presented with one day of nausea, vomiting, epigastric pain and shortness of breath. Her presenting vitals were: temperature 36.4°C, pulse 77 beats/minute, blood pressure 129/69 mmHg, respirations 19 breaths/minute, and oxygen saturation of 100% on room air. Exam revealed only epigastric tenderness. The patient received 4mg IV ondansetron, 30mg IV ketorolac, and was placed on cardiac monitoring. An ECG obtained one minute after ondansetron demonstrated premature ventricular contractions with a QTc of 653ms. Thirteen minutes after receiving ondansetron she developed TdP, witnessed by the bedside nurse, and cardiac arrest. She received immediate CPR and IV epinephrine 1mg with defibrillation at one minute. Return of spontaneous circulation occurred at the two-minute pulse-check. She was then given 2g IV magnesium.

Table(#198). ECG and Laboratory Data Over Time.

	ED visit pre-arrest	ED visit post-arrest	Hospital day #2 of 10	Hospital day #6 of 10	Repeat visit at 18 months
ECG parameters					
HR (beats/min)	88	129	103	114	73
QT (ms)	540	384	358	312	418
QTc (ms, Bazett's)	653	562	468	430	460
Laboratory values					
Potassium (mEq/L)	3.2	–	3.6	3.3	3.5
Calcium	9.6*	–	1.1**	1.07**	9.5*
Magnesium (mg/dL)	1.3	–	2.3	1.8	1.2
Lipase (IU/L)	4,918	–	–	–	5,448
Troponin I (ng/mL)	<0.034	–	<0.01	–	–

ms = milliseconds; * = total calcium in mg/dL, ** = ionized calcium in mmol/L

Post-arrest ECG demonstrated persistent QTc prolongation immediately and three hours post-arrest. Laboratory studies, drawn prior to arrest, later demonstrated hypokalemia, hypomagnesemia, and evidence of acute pancreatitis (Table). She received no additional QT-prolonging agents and was extubated within 24 hours. An ECG approximately 12 hours post-arrest demonstrated QT interval improvement. Transthoracic echocardiogram at that time was normal: ejection fraction was 65-70% with no wall-motion-abnormality. ECG intervals normalized by discharge. No further cardiac workup was pursued and she was discharged neurologically intact. The patient returned 18 months later with recurrent pancreatitis and similar labs; QT-prolonging agents were avoided and her course was uncomplicated.

Discussion: This patient likely experienced cardiac arrest secondary to TdP from 4mg of IV ondansetron, a phenomenon that, to our knowledge, has not been described. Ketorolac has not been described to cause QT prolongation, and she received no other medications. Cases of drug-induced TdP are frequently multi-factorial; in this case electrolyte disturbances, acute pancreatitis, and general health due to her AUD were likely all contributory to her arrest. A subsequent similar presentation occurring 18 months later in which QT-prolonging agents were avoided suggests ondansetron was contributory to her episode of TdP. Ondansetron is commonly administered prior to ECG or laboratory studies in the ED; clinicians should be aware dysrhythmias may occur even with small doses in high-risk patients. As cases of drug-induced TdP occur rarely and are also rarely published, it is unclear if ondansetron is safer than other common antiemetics associated with QT-prolongation, such as droperidol.

Conclusion: QT prolongation with subsequent Torsades des Pointes and cardiac arrest may occur in high-risk patients receiving 4mg of IV ondansetron. Further studies are warranted to determine the safest antiemetic for use in the emergency department.

KEYWORDS torsades des pointes, QT prolongation, ondansetron

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199. Qualitative Tricyclic Antidepressant (TCA) Serum Testing in an Urban Children's Hospital Has Sad Value

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Background: Poisonings due to prescription TCAs are feared due to their notorious cardiovascular and neurological toxicity. Our hospital packages a qualitative TCA test, DRI® Tricyclics Serum Toxicology Assay (ThermoFisher Scientific) on Vitros® 5600 instrument (Ortho Clinical Diagnostics), into a "serum drug screen" along with quantitative tests for acetaminophen, salicylate and ethanol. As a clinical toxidrome for TCA toxicity exists, and as TCA screening is known to be hampered by false positives, the utility of TCA screening in our population is unknown. We examined two years of data to evaluate the frequency of testing, positivity rate, and false positive rate; and to see if testing impacted clinical management.

Methods: Laboratory records were used to identify all TCA tests performed, 2018-2019, in our urban, academic tertiary-care, children's hospital; in a quality assurance activity the electronic hospital charts of subjects with positive tests were abstracted. De-identified records were used to assess the incidence of positive tests, the proportion of false positive tests, and the impact testing had on clinical care.

Results: 1,174 tests were obtained over 2 years with 79% ordered from the emergency department, 12% from intensive care units, 8% from general inpatient wards, and 1% from other outpatient areas. There were 7 positive results (incidence 0.6%; [95%CI: 0.3-1%]) and 4 true-positive results (incidence 0.3% [0.1-0.9%]. Age range of true positive tests was 9-16 years. Clinicians determined 3/7 tests (43%) to be false positives implicating cyclobenzaprine, diphenhydramine, and quetiapine. Among the 4 cases felt to represent true positive TCA testing, all were known to have access to TCAs. TCA ingestion was positively disclosed by 2, was considered by history in the other two, and no changes in patient care were documented as arising from TCA testing.

Conclusions: In the two-year study period, qualitative serum TCA testing had a low incidence of positivity, a high false positive rate, and did not discernably alter clinical care. All true positive cases had been suspected based upon medical history and toxidrome analysis. The cost-benefit of routine serum TCA screening in our clinical environment warrants critical analysis. The generalizability of this data is limited by its derivation from a single pediatric center. A false negative rate could not be determined as the total number of patients exposed to TCAs was unknown.

KEYWORDS Tricyclic Antidepressant, Drug Screening, Pediatrics

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200. Phencyclidine (PCP) Exposure Cases Among Young Children Reported to Five U.S. Statewide Poison Control Center Systems, 2009-2018

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Background: Drug use in child environments puts children at risk of injury. PCP, a piperidine derivative used as an anesthetic and psychoactive compound, is an infamous drug of abuse; infants may be exposed via passive inhalation of ambient smoke, or from ingestion of powder or solubilized forms. This study aimed to characterize the epidemiology of PCP exposures, among young children, reported to select U.S. poison centers. Our previous work suggested 167 relevant case records, over a ten-year period, among the American Association of Poison Control Centers' (AAPCC) National Poison Data System; this study reviewed a subset of poison center narrative charts to obtain patient-level detail of the phenomenon.
Methods: Description of retrospective cohort of phenylcyclohexylpeperidine exposures (AAPCC generic code 071000) among children 2-months through 5-years of age reported to five geographically diverse U.S. state poison control center systems (neonates were excluded to eliminate cases of maternal-fetal drug transmission). Study period was January 1, 2009, through December 31, 2018. Discrete data fields were tabulated, and two trained abstractors summarized each narrative note using standardized data fields. Demographic data, exposure route, physical signs, and medical therapies were summarized.
Results: Sixty-four records (38% of the national sample) were initially retrieved. Thirteen were miscoded by exposure, 2 had PCP concerns but no real exposure and 2 were miscoded by age; 5 cases believed to be PCP by drug screening were found to be false-positive tests. Forty-two subjects (TX–19, CA–8, PA–7, NV–5, NJ–3) were eligible for study with an age range from 2 months to 5 years. Twenty-six (62%) were male. Most exposures were coded as "unintentional – general" and occurred in the child's own residence. Twenty-three cases (55%) were coded as moderate or severe toxicity with no fatalities. Four children were endotracheally intubated, and 8 were hospitalized for more than 3 days. Frequency of characteristic signs of PCP positively identified in charts were: somnolence/coma–17 (40%), "seizures"–12 (29%), nystagmus–9 (21%), blank stare/delirium–9 (21%), T > 38.0C–8 (19%). Thirty-three of the children had a positive urine drug screen for PCP, 5 were negative, and 4 had no test performed; three had serum concentrations measured (27, >250, and 325 ng/mL).
Discussion: PCP exposures among children under age 6 years are uncommonly reported to U.S. poison centers. Most cases result from exploratory child behaviors, or environmental exposures, within the home. Young children identified with PCP toxicity may experience significant poisoning leading to endotracheal intubation and prolonged hospital stay, but no fatalities were recorded over 10 years. Commonest recorded signs of PCP intoxication were central nervous system depression, seizure-like movements, nystagmus, and delirium. Twenty percent of retrieved cases from the AAPCC NPDS were miscoded by exposure and had no mention of PCP. Hospital record review or prospective data collection might improve the accuracy of this toxic syndrome description.

KEYWORDS Phencyclidine, Pediatrics, NPDS

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201. Marijuana Exposure of Young Children in Pennsylvania and Delaware as Reported to Pennsylvania Poison Centers, July 2014-June 2019

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Background: Children are a vulnerable group for exploratory marijuana ingestion or environmental marijuana exposure, and reports have shown an increase in related poison center calls, and visits to pediatric emergency departments, following marijuana's decriminalization and legalization among states nationwide. The aim of this study was to describe the epidemiology of pediatric marijuana exposure, in Pennsylvania and Delaware, as reported to Pennsylvania's poison control centers.
Methods: Retrospective, descriptive cohort. The American Association of Poison Control Centers' National Poison Data System (NPDS) was queried for marijuana cases (NPDS codes 0083000, 0310121, 0083000, 0310096, 0310124, 0310122, 0310126, 0310125, 0310123, 0200617) among children ≤6 years old, reported from Delaware and Pennsylvania to their designated poison control center (PCC), for the 5-year period from July 2014 through June 2019. NPDS substance categorizations were reviewed, and only cases pertaining to phytogenic marijuana were included.
Results: Database query identified 70 potential subjects, but 13 were not included due to primary involvement of other drugs such as synthetic cannabinoids, leaving 57 cases deemed related to marijuana exposure in children ≤6 years old. The majority of the cases were reported from PA (86%) with 8 cases reported from Delaware. Annual reported cases increased more than 500% from the 2015 to 2019 academic years. 63% of reported cases were among children 2 years or younger with a median age of 16 months. 27 case calls originated from a residence and 11 (41%) were managed onsite without healthcare facility (HCF) referral. Of the 46 children referred to or treated in a HCF, 17 (37%) were evaluated and discharged, 13 (28%) were admitted to a noncritical unit, and 7 (15%) were admitted to a critical care unit. Seven families declined HCF referral and two left against medical advice. Medical outcomes varied among marijuana exposure in this population. 31 reports were judged nontoxic or weren't followed to known outcome; 14 had minor clinical effects, 10 had moderate and 2 were classified as major. Five children received medical interventions beyond fluids and supportive care including endotracheal intubation (2), naloxone (1) benzodiazepines (1), and flumazenil (1). Among the two reports resulting in a major medical outcome, a 15-month-old boy was intubated due to mental status depression and a possible seizure, and a 2 year old boy was intubated due to altered mental status and cardiovascular instability. These data are limited by the voluntary nature of poison center reporting, and the inability to verify the association between marijuana exposure and reported clinical effects.
Conclusion: Social attitudes toward marijuana are evolving. Marijuana in child environments places children at risk of exposure. Among marijuana-exposed children ≤6 years old reported to PA poison centers, over 20% were judged to suffer moderate to severe toxicity and 15% were hospitalized in intensive care settings. Child marijuana reports in 2019 were at least twice as high as any other study year. Public policy must consider risks to young children.

KEYWORDS marijuana, pediatrics, poison control center

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202. Diagnosis of Pediatric Fentanyl Poisoning Confounded by Suboptimal Urine Drug Screening and by Medical Fentanyl Administration

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Background: The U.S. has been in the midst of an epidemic of opioid poisoning during which the epidemiology of the implicated opioids has evolved over time. Despite constant or increasing rates of opioid use, research has recently shown that rates of opiate-positive hospital drug screens are going down as many tests do not accurately detect synthetic or semi-synthetic opioids. This can pose particular challenges in identifying opioid-poisoned young children. We present two cases of pediatric fentanyl poisoning in which suboptimal initial urine drug screening, and subsequent therapeutic use of fentanyl, lead to practical diagnostic challenges.
Case Reports: Case 1–A 2-year-old boy was found unresponsive. Midazolam and succinylcholine were given to facilitate endotracheal intubation. The hospital's commercial immunoassay subsequently was positive for benzodiazepines and negative for opiates. Brain CT demonstrated brainstem edema, the child was transferred to a tertiary-care children's hospital for emergent surgical brain decompression with propofol and inhaled anesthetic, and fentanyl and midazolam infusions were used post-operatively. A GC/MS analysis of a new urine sample was positive only for midazolam and fentanyl, which had been given medically, leading clinicians to deduce that the child did not have a toxicological diagnosis. An early urine sample was retrieved from the referring hospital; LC/MS/MS testing found fentanyl (39 ng/mL), and norfentanyl (>1000 ng/mL) confirming fentanyl as the cause of illness.
Case 2–An 11-month-old boy became unresponsive after being seen holding a bag of "white powder." In a community ED he had GCS =7, T 29°C, and care providers had concern for seizure. He was given a paralytic and lorazepam and was endotracheally intubated. The hospital's commercial urine immunoassay for drugs of abuse was negative for opiates. Intravenous midazolam and fentanyl were given for sedation during transport to a tertiary care children's hospital. LC/MSMS testing of a new urine sample at the receiving hospital found fentanyl, fentanyl metabolites, tramadol and midazolam; all except tramadol had been given by the medical team, leading to diagnostic confusion. An early urine sample from the first hospital was recovered, and LC/MS/MS demonstrated fentanyl, fentanyl metabolites, and tramadol, confirming fentanyl and tramadol exposure as the cause of illness.
Discussion/Conclusions: Children remain tragic victims of the opioid epidemic. Clinicians are alerted that fentanyl is a common illicit opioid, yet many ED urine drug screens fail to identify fentanyl. In the setting of an illicit fentanyl epidemic, therapeutic use of fentanyl before obtaining appropriate toxicology testing may confound diagnosis. As illicit opioids are rarely pure, drugs like tramadol may be markers for illicit fentanyl / opioid exposure.

KEYWORDS fentanyl, pediatrics, urine drug screen

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203. Near-Syncope, Vomiting, Hypotension, and Metabolic Acidosis After IV Iron Sucrose Self-Administration with Serum Iron Levels

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Background: Acute iron overdose is a notorious poisoning syndrome, but most clinical experience and published guidance refers to oral overdose. Many formulations of iron-carbohydrate complexes for intravenous administration exist in the U.S. market. The clinical pharmacokinetic and pharmacodynamic profile is highly patient dependent and varies tremendously across these products. Risk assessment and medical response in this context warrants further characterization. We describe a clinical case of IV iron sucrose overdose with high serum iron concentration and concerning symptoms, and review published pharmacokinetic data.
Case Report: A 44-year-old, 67kg, woman gave herself an IV injection of 300 mg of iron sucrose (4.4mg/kg). She quickly developed vomiting and had a near-syncopal event. Upon emergency department arrival she was diaphoretic and pale with stable vital signs. Three hours after the injection her pH was 7.31 and serum iron concentration was >2000mcg/dL. She had a normal white blood cell count and blood glucose concentration, and normal plasma lactate. Within several hours her BP was 83/51mmHg and her serum bicarbonate was 15 mEq/L. She was treated with IV crystalloid, and IM deferoxamine (1000mg at 8 hrs, then 500mg q6 hrs X 5 doses). Subsequent iron levels included: (15 hrs) 534mcg/dL, (24 hrs) 429mcg/dL, (60 hrs) 379mcg/dL. Her clinical symptoms and signs, and her acidosis, rapidly improved. In a PK study involving healthy adults, IV iron sucrose at 100mg had a mean maximum serum iron concentration (C_{max}) of 538μmol/L (3,000 mcg/dL).
Discussion/Conclusion: It is not clear if initial gastrointestinal and neurological symptoms, hypotension, and metabolic acidosis in this case were due to hypersensitivity, direct iron toxicity, or other etiology. The C_{max} after IV iron sucrose overdose should not be judged in the context of historical oral iron salt overdose treatment recommendations. Indications for chelation therapy after IV iron carbohydrate complexes warrant further elucidation; chelation was administered in this case.

KEYWORDS iron, iron sucrose, deferoxamine

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204. Benzodiazepine and Opioid Toxicity Treated with Concurrent Flumazenil and Naloxone Infusions

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Background: Flumazenil and naloxone are FDA-approved for the reversal of opioid and benzodiazepine toxicity, respectively. Flumazenil antidote therapy is infrequently utilized in benzodiazepine overdose due to the risk of precipitating seizures in select populations. We present a case of combined benzodiazepine and opioid overdose in which concurrent flumazenil and naloxone infusions prevented the need for mechanical ventilation. Use of this combination has not previously been reported.

Table 1(#204). Serum Concentrations of Clonazepam and 7-Aminoclonazepam.

Day	Clonazepam (ng/mL)	7- Aminoclonazepam (ng/mL)	Flumazenil Infusion
4	77.9	56.2	Yes
5	54.5	43.5	Yes
6	35.2	31.3	Yes
7	25.0	21.4	No

Case Report: A 48 year-old-male with sleep apnea and no prior benzodiazepine use presented to the emergency department (ED) after an intentional overdose of 120 mg of clonazepam, 75 mg of hydrocodone, and 4875 mg of acetaminophen. Upon presentation he had a Glasgow Coma Scale (GCS) of 14. Initial vitals were T 97.6 F, BP 106/79 mmHg, P 79 bpm, RR 12, SpO2 95% on 3L O2 by nasal cannula and pupils were 1mm. Initial urine drug screen (UDS) detected only opiates. Acetaminophen concentration was 23 μg/mL. After seven hours, his condition worsened to a GCS of 6, bradypnea with RR 6, and hypoxemia (SpO2 85% on RA). Naloxone 0.4 mg administration did not result in a significant clinical response. Flumazenil 0.1 mg was later administered. The patient then began to yawn, his RR increased to above 10, and his oxygen saturation improved. Flumazenil infusion of 0.1 mg/h was started to maintain RR above 10 and SpO2 above 90%. Naloxone 1 mg was administered two hours after initiation of the flumazenil infusion with continued improvement in mental status to GCS 10 and RR 12. Naloxone infusion was initiated at 1 mg/h. A UDS sent 36 hours later detected benzodiazepines and opiates. Attempts to decrease naloxone after 12 hours, and flumazenil on the third, fourth, and fifth days after initiation were each unsuccessful as the patient redeveloped CNS/respiratory depression. Due to the inability to discontinue antidote therapy, a daily UDS and quantitative serum clonazepam concentrations (resulted after discharge, see Table 1) were obtained. Naloxone was discontinued on day five when opiates were no longer detected on UDS. Flumazenil was discontinued on day seven without redevelopment of CNS or respiratory depression, despite persistent benzodiazepine detection on UDS.
Case Discussion: Use of flumazenil antidote therapy versus supportive management, including mechanical ventilation if needed, for benzodiazepine toxicity is uncommon and controversial. Hesitancy about flumazenil as antidote therapy is due to the risk of seizures especially with benzodiazepine dependency, seizure disorder, and/or coexisting tricyclic antidepressant toxicity. While naloxone (bolus and/or infusion) antidote therapy is not uncommon, we are unaware of any case reports of concurrent infusions of these medications. In this case, with appropriate patient selection, close monitoring, and targeted endpoints, flumazenil and naloxone infusions were utilized safely in combination for an extended duration.
Conclusion: This is the first case report of the use of concurrent flumazenil and naloxone infusions as antidote therapy for combined benzodiazepine and opioid toxicity. Further investigation of this antidote therapy is warranted in appropriate overdose patients, given the potential morbidity and mortality associated with prolonged mechanical ventilation.

KEYWORDS flumazenil, naloxone, antidote therapy

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205. Intentional Suspected Suicide Exposures by Poisoning Among Adolescents from 2009 to 2018 Reported to a Regional Poison Center and Compared Nationally

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Background: The rise of suicide and suicide attempts in adolescents is a major public health issue. Suicide is the second leading cause of death for individuals between the ages of 10-34 in the United States. Poisoning is a common method of self-harm and death among adolescents, it ranks as the third most common method used in suicide deaths in the United States.

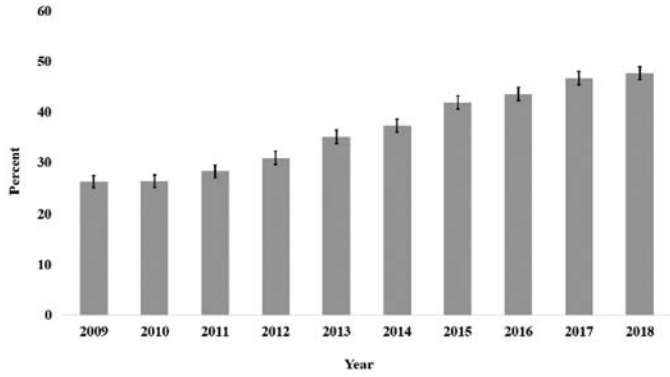

Figure 1(#205). Intentional Suspected Suicide among 13-19 year olds reported to a regional poison center, percent of calls per year to a regional poison center among 13-19 year olds. Error bars represent 95% confidence intervals.

Objective: This study aimed to report the incidence and characteristics of intentional suspected suicide exposures involving 13-19 year olds over a 10-year period reported to a regional poison center and compared nationally.
Methods: A retrospective chart review of intentional suspected suicide cases reported to a regional poison center from 2009 to 2018 for patients 13-19 years old. For comparison, data from the National Poisoning Data System (NPDS) was obtained. Cases coded as unrelated effect and confirmed non-exposure were excluded. Changes in the incidence rate and characteristics by patient age and gender were evaluated.
Results: Of the 19,733 cases of intentional suspected suicide cases reported to a regional poison center between 2009-2018, 74.9% were females. The total number of cases nearly doubled over the ten-year study, increasing annually by 12.7% (Figure 1). Majority (90.1%) of the exposures occurred in the home. Among the patients admitted to a healthcare facility, 34.1% were admitted to psychiatric care facility, 21.4% were admitted to critical care unit and 11.1% were admitted to noncritical care unit. No effect and minor effect resulted in 60.5% of the cases. More than half (66.5%) of the cases involved only one substance. Pharmaceuticals made up 94.5% of the substances (Figure 2) used with analgesics accounting for 43.1%, followed by antidepressants (20.8%). A significant difference was found in substances used among males and females ($p < .001$). Females were more likely to use analgesics (45.17% vs. 32.90%) and supplements/vitamins/hormones/herbals/minerals/electrolytes than males. Males were more likely to use alcohols/ ethanol (3.50% vs. 1.97%), arts/crafts/office supplies (0.18% vs. 0.02%), household cleaning substances (4.77% vs. 2.56%), marijuana (1.15% vs. 0.27%), pesticides/outdoor chemicals (0.71% vs. 0.14%), plants/mushrooms (0.32% vs. 0.03%), sedatives/hypnotics/antipsychotics (20.45% vs. 13.58%) and stimulants/street drugs (6.87% vs. 4.12%) than females. As compared to similar teen data reported by other US poison centers, the regional poison center was more likely to have more patients admitted to critical care and a psychiatric care facility, and fewer patients with major and moderate effects. And while most of the regional poison center patients were female, they had a larger proportion of male patients than other US poison centers ($p < .001$).
Conclusions: Intentional suspected suicide exposures by poisoning is on the rise and higher among females. There is no single means of preventing suicide but a comprehensive and collaborative approach across multiple sectors can help minimize the prevalence rates. Guidance measures that include medication storage, medication disposal and poison prevention tips should be included in multiple sectors throughout the state.

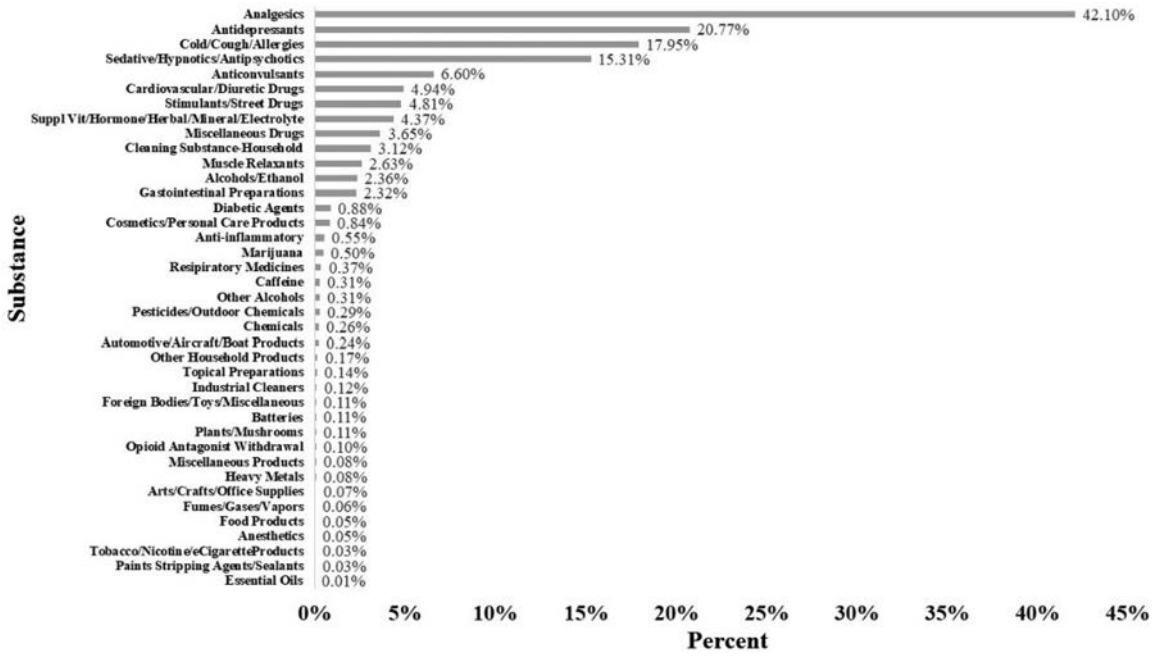

Figure 2(#205). Substances Reported to a Regional Poison Center for Intentional Suspected Suicide Cases, 2009-2018.

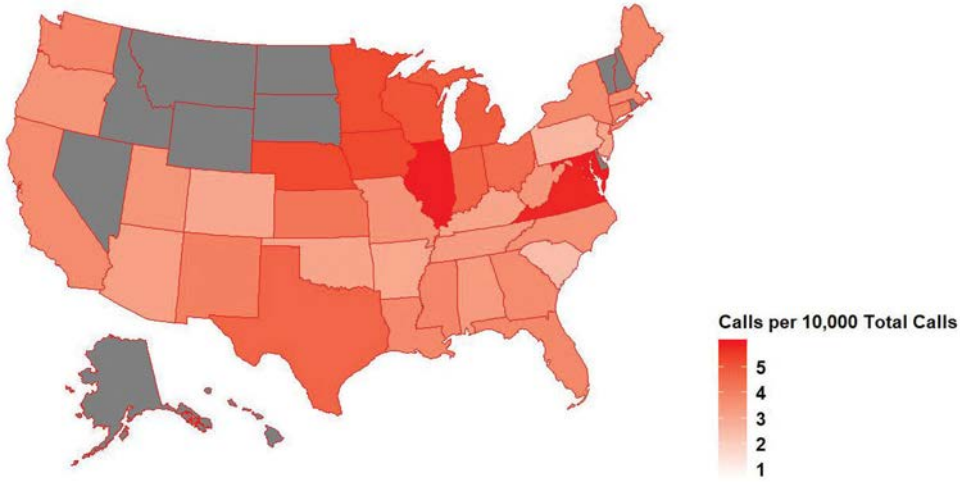

Figure 3(#205). Calls per 10,000 Total Calls Reported to U.S. Poison Centers for Intentional Suspected Suicide Cases, 2009-2018.

KEYWORDS suspected suicide, adolescents, 2009-2018

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206. Lactic Acidosis after Inadvertent Intravenous Administration of Oral Acetaminophen containing Propylene Glycol Diluent

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Background: We present a case of single inadvertent iatrogenic intravenous (IV) administration of a liquid oral formulation of acetaminophen with a propylene glycol diluent, which was followed by shock and lactic acidosis. Prior reported cases of propylene glycol administration causing lactic acidosis have been after prolonged IV infusions.

Case Reports: A 61-year old female with a history of multiple abdominal surgeries for Crohn's disease with an indwelling IV central line and percutaneous gastric tube (G-tube) was admitted for abdominal pain and vomiting. While admitted, she was ordered a dose of oral acetaminophen liquid through her G-tube, but it was inadvertently administered through the IV line. 3 hours after administration, she developed profound dizziness with systolic pressure of 60 mmHg, as well as lactic acidosis with a pH of 7.20 and lactate of 7.7 mmol/L. Treatment was with IV crystalloid, norepinephrine infusion and empiric antibiotics. Blood cultures were negative, and the patient improved over the following 24 hours. A source of infection was not identified.

Case Discussion: Propylene glycol toxicity with shock and lactic acidosis has been reported after long term IV administration of medications with propylene glycol diluents. In this case, a single bolus intravenous administration of an oral formulation of

acetaminophen was associated with significant symptoms. Assuming a concentration of propylene glycol in acetaminophen formulations between 5% and 13%, the patient received between 1.5g and 4g of propylene glycol (15-40 mg/kg). The bolus administration may have contributed to the severity of symptoms despite the propylene glycol dose. Propylene glycol is metabolized to lactic acid, and has shown cardiac depression in animal studies. In this case, a combination of cardiac depression from propylene glycol and metabolic acidosis likely contributed to the patient's shock, which improved as the propylene glycol and lactic acid were metabolized. One alternative hypothesis was septic shock secondary to the injection of the non-sterile formulation, however all blood cultures had no growth and the patient never developed any other infectious symptoms.
Conclusion: This is a unique case of iatrogenic intravenous administration of a liquid oral acetaminophen formulation with associated lactic acidosis, suspected to be secondary to the propylene glycol diluent.

KEYWORDS Propylene Glycol, Acetaminophen Liquid Formulation, Lactic Acidosis

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207. A Case Report of Cannabinoid Hyperemesis Syndrome Contributing to the Development of Wernicke's Encephalopathy

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Background: Cannabis is the most widely used illicit agent in the United States and associated use disorders are on the rise. Cannabinoid hyperemesis syndrome (CHS) is associated with chronic marijuana use. It is characterized by emesis and abdominal pain partially relieved by hot showers. CHS is a diagnosis of exclusion. Common complications of CHS include dehydration, electrolyte derangements, and weight loss. Rarely has CHS been associated with more serious adverse effects. This case report details CHS contributing to development of Wernicke's encephalopathy (WE), an uncommon, but dangerous neurologic sequelae of thiamine deficiency.
Case Report: A 25-year-old female with a known history of CHS presented to the emergency department complaining of three months of frequent vomiting with acute confusion, vision change, and difficulty ambulating. The diagnosis of CHS was made prior to this visit after an extensive negative workup for other etiologies. The patient also had the CHS clinical criteria previously detailed. This was her eighth visit for vomiting over a three-month period with a reported 30-pound weight loss over that time frame. Her diet consisted of soft foods and liquids when vomiting improved due to difficulty swallowing. On presentation, the patient was afebrile and hemodynamically stable with neurologic findings including nystagmus, disorientation, difficulty following commands, and gait instability. Lab tests were notable for hypokalemia (2.7 mmol/L), hypophosphatemia (2.6 mg/dL), and elevated lactate (4.5mmol/dL). Urine drug screen was positive for tetrahydrocannabinol. A lumbar puncture was performed and cerebrospinal fluid studies were normal. The patient was initiated on intravenous fluids, electrolyte repletion and high dose thiamine. Magnetic resonance brain imaging revealed abnormal signal within the periaqueductal coronal gray matter and mammillary bodies consistent with WE. During her admission, in addition to CHS she was diagnosed with avoidant and restrictive food intake disorder secondary to fear of swallowing spurred by a remote choking event. The patient remained inpatient for 25 days for intravenous thiamine, additional nutritional supplementation, and psychiatric evaluation and treatment. The nausea and vomiting attributed to CHS improved by day 13 of admission. She required percutaneous endoscopic gastrostomy placement to supplement oral intake secondary to ongoing swallowing anxiety. The patient was discharged with persistent cognitive dysfunction (Montreal Cognitive Assessment of 20/30) and walker dependence for gait instability.
Discussion: WE is a rare, but serious complication of malnourishment that can cause acute confusion, ophthalmoplegia and ataxia. It is classically associated with chronic alcoholism. This case report highlights CHS as a contributing factor in the development in WE. Awareness of this complication is critical to properly treat preventable sequelae of nutritional deficiencies in patients with CHS.
Conclusion: Awareness of nutritional deficiencies resulting from CHS can aid in prevention of serious complications such as WE. In addition to symptom management, electrolyte repletion and hydration, nutritional supplementation may be indicated in patients with severely malnourished states as a result of CHS.

KEYWORDS Cannabinoid Hyperemesis Syndrome, Wernicke's Encephalopathy, Cannabis

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208. Pediatric lamp oil exposures reported to poison centers

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Background: Lamp oil and related products, such as citronella and tiki torch fuels, are hydrocarbon or petroleum-based products. Ingestion or aspiration of lamp oil may result in cough, vomiting, nausea, fever, drowsiness, dyspnea, hyperventilation, erythema, pneumonitis, and respiratory distress. Deaths have been reported. Young children may be attracted by the lamp oil's color or by its fragrance. Furthermore, lamp oil may be stored in containers that children may easily open or in the product for which the fuel is intended (e.g., lamp, torch) and left within reach of children. The objective of this study was to describe pediatric lamp oil exposures reported to poison centers.
Methods: Cases were lamp oil (Generic code 0201031) exposures involving patients age 0-5 years reported to a statewide poison center system during 2000-2018. Exposures involving other substances in addition to lamp oil and exposures not followed to a final medical outcome were included. The distribution of the cases was determined for various factors related to patient demographics, exposure circumstances, management, and outcome.
Results: A total of 2,310 pediatric lamp oil exposures were identified. The annual number of exposures declined from 205 in 2000 to 44 in 2018. The patient age distribution was 161 (7.0%) 0 years, 1,099 (47.6%) 1 year, 740 (32.0%) 2 years, 190 (8.2%) 3 years, 74 (3.2%) 4 years, 36 (1.6%) 5 years, and 10 (0.4%) unknown age; 1,389 (60.1%) of the patients were male, 915 (39.6%) female, and 6 (0.3%) unknown sex. The exposure route was 2,190 (94.8%) ingestion, 246 (10.6%) dermal, 144 (6.2%) aspiration, 50 (2.2%) ocular, 24 (1.0%) inhalation, and 5 (0.2%) otic. The exposures were 2,301 (99.6%) unintentional, 5 (0.2%) intentional, 2 (0.1%) adverse reaction, and 2 (0.1%) other/unknown. Most (n = 2,134, 92.4%) of the exposures occurred at the patient's own residence, 136 (5.9%) at another residence, 15 (0.6%) at a pubic area, 5 (0.2%) at school, and 20 (0.9%) at other/unknown locations. The management site was 1,296 (56.1%) on

site, 659 (28.5%) already at or en route to a healthcare facility, 343 (14.8%) referred to a healthcare facility, and 12 (0.5%) at other/unknown locations. The medical outcome was 790 (34.2%) no effect, 590 (25.5%) minor effect, 233 (10.1%) moderate effect, 48 (2.1%) major effect, 71 (3.1%) not followed-judged nontoxic, 402 (17.4%) not followed-minimal clinical effects possible, 155 (6.7%) unable to follow-potentially toxic, and 19 (0.8%) unrelated effect; 2 deaths were reported. The most frequently reported clinical effects were cough/choke (n = 795, 34.4%), vomiting (n = 303, 13.1%), fever/hyperthermia (n = 171, 7.4%), positive X-ray findings (n = 158, 6.8%), hyperventilation/tachypnea (n = 80, 3.5%), and drowsiness/lethargy (n = 73, 3.2%). The most common treatments were dilute/irrigate/wash (n = 1,453, 62.9%), food/snack (n = 182, 7.9%), oxygen (n = 140, 6.1%), and intravenous fluids (n = 122, 5.3%).
Conclusions: The number of pediatric lamp oil exposures reported to these poison centers declined over the time period. Most exposures involved patients age 1-2 years and male. Most of the exposures were unintentional and occurred at a home and by ingestion. The exposures tended to be managed outside of a healthcare facility and did not result in serious outcomes.

KEYWORDS lamp oil, hydrocarbon, pediatric

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209. Naloxone Rescue Kits and Syringe Exchange Services: People Who Use Drugs Are Life Savers!

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Background: Since equipping laypersons with naloxone rescue kits began over two decades ago, non-medical community members have saved thousands of lives nationwide. One of the most successful access points for placement of these kits is in the setting of syringe exchange. Partnerships that place naloxone directly in the hands of people who use drugs have demonstrated crucial strides in preventing preventable deaths, and give us frontline information about naloxone use in those most at risk and using the substances we often know the least about.
Objective: To describe the reported use of intramuscular (IM) injectable naloxone rescue kits (containing 0.4 mg/ml naloxone doses) within a population of layperson participants in multiple syringe exchange services (SES) programs.
Design/Methods: Anonymous self-reporting of naloxone rescue kit use including: the number of 0.4 mg naloxone doses/vials used in an opioid overdose reversal, who it was used on, if EMS was called, and if the individual survived. Participant kits each contain two doses of 0.4 mg naloxone (single dose vials), two syringes, and instructions. SES participants were encouraged to obtain multiple kits. Reversal data was collected anonymously by trained staff of each SES and aggregated by the lead agency.
Results: 2,405 individual reports of naloxone rescue kit use were documented over 39 mos (02/17-05/20), data points were obtained on 673 of these reversals. Kits were furnished by one central agency to 5 community-based organizations (CBOs), and were provided to participants during SES outreach services. 98% (660) of the reports described a successful reversal and survival. The reported use was on a friend/acquaintance(69%), self(10%), stranger(9%), family member(5%), spouse(1%), unknown(6%). One dose of naloxone (0.4 mg IM) was used to reverse an overdose in 28% (187) of the reports, two doses 54% (362), 3 doses 11% (71), 4 doses 4% (28), 5+ doses 2% (13), unknown doses 2% (12). There were 13 unsuccessful reversal reports during this time period using between 1-4 vials of naloxone. EMS was reportedly called 40% (268) of the time when a layperson kit was used in this setting.
Conclusions: Individuals participating in SES programs self-reported use of naloxone rescue kits that had been furnished to them. 98% of those administered layperson naloxone in this setting survived. The majority of the reversals were on a friend/acquaintance, but also on family members, the participants themselves, and even strangers. Over 82% of the reversals were reported successful with 1 or 2 doses of 0.4 mg IM injectable naloxone. These results do not indicate that an increased dose of naloxone is required in rescue kits that equip laypersons. These results do suggest that individuals in the SES setting should have access to multiple kits or kits with at least 3-4 doses given that 60% of the reports did not include a call to EMS. Increased education about the role of EMS, enhancing Good Samaritan legal protections for those who call 911, and ensuring individuals in this setting have access to multiple kits/doses is recommended. People who use drugs are saving the lives of those around them.

KEYWORDS naloxone, syringe exchange, overdose prevention

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210. Pediatric Opioid Events in the Emergency Department Setting: One Healthcare System's Encounters 2014-2016

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Background: Overdose is the leading cause of injury death in the U.S. and in this state which is has been as high as 4th in the nation for overdose deaths. Toxicologic ingestions are common in children and opioids are among the most dangerous ingestions. Recent national data showed that pediatric hospitalizations for opioid poisonings nearly doubled from 1997-2012.
Objective: To describe the characteristics of children seen for opioid-related events or conditions in the Emergency Departments (EDs) of a large U.S. health care system.
Design/Methods: We systematically collected demographic and clinical data from the electronic medical records of patients 0-18 yrs seen in any of the 16 EDs in one healthcare system using ICD9/ICD10 coding for opioid poisoning, opioid abuse, opioid withdrawal, or opioid dependence from 2014-2016. This healthcare system accounts for approximately 55% of the ED care in this state.
Results: 532 patients were identified by ICD codes and 52% (277) of those were confirmed by chart review as experiencing an opioid-related event. The age distribution is bimodal, 31% 0-5 yrs, 63% 13-18 yrs. 59% were female. 90% of exposures occurred in the home with less than 1% occurring in school settings (two exposures seen at one school in a singular event where no naloxone was required). Events were concentrated in the state's urban and suburban population center. For medication

exposures, 82% of substances were not the patient's: 62% parent/sibling, 13% other family. The substance breakdown is presented in Table1. In 39%, the exposure was a self-harm attempt. Naloxone was administered en route to or while in the ED in 25%. 17% were admitted for behavioral health treatment and 32% were hospitalized for medical stabilization. 31% of those admitted to a medical service required ICU-level care. There were 0 fatalities. 72 (26%) patients presented requesting detoxification, recovery treatment, and/or with opiate withdrawal symptoms. All of these were 14-18 yrs and 61% were discharged from the ED without placement in detox or in a treatment setting. Of these, one patient was placed on buprenorphine in the ED.

Conclusions: Children with opioid related ED visits in this single large healthcare system had a bimodal age distribution, mostly ingested medications belonging to family members, and 49% were admitted for further medical or behavioral health care. These results support redirecting anticipatory guidance to include screening for opioids in the home, education on the risks of opioid exposure in children, and access to naloxone rescue kits in homes with opioids and children present. Increased access to detox and/or recovery services are also needed. Further evaluation of how current overdose prevention and treatment access strategies can target those at risk is necessary.

KEYWORDS pediatric, opioid, overdose

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211. 2019 webPOISONCONTROL® Analysis: A Poison Center's Review

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Background: webPOISONCONTROL® (webPC) is a free online tool and corresponding mobile app that allows the public to determine appropriate triage and first aid recommendations for poison exposures without calling a poison center (PC). A previous study of the feasibility, safety, and user-acceptance of webPC found that it augments traditional PC services. This retrospective analysis reviews one PC's 2019 webPC experience.

Methods: webPC was passively promoted through a badge at the bottom of a single PC's internet homepage. The public can also find the tool through online searches. webPC visitors were directed to contact a PC if exposures were polysubstance or if the exposed individual was not between 6 months and 79 years of age, had any serious pre-existing medical conditions, reported current pregnancy, or involved self-harm. We attempted to match all webPC cases over one month to a corresponding case in ToxiCALL®, the PC's electronic medical record system, to analyze adherence to triage recommendations. Matching was conducted by searching for date, approximate time of exposure, patient age and gender, zip code, exposure route, and substance corresponding to webPC cases. Descriptive statistics are used to describe age group, county, substance category, exposure route, triage recommendations, and medical outcome for all cases reported via webPC.

Results: A total of 2907 webPC cases were recorded for this PC's state in 2019, an increase from 732 and 2299 cases in 2017 and 2018, respectively. Children under the age of 6 years were involved in 62.5% of cases; 11.4% involved older children and teenagers (6-19 years old); 21.7% involved adults over 20 years. Cases originated from 85 of 87 (97.7%) counties in the state, indicating a wide reach that included rural areas. Ingestion accounted for 83.2% of exposures. Exposures involved non-pharmaceutical substances in 57.3% of cases, while 42.7% were pharmaceutical-related. Most common substances included cosmetics/personal care products (14.0%), household cleaning products (9.9%), and analgesics (8.5%). webPC triaged 71.7% (n = 2084) of cases to stay home, 1.9% (n = 54) to go to an emergency department (ED), and 26.5% (n = 769) to call a PC (Table 1). For self-reported outcome of users triaged to home, 94.1% experienced minimal or no effect and 3.4% had minor effects; no major effects were reported (Table 2). Outcome data for cases referred to call a PC or go to an ED were limited due to incomplete follow-up. Over one month, 51.5% of users directed to call the PC were matched to ToxiCALL® cases. Furthermore, two

Table 2(#211). Self-Reported Medical Outcome for webPC Cases Triaged to Stay Home.

Self-Reported Medical Outcome for webPC Cases Triaged to Stay Home	#	%
No Effect	528	25.3%
Minor	88	4.2%
Moderate*	7	0.3%
Major	0	0.0%
Unknown, Minimally Toxic**	1434	68.8%
Unknown, Potentially Toxic***	1	0.0%
Confirmed Nonexposure	26	1.2%
Grand Total	2084	100.0%

*Six cases reported that they stayed home after responding to follow-up emails; one case (methylphenidate exposure) reported calling the PC and then going to the ED.
**For this category, no outcome was provided due to lack of follow-up but these exposures were likely to result in only minimal toxicity with users experiencing no more than a minor effect.
***This case was an eye exposure with irritation to diaper rash cream; the user ultimately self-reported that they stayed home.

Table 3(#211). ToxiCALL® Matching for webPC Cases Over One Month.

ToxiCALL® Matching for webPC Cases Over One Month					Total	
Final Triage	No ToxiCALL® Match*		ToxiCALL® Match**			
Home	148	93.7%	10	6.3%	158	69.0%
PC	33	48.5%	35	51.5%	68	29.7%
ED	1	33.3%	2	66.7%	3	1.3%
Total	182	79.5%	47	20.5%	229	100.0%

*Matches may have been missed if webPC users reported any information differently when calling the PC (e.g., approximate time of exposure).
**A match was assumed when ToxiCALL® case criteria closely corresponded to webPC case details. However, it was not possible to verify with certainty that these cases referred to the same exposure.

Table 1(#211). Final webPC Triage Recommendations by Age Group.

Final webPC Triage Recommendations by Age Group							
	Home	%	PC	%	ED	%	Total N
0-5 Years	1389	76.4%	413	22.7%	16	0.9%	1818
6-12 Years	111	80.4%	24	17.4%	3	2.2%	138
13-19 Years	115	59.6%	71	36.8%	7	3.6%	193
20+ Years	469	61.9%	261	34.4%	28	3.7%	758
All Age Groups	2084	71.7%	769	26.5%	54	1.9%	2907

(66.7%) users referred to the ED and 10 (6.3%) users triaged to stay home called the PC for further advice or reassurance (Table 3). Limitations with matching included potential misrouting of PC calls to another regional PC and the inability to confirm a match's accuracy. Additionally, users may have gone to the ED without calling a PC first.
Conclusion: Passive website promotion by a single PC was associated with increasing use of webPOISONCONTROL® throughout the state. A majority of users were kept at home and several were found to call their local PC for additional guidance or reassurance.

KEYWORDS webPOISONCONTROL®, online, triage

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212. Atomoxetine Overdose with Neurologic and Cardiac Toxicity

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Background: Atomoxetine is a selective norepinephrine reuptake inhibitor approved for the treatment of attention-deficit/hyperactivity disorder (ADHD). Several atomoxetine studies report adverse neurological events after use with conflicting risk for adverse cardiovascular events ranging from low to moderate risk. We report neurological and cardiovascular toxicity resulting in seizures and QTc /QRS prolongation after a very large ingestion of atomoxetine.
Case Report: A 30-year-old Caucasian male with a history of bipolar schizophrenia, substance abuse, and previous suicide attempts called EMS stating he ingested 5175 mg of atomoxetine an hour prior. Paramedics found him hyperactive and tachycardic. The patient vomited with visible pill fragments en route to the hospital. On arrival to the ED, he was awake and alert, blood pressure of 141/70 mmHg, pulse 129 bpm, respirations 37/min, and oxygen saturation 100% on room air. EMS brought two empty 60-count 40 mg bottles of atomoxetine and one empty unknown count 25 mg bottle. He experienced a generalized seizure (1.5 hours post-ingestion) in the ED and was intubated for airway protection. The electrocardiogram (ECG) performed immediately after showed sinus tachycardia at 129 bpm, QRS 157 ms, QTc 602 ms, and a terminal R-wave >5mm in aVR. An IV bolus of sodium bicarbonate (NaHCO3) 150 mEq was started, followed by a continuous infusion at 150 mL/hr. An ECG following NaHCO3 showed a decrease QRS interval to 122 ms and QTc 508 ms. Initial metabolic panel was unremarkable, acetaminophen and salicylate levels were undetectable, ethanol 34 mg/dL, and urine drug screen was positive for amphetamines. The patient was admitted to a critical care unit, extubated, and continued the NaHCO3 infusion until hospital day 2. Subsequent ECGs were monitored every 2 hours during hospital day 1 and the QRS stayed below 109 ms. A quantitative serum atomoxetine level drawn 4 hours after hospital presentation resulted days later at 15,000 ng/mL. The remainder of his stay was unremarkable and the patient was discharged on hospital day 7.
Case Discussion: One previously documented case described a 17-year-old female who ingested 2840 mg with a detected atomoxetine level of 1995 ng/mL and experienced mild QRS widening, 94 ms, that resolved to 79 ms, and prolongation of the QTc interval, 476 ms, that resolved to 440 ms. Our patient self-reported an ingestion of 5175 mg resulted in an atomoxetine level of 15,000 ng/mL 4 hours post-ingestion and a significantly widened QRS interval and prolonged QTc. A study conducted in 2009 suggested that atomoxetine directly blocks hERG currents and may provide an explanation for the QTc prolongation, but does not provide a conclusion for the significant QRS widening that our patient experienced. Our patient's onset of seizure and overall return to baseline/recovery is similar to what is reported in tox literature regarding atomoxetine overdoses.
Conclusions: We report the largest atomoxetine overdose with a quantitative level in the literature to date, resulting in neurological and cardiac toxicity via seizures and QTc/QRS prolongation. Clinicians should be aware of the potential for QRS widening in atomoxetine overdoses.

KEYWORDS atomoxetine, QRS prolongation, seizures

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213. Pediatric Clonidine Poisoning a Quarter-Century Later

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Objectives: Clonidine is an alpha-2 agonist designed as an antihypertensive agent but has also been used in the treatment for ADHD, Tourette's Syndrome, sleep disturbances and refractory conduct disorder. Over the years, prescription of clonidine to pediatric patients for these conditions have increased. In our previous study on clonidine, the epidemiology, management, and a review of clonidine related hospitalizations in children were studied for a 6-year period from 1987 to 1992. The purpose of this study is to describe the changes in the epidemiology, management and use of naloxone for clonidine exposures at the same institution, a quarter-century later.
Methods: We conducted a retrospective study of clonidine ingestion in children ages 0-6 from 2013 to 2018. Our poison center's database was queried and a list of cases was obtained. We reviewed the hospital electronic medical records to extract data. Only cases where clonidine was the sole ingestant were included.We obtained demographic information and patient management data including use of and response to naloxone. Descriptive analysis was performed to calculate frequencies and proportions. We compare findings from this study with the prior study. The number of patients in the previous study was 80.
Results: 80 cases were included in the current study. The median age of all patients was 2.4 years (IQR: 1.8 to 3.1). Clonidine prescribed most commonly belonged to the patient's sibling (30.0%), the patient's grandparent (26.3%), or self (12.5%); compared to the previous study of 1987-1992 where clonidine most commonly belonged to the grandmother (54%). 88.8% of patients in this study utilized Medicaid as their primary insurance, compared to 34% with Medicaid coverage as their primary insurance in the prior study. 88.8% of patients were admitted to an intensive-care unit for monitoring, with an average length of stay of 21.6 hours. 11.5% of patients required intubation due to respiratory failure. Naloxone was utilized in 53.8% of patients, with 60.5% noting improvement in symptoms, compared to 49% of patients receiving Naloxone with 16% demonstrating improved symptomatology in the previous study.
Conclusion: As clonidine is being prescribed more frequently to pediatric patients, toxic exposures in children are more likely to come from a sibling or a medication prescribed to self than a grandparent. Naloxone as an antidote for clonidine can prove to be effective.

KEYWORDS Pediatric, Clonidine, Poisoning

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214. Presumed COVID-19 Delaying the Diagnosis of Methemoglobinemia: A Case Report

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Background: Dapsone is a potent oxidizing agent and well known cause of intravascular hemolysis and methemoglobinemia. Herein we present a woman admitted from a viral clinic during the COVID-19 pandemic with presumed COVID-19 who was later found to have symptomatic methemoglobinemia, intravascular hemolysis, and acute on chronic anemia attributed to dapsone.

Case Report: A 34-year-old woman with systemic lupus erythematosus, lupus nephritis, and anemia of chronic kidney disease, presented to the viral clinic in the midst of the COVID-19 pandemic with one week of progressive fatigue, palpitations, and dyspnea on exertion. Two months prior she was treated for Pneumocystis jiroveci pneumonia with three weeks of atovaquone and higher-dose prednisone. This was followed by clindamycin and primaquine after G6PD screening had returned negative. She had since been on prophylactic dapsone, in addition to her daily immunosuppressives prednisone and mycophenolate mofetil.

In clinic, vital signs were within normal limits and laboratory studies revealed a hemoglobin of 6.7 g/dL, WBC 3.62 K/uL, haptoglobin 19 mg/dL, ferritin 721 ng/mL, potassium 6.2 mEq/L, bicarbonate 20 mEq/L, and anion gap of 9. Her C-reactive protein, D-dimer, transaminases, and total bilirubin were normal. Her creatinine was 2.13 mg/dL, consistent with her baseline kidney function. She was admitted with presumed COVID-19 and acute on chronic anemia with probable hemolysis. Dapsone was stopped and she received multiple packed RBC transfusions. Her COVID-19 test returned negative.

Over the next 36 hours she became more dyspneic with increasing palpitations. She also reported headache, dizziness, and distal paresthesias. Her lips became progressively cyanotic appearing despite normal oxygen saturations on pulse oximetry.

At this point, a methemoglobin level was ordered and returned at 28.5%. She was diagnosed with symptomatic methemoglobinemia from dapsone, her symptoms likely exacerbated by anemia. She was given one bolus of intravenous methylene blue at 1mg/kg and started on oral cimetidine 1200 mg daily, the latter used to inhibit CYP450 conversion of dapsone to its oxidizing metabolite. Within an hour her symptoms had improved dramatically. Over the next few days she remained asymptomatic, required no additional transfusions, and serial methemoglobin levels returned at ~10-15%. She continued cimetidine until her methemoglobin level was under 10%.

Case Discussion: Dapsone is unique in that it can cause persistent methemoglobinemia for multiple days given the long half-life of the parent compound and presence of an active metabolite. In this case, the assessment was clouded, and diagnosis delayed, by suspicion for COVID-19 in the setting of a global pandemic. It was not until COVID-19 testing returned negative that toxicology was consulted, methemoglobin levels obtained, and treatment initiated - an example of how anchoring bias can adversely affect clinical decision making.

Conclusions: Dapsone is a well known cause of persistent intravascular hemolysis and methemoglobinemia, which in this case presented with symptoms similar to COVID-19. As methemoglobinemia and COVID-19 may have similar initial presentations, one must maintain a broad differential during the coronavirus pandemic to avoid anchoring bias.

KEYWORDS methemoglobinemia, COVID-19, anchor bias

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215. A textbook presentation of inorganic mercury poisoning from skin lightening cream – with persistent disease despite source removal

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Background: Mercury is a ubiquitous, non-essential, and toxic metal that exists in elemental, inorganic, and organic forms. Inorganic mercury salts have been used historically as antibacterials, topical antiseptics, paints, and dyes. Dermal absorption increases in lipophilic vehicles like creams. Herein we present a woman with subacute onset migratory rashes, nephrotic syndrome, and neuropsychiatric symptoms attributed to inorganic mercury poisoning from chronic application of an unregulated skin lightening product.

Case Report: A 40-year-old woman with morphea of her trunk and arms presented with three months of progressive lower extremity bilateral edema and a dynamic, painful, maculopapular desquamating rash to her face, neck, and upper extremities. Vital signs were within normal limits and laboratory studies revealed nephrotic-range proteinuria (8.2 g/day) and normal renal function (creatinine 1.0 mg/dL). Hemogram, metabolic panel, and urine studies were unremarkable. Renal biopsy revealed membranous nephropathy; skin biopsy revealed a neutrophilic infiltrate characteristic of hypersensitivity rash.

Suspicion for mercury toxicity grew when she revealed use of skin lightening cream, originating in Mexico, obtained from a well-known online retailer and applied daily over the previous year. Progressive symptoms of fatigue, insomnia, depression, irritability, insecurity, and apathy had developed over the same timeframe. Unspeciated urine mercury returned at >80 ug/L (normal <5 ng/mL) and whole blood mercury returned at 9 ng/mL (normal 0-9 ng/mL).

She stopped applying the cream when it was found to have a high mercury concentration (5880mg/kg). An outside healthcare provider decided against chelation. After discontinuation of the cream, urine mercury levels became undetectable over six months. Proteinuria and migratory rashes persisted despite the passage of nearly one year after source removal and five months since normalization of urine mercury levels.

Case Discussion: Some skin lightening and smoothing creams have previously been found to contain dangerous levels of mercury. In our case, chronic use of skin lightening cream (Nunn Care Crema Limpiadora) caused rashes characteristic of acrodynia on treated skin, symptomatic membranous nephropathy, and an array of neuropsychiatric symptoms. While early chelation may have been beneficial, at the point of regional Poison Control System consultation urine mercury levels were below 50ug/L and steadily decreasing, consistent with the 40-45 day half-life of inorganic mercury. Proteinuria had also plateaued. Given this, chelation was not pursued, anticipating limited benefit to symptoms likely to abate, with urine surveillance demonstrating normalization with source removal alone. Unfortunately, one year after exposure removal the proteinuria and migratory rashes have unexpectedly persisted.

Conclusions: Inorganic mercury poisoning results from dermal application of some poorly regulated skin lightening creams. We present a case of membranous nephropathy, subtle neuropsychiatric symptoms, and acrodynia to mercury exposed skin in an otherwise healthy adult. Despite removal from exposure,

proteinuria and rashes persist. Although awareness of the dangers from skin lightening creams, especially in some immigrant communities, is already heightened in public health and toxicology communities, we highlight the importance of maintaining a differential diagnosis that includes chronic exposure to toxins that may hide in everyday sight.

KEYWORDS mercury poisoning, nephropathy, skin lightening cream

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216. Incidence and Risk Factors for Carbon Monoxide Poisoning in the Emergency Department in Patan, Nepal

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Background: Carbon monoxide (CO) poisoning is a common cause of accidental and preventable death across the globe. In Nepal, carbon monoxide exposure occurs in the home due to the use of solid fuels for cooking and heating coupled with poor ventilation. The diagnosis is frequently made clinically as laboratory services and co-oximetry are not readily available. In order to understand the impact of CO poisoning in Nepal, a baseline incidence should be established. The objective of this study is to evaluate baseline carboxyhemoglobin (COHb) levels, population risk factors, and incidence of CO poisoning at a single hospital in Nepal.

Methods: This was a prospective, observational study conducted at the Patan Hospital Emergency Department. A convenience sample of patients greater than 18 years of age was evaluated over the course of one year (April 2019-March 2020). Patients were first administered a data collection instrument which gathered demographic information, smoking status, chief complaint, occupation, vital signs, COHb level, and information about the home including cooking source, presence of chimney, and number of windows. The provider also was asked to provide a pretest probability of CO poisoning based on clinical examination. For the purposes of the study, CO poisoning was defined as a COHb level >10%. COHb level was obtained using a noninvasive co-oximeter (Rad57 Masimo). Trends were analyzed between different risk factors using independent sample T test.

Results: 1040 patients completed the questionnaire. Of these, 745 patients completed the questionnaire and had recordable COHb levels. Of the 745 patients, the age range was 18-97, 407 (55%) were female, 153 (21%) were smokers. 425 (57%) of patients were assessed during warm months and 320 (43%) were assessed during cold months. The average COHb was 7.2% across the sample. The incidence of COHb >10% was 31%. Interestingly warm months were statistically significantly associated with higher COHb levels (8.12% vs 5.99%, $p < 0.05$) as well as higher incidence of COHb >10% (37% vs 22%). There was no difference in COHb levels between patients with indoor or outdoor based occupations. Regarding cooking source, those using firewood had statistically significantly higher COHb levels comparing to those using gas heat (8.51% vs 7.05%, $p < 0.05$).

228 (31%) of the patients were identified as having CO poisoning based on a COHb level >10%; providers identified 11 of these patients based on high clinical suspicion. All of these patients were either sleeping in enclosed spaces with poor ventilation or showering with a gas geyser.

Conclusion: We found a significant baseline incidence of COHb >10% (31%) in a convenience sample of adult patients presenting to a hospital in Nepal. Risk factors for higher baseline COHb levels identified in this sample included warmer months and cooking with firewood. While this study is limited by convenience sampling and the use of noninvasive CO-oximetry, the results are helpful to inform future research in this area.

KEYWORDS Carbon Monoxide, Nepal, unintentional exposure

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217. A Case Series of Defatting Dermatitis Requiring Surgical Intervention from Prolonged Dermal Methylene Chloride Exposure

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Background: Methylene chloride exposure is commonly associated with carbon monoxide (CO) poisoning via oxidation by the cytochrome P450 system. Although not well-defined in the literature, methylene chloride can also cause a significant defatting dermatitis and full thickness burns from prolonged dermal exposure as demonstrated in this case series.

Case Report: This is a case series of three patients with prolonged dermal methylene chloride exposure. A 20- (patient 1), 22- (patient 2), and 37-year-old (patient 3) males all presented to the emergency department with bilateral hand pain, swelling and erythema after cleaning a spilled container of paint and epoxy remover (60% methylene chloride, 20% methanol, <5% petroleum) with ungloved hands. Estimated time of dermal exposure was 45 minutes. Additionally, a database search was conducted on methylene chloride and dermal exposure using the MEDLINE/PubMed database. On a hospital day (HD) zero, all three patients were transferred to a tertiary burn center for definitive management of dermal chemical injury. Initial carboxyhemoglobin (COhb) percentages for patient one, two and three were 3.9% (daily tobacco user), 3.2% (daily tobacco user, and 2.4% (non-tobacco user), respectively. Repeat COHb 12 hours later for patient 2 and 3 were 2% and 1%, respectively. Wound care consisted of oat beta glucan and xeroform and two of the three patients were found to have non-viable epidermis. On HD three, patients 2 and 3 had non-viable epidermis and were taken to the operating room (OR) for debridement of full thickness injury to the bilateral palms, total body surface area (TBSA) of 2.5%. The debrided palms were dressed with a bioactive tissue allograft composed dehydrated human amnion/chorion membrane. On post-operative day five, the dressings were taken down and dressed with bacitracin and xeroform with pain control achieved with oral analgesics agents. The patients were discharged from the burn center with scheduled follow up.

Discussion: Methylene chloride exposure is commonly associated with the risk of developing CO poisoning. . Besides volunteer studies from the 1960s, this is the first case series of prolonged dermal methylene chloride exposure resulting in surgical intervention.

Conclusion: It is important to also consider prolonged dermal exposure to methylene chloride and the risk of significant skin injury necessitating surgical intervention. CO toxicity is unlikely from dermal exposure.

KEYWORDS methylene chloride, occupational exposure, dermal injury

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218. A Case of a 22-year-old male presenting with Torsades de Pointes and a Type-1 Brugada Pattern in the Setting of Chronic Loperamide Misuse

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Background: Loperamide is an over-the-counter anti-diarrheal medication that possesses mu opioid agonist properties. At therapeutic dosing, the low bioavailability and the activity of p-glycoprotein result in low circulating concentrations and inability to penetrate the central nervous system (CNS). Between 2010 and 2015, loperamide exposures doubled and large doses are being misused to alleviate opiate/opioid withdrawal and/or produce euphoric effects. Cardiotoxicity from loperamide manifesting as QT and QRS interval prolongation is well described in the literature. The association between the type-1 Brugada pattern and supratherapeutic loperamide concentration is rarely described. This case study contributes to the current literature by describing as case of a type-1 Brugada pattern and an elevated plasma loperamide concentration.
Case Report: A 22-year-old male with past medical history of depression, on sertraline, was admitted to our tertiary care facility from an outside hospital after an episode of polymorphic ventricular tachycardia (pVT) requiring defibrillation and ECG showing a type 1 Brugada pattern in the setting of chronic loperamide misuse. Multiple syncopal episodes prompted the patient to present to an emergency department (ED). Telemetry monitoring revealed polymorphic ventricular tachycardia with associated loss of consciousness. The patient underwent defibrillation at 200J, intravenous (IV) administration of 4 grams of magnesium (Mg) sulfate with conversion to normal sinus rhythm and return of consciousness. On arrival to our facility, vitals were notable for heart rate (HR) in the 60s, systolic blood pressure (SBP) in the 90s with an unremarkable exam including a normal level of alertness. Labs were notable for a potassium (k) of 4.7 mEq/L, Mg 3.1 mg/dl. An electrocardiogram (ECG) at this time showed a QTc interval of 667 milliseconds (ms),QRS of 136 ms, with ST elevation in V1-V3 with a "coved" appearance consistent with a type 1 Brugada pattern. The patient reported using 600 mg of loperamide 2-3 per week for two month to self-treat anxiety with last use one day prior to admission. Pt denied family history of sudden cardiac death, and personal history of cardiac disease. A loperamide concentration obtained at time of admission was 45 ng/ml (reference therapeutic range: 2.0 - 3.1 ng/ml). The patient was started on an isoproterenol infusion due to episodes of bradycardia (HR 40-50s) and prolonged QT interval. During 48 hours of admission, the patient was titrated off the infusion and his ECG prior to discharge returned to normal sinus rhythm (NSR).
Conclusion: Supratherapeutic concentrations of loperamide from misuse is associated with QT and QRS interval prolongation and pVT. Prior to this case, the type-1 Brugada pattern with associated elevated loperamide concentrations has only been described three times in the literature. This case adds to the evidence that loperamide can precipitate this morphology on ECG and may possibly be related to sodium channel blockade and polymorphisms within the sodium channel. Limitations include the absence of prior ECG and no genetic testing.

KEYWORDS loperamide, torsade de pointes, brugada

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219. Characterizing the Opioid-related Mortality in the United States using a National Poison Database

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Objective: Opioid-related deaths are a leading causes of accidental deaths in the United States with 70,237 fatalities in 2017 and the age-adjusted rate of drug overdose deaths increasing by 16% each year between 2014 and 2017. According to the European Monitoring Center for Drugs and Drug Addiction, 8,238 overdose deaths occurred in the European Union in 2017. This study aims to characterize the opioid-related mortality reported to U.S. poison centers (PCs).
Methods: A retrospective study was conducted using The National Poison Data System (NPDS), querying it for all human exposures to opioids between 2011 and 2018. We descriptively assessed the demographic and clinical characteristics of exposures. Temporal trends in the frequency of opioid reports were evaluated by using a generalized linear mixed model. Independent predictors of opioid mortality were studied using logistic regression. Adjusted odds ratios (AOR) and the corresponding 95% confidence intervals (95% CI) were reported.
Results: There were 604,183 opioid exposure calls made to the PCs during the study. The frequency of opioid exposures decreased by 28.9% (95% CI: -29.6%, -28.1%; $p < 0.001$), and the rate of opioid exposures decreased by 21.2% (95% CI: -24.7%, -16.9%; $p < 0.001$). There were 7,246 deaths in our study sample (1.2%), with 6.8% of cases demonstrating major effects. Among opioid-related deaths, there was a greater proportion of cases demonstrating poly substance exposures (80.7% vs 48.7%), including multiple opioids (24.9% vs 7.4%) as compared to non-fatal exposures. Cases between ages 30–39 years (19.9% vs 15.3%) and males (55.4% vs 44.5%) were more common in the exposures that resulted in deaths. Intentional abuse accounted for approximately half of the opioid related deaths. Hydrocodone exposures were most frequently observed and naloxone was a commonly used therapy. The risk of opioid-related death was the highest in cases between 50 and 59 years of age (Ref: 20–29 years) (AOR: 2.53, 95% CI: 2.34–2.75). Conversely, cases under 6 years of age (AOR: 0.46, 95% CI: 0.35–0.60) were 54% less likely to have a fatal opioid exposure. Males were 16% more likely than females to have a fatal overdose (AOR: 1.16, 95% CI: 1.10–1.22). Poly-substance exposures significantly increased the risk of mortality with the odds of death increasing 10-fold in cases exposed to 4 or more substances. Other Important predictors of an opioid-related death were intentional abuse (Ref: Unintentional exposure) (AOR: 4.92, 95% CI: 4.58–5.28), parenteral route of administration (Ref: Ingestion) (AOR: 3.52, 95% CI: 3.18–3.90) and exposure in the west census region of the U.S. (Ref: Northeast region) (AOR: 2.59, 95% CI: 2.36–2.86).
Conclusions: Analysis of calls to U.S. PCs indicated a decreasing trend of opioid exposures. Several demographic and clinical factors increased the risk of a fatal overdose. Opioid-related deaths demonstrated a high risk among intentional reasons for exposures and occurred in older age groups. Continued surveillance of opioid-related adverse events is key to highlight changes in the patterns of such adverse events while also ensuring the implementation of timely and tailored responses.

KEYWORDS Opioids, Mortality, National Poison Data System

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220. Epidemiology of Severe Oxycodone Exposures Reported to the U.S. Poison Centers, 2008–2018

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Background: Drug overdoses are a leading cause of death in the United States (U.S.) with 68,577 fatalities in 2018. Between 2016 and 2017, oxycodone comprised of approximately 18.8% of all prescribed opioids in the U.S. There were 182,748 visits to emergency departments (ED) related to oxycodone products in 2010. This study examines the national trends in oxycodone exposures reported to U.S. poison centers (PCs).
Methods: The National Poison Data System (NPDS) was queried for oxycodone exposures from 2008 to 2018 using the generic code identifiers. Severe outcomes (SO) were defined as cases that resulted in major medical outcomes or death. We identified and descriptively assessed the relevant demographic and clinical characteristics. Trends in oxycodone frequencies and rates (per 100,000 human exposures) were analyzed using Poisson regression methods. Percent changes from the first year of the study (2008) were reported with the corresponding 95% confidence intervals (95% CI). We developed a predictive logistic regression model to identify important predictors of severe outcomes with oxycodone exposures.
Results: There were 183,058 oxycodone exposures reported to the PCs from 2008 to 2018, with the calls decreasing from 16,644 to 12,982 during the study period. Among the overall oxycodone calls, the proportion of calls from acute care hospitals and EDs increased from 40% to 58.8% from 2008 to 2018. Multiple substance exposures accounted for 54.5% of the overall oxycodone calls. Cases between ages 30–49 years were more common among the SO group (41.3%) as compared to the non-SO group (39.3%). Suspected suicides (55.8% vs 34.4%) and intentional abuse (19.1% vs 11.1%) were more frequent in the SO group. Additional co-occurring opioids were reported in 14% of the SO cases and 7% of non-SO cases. Benzodiazepines were the most frequently reported non-opioid co-occurring substance in both groups. The frequency of oxycodone exposures decreased by 22.5% (95% CI: -24.2%, -20.8%; $p < 0.001$), and the rate of oxycodone exposures decreased by 14.1% (95% CI: -22.6%, -5.3%; $p = 0.009$). In multivariable-adjusted analyses, the risk of SO with oxycodone exposures was significantly associated with older age with cases between 50-59 years (Adjusted Odds Ratios [AOR]: 2.15, 95% CI: 2.00–2.31) demonstrating significantly increased odds of such outcomes. Males were 10% more likely to have a SO as a result of an opioid exposure (AOR: 1.10, 95% CI: 1.06–1.15). Suspected suicide (AOR: 2.22, 95% CI: 2.10–2.36) and abuse (AOR: 3.21, 95% CI: 2.98–3.35) were strong predictors of SO (Reference: Unintentional Reasons). Exposures to more than three substances (AOR: 3.16, 95% CI: 2.95–3.39) and involvement of parenteral route of administration (AOR: 2.53, 95% CI: 2.09–3.06) significantly increased the risk of a serious outcome in oxycodone exposures.
Conclusions: PC data demonstrated a decreasing trend of oxycodone exposures, which may in part be attributed to the reformulation of this medication with abuse-deterrent properties in 2010. However, the increase in the calls from the acute-care hospitals and EDs indicates higher risk of such exposures which may be mediated by several clinical and demographic factors.

KEYWORDS Oxycodone, Poison Center, Toxic Exposures

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221. Patterns of Heroin Exposures with Severe Adverse Events Reported to the U.S. Poison Centers

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Background: Heroin use in the United States has increased significantly with over 15,000 deaths in the year 2018. According to the National Survey of Drug Use and Health, the past year prevalence of heroin use was 0.3 per 100 persons in 2018. We sought to characterize the heroin exposures reported to the U.S. National Poison Data System (NPDS) which resulted in severe adverse events (SAEs).
Methods: The NPDS was queried for all human exposures to heroin reported to the U.S. Poison Centers (PCs) between 2008 and 2018. Cases that resulted in fatalities or major medical outcomes were classified as SAEs. We descriptively assessed the demographic and clinical characteristics. Trends in heroin exposures with SAEs were analyzed using Poisson regression with percent changes being reported. Independent predictors of SAEs were studied using multivariable logistic regression with adjusted odds ratios (AOR) reported.
Results: There were 49,839 heroin exposure calls made to the PCs from 2008 to 2018, with the number of annual exposures with SAEs increasing from 293 to 1,533 during the study. Single substance exposures accounted for 52.2% of heroin exposures with SAEs. Approximately 79% of SAE calls were reported from acute care hospitals and Emergency Departments (EDs). Of the patients reporting heroin exposures with SAEs, 39.4% were admitted to the critical care unit (CCU). Residence was the most common site of exposure (75.9%), and 85.7% of these cases were enroute to the hospital via EMS when the PC was notified. Among the SAE exposures, 69.5% were male, with individuals most commonly being between the ages of 20 and 29 years (42.2%). Intentional abuse (78.5%) and suspected suicides (10.3%) were commonly observed reasons for exposure. During the study period, the proportion of heroin abuse exposure cases increased (70.1% to 79.9%), while suspected suicides decreased (15.7% to 9.1%). There was a 2-fold increase in the number of annual deaths due to heroin. The most frequently co-occurring substance was benzodiazepines (12.9%). During the study period, the rate of heroin exposures with SAEs increased from 11.9 to 80.2 (per 100,000 human exposures) ($p < 0.001$). Patients over 60 years of age (Ref: 20–29 Years) (AOR: 1.30, 95% CI: 1.11–1.51) and males (Ref: females) (AOR: 1.09, 95% CI: 1.04–1.15) were at a significantly higher risk of SAE. Other factors that increased the odds of SAEs were 3 or more exposure substances (Ref: single substance exposures) (AOR: 2.36, 95% CI: 2.13–2.16), presence of additional opioids in exposure (Ref: No additional opioids) (AOR: 1.23, 95% CI: 1.14–1.33), and intentional abuse (Ref: unintentional exposures) (AOR: 1.56, 95% CI: 1.44–1.68).
Conclusion: There was a significant increase in the reports of heroin exposures with SAEs which may be a result of multiple factors including the cheaper cost of heroin and the adulteration of heroin with fentanyl and analogs. Several key characteristics, including reasons for exposure and presence of co-occurring opioids significantly increased the risk of SAE. Greater intervention and awareness initiatives are needed considering the severity of such overdoses.

KEYWORDS Heroin, Drugs of Abuse, Poison Centers

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222. Fentanyl Exposures Reported to the U.S. Poison Centers

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Background: There were more than 67,000 overdose-related deaths in the United States in 2018, with 70% of these fatalities involving opioids. Overdoses due to synthetic opioids increased by 45% between 2016 and 2017, primarily driven by fentanyl and analogs. Although between 2016 and 2017, more than 5 million prescriptions were dispensed, there is a paucity of nationally representative U.S. fentanyl overdose data. This study aims to examine the national trends in tramadol exposures reported to U.S. poison centers (PCs).
Methods: The National Poison Data System (NPDS) was queried for all closed, human exposures to fentanyl from 2013 to 2019 using the American Association of Poison Control Center (AAPCC) generic code identifiers. We identified and descriptively assessed the relevant demographic and clinical characteristics. Fentanyl reports from acute care hospitals and Emergency Departments (ACHs) were analyzed as a sub-group. Trends in frequencies and rates (per 100,000 human exposures) were analyzed using Poisson regression methods. Percent changes from the first year of the study (2013) were reported with the corresponding 95% confidence intervals (95% CI).
Results: There were 12,843 fentanyl exposures reported to the PCs from 2013 to 2019, with the calls increasing from 1,544 to 2,761 during the study period. Confirmed reports of illicit fentanyl overdoses grew from 3 reports in 2013 to 141 in 2019. The proportion of calls from ACH increased from 64% to 67.4% during the study. Multiple substance exposures accounted for 69.9% of the overall fentanyl calls and 53.4% of the calls from ACH. The most frequent co-occurring substances reported were benzodiazepines (15.5%) and heroin (7.2%). Residence was the most common site of exposure (80.1%) and 73.1% cases were enroute to the hospital when the PC was notified. Tachycardia and respiratory depression were the most frequently demonstrated clinical effects. Naloxone was a reported therapy for 44.1% cases, with this therapy being performed prior to PC contact in most cases. Demographically, 55.5% of cases were males, and the most frequent age groups were 20-29 years (22.5%) and 30-39 years (21.3%). Intentional misuse (41.4%) and suspected suicides (16.8%) were commonly observed reasons for exposure, with the proportion of suicides being higher in cases reported by ACH (22.8%). Approximately 22% of the patients reporting fentanyl exposures were admitted to the critical care unit (CCU), with 11% of patients being admitted to non-CCU. Major effects were seen in 18.2% cases and the case fatality rate was 9.2%, with deaths increasing significantly during the study period (62 deaths in 2013 to 1,184 deaths in 2019). The frequency of exposures increased by 78.8% (95% CI: 68%, 90.3%; $p < 0.001$), and the rate of exposures increased by 82.3% (95% CI: 36.3%, 143.9%; $p < 0.001$).
Conclusions: PC data demonstrated an increasing trend of fentanyl exposures, which may in part be attributed to the due to increased use of illegally or illicitly made fentanyl. Our study demonstrated a significant proportion of fentanyl exposures associated with intentional abuse, suicide and a significantly increasing mortality rate. Fentanyl exposure reports from acute care hospitals and EDs during the study increased.

KEYWORDS Fentanyl, National Poison Data System, Drugs of Abuse

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223. Epidemiology of Benzodiazepine Exposures using the National Poison Data System

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Background: The rate of visits involving benzodiazepine prescriptions increased from 3.8% to 7.4% between 2003 and 2015 in the United States. Benzodiazepine-related overdose mortality has risen sharply, from 0.6 per 100 000 adults in 1999 to 4.4 per 100 000 in 2016. Approximately 30% of overdoses involving opioids also involve benzodiazepines. The objective of the study was to describe the epidemiology of benzodiazepines exposures using a near real-time national poison center (PC) database.
Methods: The National Poison Data System (NPDS) was queried for all human exposures to benzodiazepines from 2013 to 2019 using the American Association of Poison Control Center (AAPCC) generic code identifiers. We descriptively assessed the relevant demographic and clinical characteristics. Reports from acute care hospitals and emergency departments (ACHs) were analyzed as a sub-group. Trends in benzodiazepines frequencies and rates (per 100,000 human exposures) were analyzed using Poisson regression methods. Percent changes from the first year of the study (2013) were reported with the corresponding 95% confidence intervals (95% CI).
Results: There were 490,572 human exposures to benzodiazepines reported to the PCs from 2013 to 2019, with the number of calls decreasing from 75,108 to 58,377 during the study period. Polysubstance exposures accounted for 73.5% of benzodiazepines exposures. Of the total benzodiazepines calls, the proportion of calls from ACH increased from 63.7% to 69.3% during the study period. Multiple substance exposures accounted for 70.6% of the calls from ACH. Approximately 23.1% of the patients reporting benzodiazepines exposures were admitted to the critical care unit (CCU), while 12.3% patients were treated and released. Residence was the most common site of exposure (93.6%), and 75.8% cases were enroute to the hospital when the PC was notified. Among the patients, 61.4% were females, with the majority of benzodiazepines exposures occurring between the ages of 20-29 years (18.6%). Suspected suicides (60.6%) was the most commonly reported reason for exposure. The proportion of such cases was higher in reports from acute care hospitals and EDs (74.1%). Among single substance benzodiazepine exposures, this proportion was significantly lower (60.6% vs 47.6%). Major effects were seen in 6% cases and the case fatality rate was 0.5%. Notably, there was an approximately 54% decrease in the number of deaths during the study period. The most frequently co-occurring substances associated with the cases were alcoholic beverages (15.9%) and antipsychotics (8.8%). Tachycardia (15.2%) and respiratory depression (5.5%) were commonly observed clinical effects. During the study period, the frequency of benzodiazepines exposures decreased by 22.3% (95% CI: -17.5%, -29.1%; $p = 0.01$), and the rate of benzodiazepines exposures decreased by 20.8% (95% CI: -14.8%, -25.9%; $p = 0.03$).
Conclusions: Benzodiazepines exposures decreased during the study period. The increased severity of cases observed may be attributed to its concurrent use with opioids. Abuse and diversion of benzodiazepines may be as a result of its perception as a low cost alternative to opioids. Benzodiazepines has also been increasingly associated with suicidal ideation, the most common reason for exposure in our sample. Increasing prescriber awareness and better screening may be key to reduce such overdoses.

KEYWORDS Benzodiazepines, Toxic Exposures, National Poison Data System

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224. Characteristics and Predictors of Hydrocodone Misuse: Results from the 2018 National Survey on Drug Use and Health

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Background: There were more than 168 million total opioid prescriptions dispensed in the United States in the year 2018. The abuse and diversion of prescription opioids, especially hydrocodone, continue to be a serious public health concern. According to the Monitoring the Future survey, prevalence of the past year Vicodin misuse were 0.9% and 1.1% for 8th and 10th graders respectively. The current study aims to identify predictors of hydrocodone misuse using the National Survey of Drug Use and Health (NSDUH) data.
Methods: The 2018 NSDUH public use cross-sectional data were analyzed. The respondents were classified into two groups, past year hydrocodone users and misusers, based on the screening questions assessing past year use and misuse of hydrocodone products. The prevalence of selected demographics, clinical factors, and substance use/abuse, including prescription medications, was assessed descriptively for the two population groups using cross tabulated frequencies and chi-square tests. Logistic regression was used to identify predictors of hydrocodone misuse adjusting for covariates. Adjusted odds ratios (OR) and corresponding 95% Confidence Intervals (CI) were calculated.
Results: The survey included 56,313 respondents, of which 8,064 respondents (14.3%) reported using hydrocodone in the previous year. Of these 1,193 reported hydrocodone misuse, accounting for 14.7% of the total hydrocodone users or 2.1% of the survey sample. Past year hydrocodone misusers were more likely to be males (53.9% vs 42.4%, $p < 0.001$), unmarried (75.5% vs 56.8%, $p < 0.001$), and under 25 years of age (42.7% vs 25.8, $p < 0.001$) compared to non-misusers. The proportion of past year alcohol use (59.9% vs 33.3%, $p < 0.001$), low income (21.3% vs 17.7%, $p = 0.01$), and major depression (22.2% vs 11.8%, $p < 0.001$) was greater in people misusing hydrocodone. Past year use and misuse of substances, including heroin (6.5% vs 1.4%, $p < 0.001$) and marijuana (64.7% vs 25.6%, $p < 0.001$), was significantly higher in hydrocodone misusers. Previous year use of marijuana (OR: 2.47, 95% CI: 2.11–2.90) and tranquilizers (OR: 1.17, 95% CI: 1.01–1.42) were significant predictors of hydrocodone misuse (ref: non-users). Males (vs females) were 38% (OR: 1.38, 95% CI: 1.19–1.68) and unmarried individuals (vs married) were 18% (OR: 1.18, 95% CI: 1.03–1.41) more likely to be hydrocodone misusers. Among clinical conditions, presence of major depressive disorder (OR: 1.19, 95% CI: 1.01–1.48) and suicidal ideation (OR: 1.52, 95% CI: 1.20–1.92) increased the risk of hydrocodone misuse. Hydrocodone misuse was significantly more likely among misusers (vs non-misusers) of other substances including sedatives (OR: 1.95, 95% CI: 1.11–3.14), morphine (OR: 4.40, 95% CI: 2.06–9.43), and stimulants (OR: 2.90, 95% CI: 1.22–6.86). Conversely, individuals with older age (65 years and above) (ref: 12-17 years) (OR: 0.35, 95% CI: 0.21–0.60) were significantly less likely to misuse hydrocodone.
Conclusions: The results indicate a high prevalence of hydrocodone misuse within a nationally representative sample of survey respondents. Use and misuse of substances and underlying mental health conditions were important predictors of hydrocodone misuse. Appropriately directed harm reduction strategies must be developed focusing on these predictors.

KEYWORDS Hydrocodone, NSDUH, Predictors of Misuse

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225. Pediatric Opioid Exposures Reported to the U.S. Poison Centers

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Background: Pediatric accidental exposures present a significant public health challenge and can result in serious complications, with approximately 60% calls received by poison centers (PCs) in 2017 attributed to children. There were 4,235 fatalities among patients aged 15-24 years as a result of a drug-related overdose in 2015 with more than half of these involving opioids. The aim of this study was to evaluate pediatric opioid exposures reported to the United States Poison Centers (PCs).
Methods: A retrospective study was conducted utilizing the National Poison Data System (NPDS). Pediatric exposures, defined per NPDS specifications as individuals aged $\leq$19 years, to opioids were identified using generic codes. Serious medical outcomes (SMO) were defined as cases that resulted in moderate or major outcomes as well as deaths. Descriptive statistics were used to analyze the characteristics of pediatric exposures. Poisson regression models were used to evaluate the trends in the number and rates of exposures with the year as the independent variable. Important risk markers for SMO were highlighted using multivariable logistic regression models. We reported adjusted odds ratios (AOR) and the corresponding 95% confidence intervals (CI).
Results: There were 101,201 pediatric opioid exposures reported to the PCs during the study, with 21% of the cases demonstrating SMO. The proportion of patients under 5 years of age was significantly lower in exposures with SMO (21.9% vs 78.1%). The proportion of SMO during the study period increased from 15.2% to 21.1%. Demographically, the exposures with SMO occurred more frequently in males (54.1% vs 45.3%). The proportion of suspected suicides (46% vs 21.6%) and intentional abuse (20.4% vs 5.8%) was higher among exposures with SMO, primarily driven by the teenage population. More than 80% of the cases less than 5 years of age resulted from accidental exposure to opioids. Single substance exposures were more common in exposures without SMO (53.5% vs 42.7%). Multiple opioids were reported in 7.5% of SMO exposures and 2.8% of exposures without SMO. The most common site of exposure in both groups was residence and hydrocodone and oxycodone were the most commonly reported opioid exposures. Children between 6 and 19 years of age had a 35% higher risk of such outcomes (AOR: 1.35, 95% CI: 1.27–1.44) (Reference: 0–5 years). Similarly, males had a significantly higher risk of SMO compared to females (AOR: 1.19, 95% CI: 1.14–1.23). SMO were 4 times more likely in cases of intentional abuse (AOR: 4.78, 95% CI: 4.47–5.13). Serious outcomes were also significantly associated with exposure to multiple substances (AOR: 2.18, 95% CI: 2.10–2.27).
Conclusions: Our study noted an increase in the proportion of serious medical outcomes among pediatric opioid exposures, which highlights the need for greater attention to managing prescriptions and increasing patient awareness regarding the safe storage and adverse effects of these medications. The reasons for exposure varied among different pediatric age groups. Several factors independently increased the risk of serious medical outcomes in this patient population.

KEYWORDS Opioids, National Poison Data System, Unintentional Exposures

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226. Smoking Hookah, an Under-recognized Source of Carbon Monoxide Poisoning

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Background: Unintentional carbon monoxide (CO) poisoning is a leading cause of poisoning morbidity and mortality in the United States. Amongst many sources of exposure, an often unrecognized and preventable cause of poisoning is water pipe tobacco smoke, or hookah. The goal of this study was to identify the prevalence and outcomes of CO poisoning from smoking hookah in our urban emergency department (ED).
Methods: We performed a retrospective chart review of all patients who presented to our ED between January 2012 and March 2020 and who had a carboxyhemoglobin (CO) level measured. Identified charts were reviewed and cases were included if there was mention in the documentation of smoking hookah. Cases involving structural fires, gas exposures, vehicular and other non-smoking exposures were excluded. Patient demographics, clinical characteristics, associated symptoms, others exposures and disposition were recorded.
Results: During the 8-year period, a total of 875 patients had a CO level. Of those, 771/875 were excluded, leaving 104 cases. Of these cases, 59% of patients were female, and 45% had a history of regular tobacco use. Clinical manifestations included syncope (n = 48, 46%), dizziness (n = 38, 37%), headache (n = 20, 19%), altered mental status (n = 19, 18%), and seizure (n = 6, 6%). 43 patients had isolated complaints of chest pain or shortness of breath. No patient had ischemia on ECG. Carboxyhemoglobin levels ranged from 0.2 to 33.7%. 56 (54%) patients were discharged home and 26 (25%) were transferred to the regional hyperbaric (HBO) center. 22 (21%) were discharged against medical advice, eloped, or were admitted for other conditions. Of the 28 patients for whom transfer was recommended, 25 (96%) experienced a syncopal episode and 26 (96%) had a CO level above 11.8% No data was available regarding long term outcomes of patients transferred for HBO therapy.
Discussion: Per the CDC, there were 10,663 ED visits in New York State between 2012-2018 for unintentional CO poisoning, with 1,236 hospitalizations. Nationally, between 2010-2015, a total of 2,244 deaths were due to CO poisoning, mostly during the winter months. The majority of exposures were from fires, stoves, and vehicles. We identified smoking hookah as a significant source of CO exposure in our population. The Monitoring the Future survey found that in 2018, 1 in 13 High School students in the US admitted to smoking hookah. It also showed variable prevalence of smoking hookah by region. The Northeast had the highest prevalence, where 1 in 6 young adults (19-30 years) had smoked hookah. In our series, smoking hookah led to 104 potentially preventable ED visits, with 26 requiring transfer. More significant outcomes were associated with CO >11% and syncope.
Conclusion: Smoking hookah is an under-recognized and significant source of CO exposure. Recognition of exposure is the first step, and a thorough social history should be performed. Prompt identification and referral to definitive therapy can potentially preclude lasting neurologic or neuropsychiatric sequelae. Further study is needed to determine long term outcomes. Additional public health educational efforts should be directed towards broad dissemination of this consequential exposure.

KEYWORDS Carbon Monoxide, Hookah, Syncope

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227. Survival from Out-of-Hospital Cardiac Arrest from Opioid Overdose

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Background: In 2018, 46,802 drug overdose deaths from opioids were reported the U.S. Although this represents a 4.6% decrease in the age-adjusted rate of overdose deaths from 2017 (from 21.7 to 20.7 per 100,000 population), these deaths place a tremendous burden on families, the healthcare system and society at large. The average age of the victim of sudden cardiac arrest in the US is 60 years and the survival to hospital discharge is 10.8%.
The Statewide Opioid Reporting Directive (SWORD) requires Emergency Medical Service (EMS) providers report all suspected opioid overdoses to the Poison Control Center (PCC). SWORD data collection by PCC is both prescribed and prospective. The object of this study is to determine the survival rate following out-of-hospital cardiac arrest (OHCA) from opioid overdose using a statewide surveillance system.
Methods: A retrospective cohort study of all suspected opioid overdose events reported to the PCC from July 1, 2019 to December 31, 2019 (six months) was conducted. Specialists in Poison Information (SPI) collected pre-scripted data on each overdose event including demographic information, circumstantial details, and patient disposition (e.g., dead on scene, transported to emergency department (ED), refused transport). For those overdose victims transported to the ED, SPIs performed follow up calls to gather additional clinical information until either death or final medical outcome was determined.
Results: A total of 2,392 suspected opioid overdose events were reported over the six-month study period. Of these, 1,757 patients (73%) were male and mean age was 41.2 years (range 3-95 years).
Of the 2392 opioid overdose events, 221 (9.2%) persons suffered from OHCA. Of these, 97 had overt signs of irreversible death (rigor, dependent lividity, decomposition, etc.) and were excluded from further analysis, while 124 had potentially reversible OHCA.
All 124 persons suffering from potentially reversible OHCA received CPR and ACLS at the scene. Thirty-four (27.4%) did not have return of spontaneous circulation (ROSC) and resuscitation efforts were terminated at the scene. These 34 persons were determined dead at the scene and were not transported to the ED. Ninety (72.6%) had ROSC and were transported to the ED. None died in transit.
Of the 90 OHCA with ROSC transported to the ED, 45 (50%) died in the ED and 45 (50%) were admitted to the ICU. Of the 45 persons admitted to the ICU, 18 (40%) died during the hospitalization and 27 (60%) survived to hospital discharge. The overall rate of survival to hospital discharge was 27/124 (21.8%) for OHCA from opioid overdose.
Conclusions: In a statewide surveillance system, the rate of survival to hospital discharge following OHCA from opioid overdose was 21.8%, double that of the general population, 10.8%. For those with ROSC and admitted to the ICU, the survival rate was 60%. A larger longitudinal study with logistic regression would help determine the factors related to the higher survival rates in this population. Public health authorities and all providers can use these survival rates to inform policies and conversations.

KEYWORDS Survival Statistics, opioid overdose, cardiac arrest

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228. Opioid use among rattlesnake envenomations differs by type of antivenom

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Background/Objectives: Rattlesnake envenomations are often treated with opioids during initial hospitalization due to the associated pain. As of 2019, two commercially available antivenoms are used to treat rattlesnake envenomations: FabAV, an ovine-derived Fab antivenom, and Fab2AV, an equine-derived $F(ab')_2$ antivenom. The objective of this analysis is to investigate whether opioid usage during initial hospitalization differs depending on which antivenom was used.

Methods: The American College of Medical Toxicology (ACMT) North American Snakebite Registry (NASBR) database was queried for rattlesnake envenomation cases reported in 2019 that were treated with antivenom. Open text fields were reviewed for additional information to supplement the categorical data. Rattlesnake envenomations can be treated with more than one type of antivenom; for this analysis, cases were categorized based on the type of antivenom received at the first dosing event. Demographics, bite characteristics, and opioid use during initial hospitalization were summarized by antivenom group. The proportion of cases with opioid use during initial hospitalization was compared between antivenom groups using a two-sided Fisher's exact test.

Results: There were 113 rattlesnake evenomation cases reported to NASBR in 2019. Eighty-five patients were first treated with FabAV and 28 were first treated with Fab2AV. Of those first given FabAV, 33 (38.8%) were also given Fab2AV during subsequent doses, and of those first given Fab2AV, one patient (3.6%) was also given a combination of FabAV and Fab2AV at a subsequent dose. The patient population was predominantly male (75.6%) with a median age of 38 years (IQR: 19-56) and most (71.2%) were discharged within 48 hours. Patients who received FabAV initially were more likely to have an upper extremity envenomation (52.9% vs. 32.1%) and to be treated sooner after the bite time (median 3 hours, IQR 2-4 vs. median 4, IQR 2-8; Table 1).

Among the FabAV group, 63 (74.1%) were treated with opioids during the initial hospitalization, as compared to 27 (96.4%) of the Fab2AV group ($p = 0.0228$; Table 2). Among adolescents and adults (age >12 years), 76.8% of the FabAV group and 95.7% of the Fab2AV group were treated with opioids ($p = 0.0610$). Among all patients, those who were treated with FabAV first and subsequently given Fab2AV were more likely to use opioids than those who were treated with FabAV alone (90.9% and 63.5%, respectively).

Conclusions: In this uncontrolled observational study, rattlesnake envenomation patients initially managed with FabAV were less likely to receive opioid analgesics during their initial hospitalization than those initially managed with Fab2AV. Baseline differences in patient population and envenomation characteristics, such as bite location, time to antivenom treatment and snakebite severity, were not controlled for in this analysis. These results are also likely affected by the practice pattern of treatment teams in participating sites. While this observational study does not prove causation, our findings suggest that there is a potential relationship between antivenom treatment type and opioid use which warrants further investigation.

KEYWORDS Rattlesnake, Antivenom, Opioid analgesics

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Table 2(#228). Opioid Use During Initial Hospitalization by Initial Type of Antivenom.

	FabAV (N = 85)	Fab2AV (N = 28)	P-Value[a]
Opioids	63 (74.1%)	27 (96.4%)	0.0228
No Opioids	20 (23.5%)	1 (3.6%)	
Unknown	2 (2.4%)	0 (0.0%)	

[a]Two-tailed Fisher's exact test; unknown cases not included in test

Table 1(#228). Demographics and Case Characteristics by Initial Type of Antivenom.

	FabAV (N = 85)	Fab2AV (N = 28)	Total (N = 113)
Age (years)			
Median (IQR)	44.0 (20.0, 59.0)	33.0 (17.5, 43.5)	38.0 (19.0, 56.0)
N	85	28	113
Sex			
Female	19 (22.4%)	9 (32.1%)	28 (24.8%)
Male	66 (77.6%)	19 (67.9%)	85 (75.2%)
Bite Location			
Lower Extremity	40 (47.1%)	19 (67.9%)	59 (52.2%)
Upper Extremity	45 (52.9%)	9 (32.1%)	54 (47.8%)
Time from bite to antivenom (hours)			
Median (IQR)	3.0 (2.0, 4.0)	4.0 (2.0, 8.0)	3.0 (2.0, 5.0)
N	83	28	111
Length of Initial Hospitalization			
≤24 Hours	10 (11.8%)	7 (25.0%)	17 (15.0%)
25-48 Hours	52 (61.2%)	12 (42.9%)	64 (56.6%)
49-72 Hours	16 (18.8%)	8 (28.6%)	24 (21.2%)
≥73 Hours	7 (8.2%)	1 (3.6%)	8 (7.1%)

229. Trends in Intentional Hydroxyzine Exposures Reported to U.S. Poison Control Centers

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Background: Despite being available for over 60 years, relatively little has been published regarding hydroxyzine overdoses. Literature is limited to a small number of older case reports, and no observational studies or reviews of hydroxyzine overdose could be found. Annual poison center data shows that antihistamines and psychotropic medications are among the most frequently encountered poisoning exposures. As both an antihistamine and anxiolytic, hydroxyzine is a medication with a high potential for overdose and better-published descriptions of exposures are needed.
Methods: Cases of intentional hydroxyzine overdose were requested from the National Poison Data System from 1/1/2000 to 12/31/2018. Single-substance exposures were examined for the most common clinic effects, therapies provided, management site, and outcomes. Cases with unknown outcomes were excluded from the analysis of single-substance exposures.
Results: There were a total of 82,347 intentional hydroxyzine exposures reported during the study period, including 19,885 single substance exposures with known outcomes. The total number of exposures increased from the previous year in 17 of the 18 years studied, and is depicted in Figure 1. The reason for exposure was most often suspected suicide (88%), followed by misuse (6%), unknown (4%), and abuse (3%). The most common clinic effects following single-substance exposures were drowsiness/lethargy (35.4%) and tachycardia (21.2%). Other clinical effects with >1% occurrence were hypertension (8.3%), agitation (6.3%), vomiting (5.0%), nausea (3.7%), hypotension (2.9%), dizziness/vertigo (2.7%), confusion (2.4%), mydriasis (2.3%), electrolyte abnormality (2.0%), slurred speech (1.9%), bradycardia (1.7%), seizure (1.4%) hallucinations/delusions (1.2%), abdominal pain (1.2%), and tremor (1.1%). No effect occurred in 35.3% of cases, minor effect in 42.1%, moderate effect in 19.2%, and major effect in 1.1%. Six deaths were reported. The most common therapies performed were IV fluids (29.3%), single-dose activated charcoal (26.8%), cathartic (7.5%), benzodiazepines (4.4%), lavage (2.6%), oxygen (2.3%), antiemetics (1.9%), dilution (1.7%), and other sedation (1.0%). The anticholinergic reversal agent physostigmine was used in 16 of 19,885 cases (0.08%). Most patients were treated in the emergency department and released to home (35.6%) or admitted to a psychiatric facility (36.7%). 13.5% of patients were admitted to non-critical care unit and 9.4% to a critical care unit. Remaining management sites included on-site (1.6%) and other (0.4%).
Conclusion: Intentional hydroxyzine overdoses have increased substantially over the past 19 years, but major effects have been rare. The most common clinical effects were drowsiness and tachycardia. Treatments most often given were IV fluids and single-dose charcoal. Physostigmine, often recommended for other antihistamine overdoses, was used in less than 0.1% of intentional single-substance hydroxyzine overdoses. 22.9% of patients required admission to the hospital.

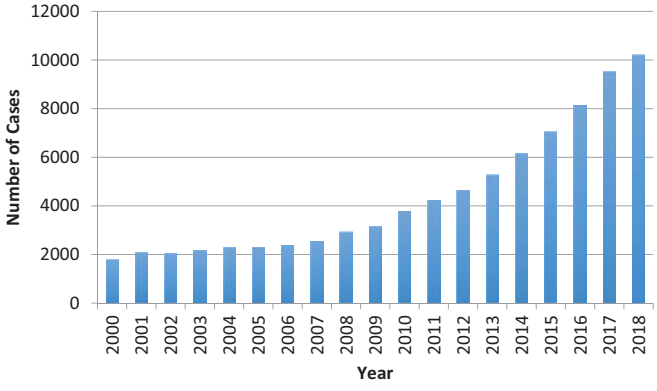

Figure 1(#229). Intentional Hydroxyzine Overdoses Reported to U.S. Poison Control Centers by Year.

KEYWORDS Hydroxyzine, Intentional Overdose, Physostigmine

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230. Intentional Diphacinone Ingestion with Severe Prolonged Coagulopathy

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Background: Diphacinone is a long-acting anticoagulant rodenticide. It is a vitamin K antagonist of the inanedione class. Human exposures to diphacinone are rare. To our knowledge, there is only one documented case of intentional diphacinone ingestion in the literature. We report a case of an analytical confirmed repeat diphacinone ingestion resulting in prolonged coagulopathy.
Case: A 51-year-old female with a history of depression presented to an emergency department (ED) with bloody stools and diffuse atraumatic bruising. She endorsed suicidality and reported ingesting eight vials of the rodenticide "Tomcat Liquid Concentrate" containing 0.106% diphacinone over the previous six weeks.
She was tachycardic (118 bpm), with otherwise normal vital signs. Her exam revealed diffuse ecchymosis and dark bloody stools. Initial labs were significant for a hemoglobin of 5.5 g/dL and an INR >8. Acetaminophen and salicylate concentrations were negative. Poison Control was contacted and recommended intravenous vitamin K, prothrombin complex concentrate (PCC), and tranexamic acid. She was given 25 mg oral vitamin K, 10 mg subcutaneous vitamin K, 2 units of packed red blood cells and 1 unit of fresh frozen plasma (FFP). PCC was not available. She was transferred to another facility where she remained stable for four days on oral vitamin K and ultimately transferred to a psychiatric facility. Her discharge INR and hemoglobin were 1.1 and 10.7 g/dL, respectively.
Six weeks later she presented again to the ED after routine labs revealed an INR of 14.3. The patient admitted to ingesting four more packets of diphacinone over the previous two weeks. She was treated with FFP, intramuscular vitamin K and transferred to another facility. She remained inpatient for three days with oral vitamin K and discharged with a plan to continue outpatient vitamin K and INR checks.
Eight weeks later the patient presented to an ED from clinic after her bloodwork showed an INR of 20.1. She was stable without any signs of bleeding and denied further ingestion. She reported she was instructed to increase her vitamin K dose for a rising INR but was concerned with her supply and began rationing the medication. She was given 2 units of FFP, intramuscular vitamin K and again transferred. She was treated inpatient with oral vitamin K for two days and discharged on vitamin K with a plan for frequent INR checks. Qualitative serum testing by high performance liquid chromatography/ tandem mass spectrometry confirmed the presence of diphacinone (NMS Labs, Horsham, PA).
Discussion: We present a case of repeated diphacinone ingestions resulting in a prolonged (> 3 months) coagulopathic state. This is

not surprising considering she endorsed multiple ingestions over an 8-week timespan and the elimination half-life of diphacinone is estimated to be 15-20 days. As expected, her coagulopathy responded to vitamin K but this case also highlights the challenge in ensuring medication compliance for these patients.
Conclusion: Treatment of diphacinone poisoning is similar to other long acting vitamin K antagonists and clinicians should be aware of the possibility of prolonged coagulopathy, especially with repeat exposures.

KEYWORDS coagulopathy, intentional, diphacinone

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231. Characterization of Nebivolol Exposures Reported to U.S. Poison Centers

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Background: Nebivolol is a selective beta1-adrenergic antagonist that slows heart rate and causes peripheral vasodilation via nitric oxide production. Approved by the Food and Drug Administration in 2007, overdose may cause hypotension, bradycardia, cardiovascular collapse and death. Despite nebivolol's availability for over ten years, a comprehensive review of this drug's toxicity is yet to be published. Given the paucity of literature, our objective was to characterize symptoms, management, and outcomes of patients exposed to nebivolol as reported to U.S. poison centers.
Methods: All nebivolol exposures reported to the National Poison Data System (NPDS) from 1/1/2008 to 12/31/2019 were abstracted. Only exposures to nebivolol as a single agent were included. Data for pediatric and adult populations were collected.
Results: We identified 3,856 nebivolol exposures during the study period. Ages ranged from 2 months to 99 years: 2,246 (58.2%) patients were under 18 years of age; and 1,697 (44%) of patients were male. Of the 1,610 adult cases, 159 (9.9%) patient ages were unknown and 1,399 (86.9%) were followed to known outcome. The most common clinical effects from all adult exposures were bradycardia (n = 86; 6.1%), dizziness/vertigo (n = 69; 4.9%), and hypotension (n = 53; 3.8%). No deaths were reported in either adult or pediatric populations.
Reasons for adult exposure included therapeutic error (n = 1,234; 76.6%) and suspected suicide (n = 157; 9.8%). Of the 1,234 patients with therapeutic errors, 81 (6.6%) experienced a minor or moderate effect and 303 (24.6%) experienced no effect after the exposure. Minor and moderate effects included dizziness/vertigo (n = 37; 45.7%), bradycardia (n = 19; 23.5%), and hypotension (n = 13; 16%).
Eleven (11) cases had major effects recorded. None occurred in the group with therapeutic errors; seven (63.6%) occurred in suspected suicides. Effects included bradycardia (n = 6; 54.5%) and hypotension (n = 6; 54.5%). Cases with major effects were treated with a combination of fluids (n = 7; 63.6%), vasopressors (n = 7; 63.6%), and glucagon (n = 6; 54.5%).
In total, 2,246 pediatric cases were identified with 1,795 (79.9%) followed to known outcome. Exposures were primarily unintentional (n = 2,223; 99%) with 116 (5.2%) occurring due to therapeutic errors. No pediatric patient suffered major effects. Minor or moderate effects occurred in 141 (7.9%) pediatric patients: drowsiness/lethargy (n = 18; 12.8%); bradycardia (n = 42; 29.8%); hypotension (n = 69; 48.9%); and vomiting (n = 15; 10.6%). Therapies utilized for these patients include activated charcoal (n = 62; 44%), fluids (n = 57; 40.4%), and glucagon (n = 12; 8.5%).
Conclusion: In this review of nebivolol exposures from the NPDS, no deaths were reported. Major effects after nebivolol exposures were expectedly bradycardia and hypotension. These primarily occurred after intentional ingestion. Limitations of this study include its retrospective nature as well as the possibility of error in coding the data. While this study sheds light on the characterization and management of nebivolol exposures, further studies might better characterize toxic dose and optimal treatment regimens.

KEYWORDS nebivolol, overdose, poison center

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232. Magnetic resonance imaging features in massive paradichlorobenzene poisoning

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Background: Paradichlorobenzene (PDCB) is a common ingredient found in mothballs and urinal deodorizer cakes. While PDCB toxicity and associated long-term neurological sequelae has been described by previous case reports, we present a unique case of acute neurological decompensation with rapidly evolving neuroimaging.
Case Report: A 31-year-old female with a past medical history significant for substance abuse (methamphetamine, opioids, alcohol) presented to the emergency department for increased lethargy over the past several weeks, bizarre behavior, and decreased oral intake. On presentation, she smelled strongly of toilet bowl deodorizer, had a hyperpigmented rash, and was not communicative. Per patient's mother, she recently admitted to sniffing and ingesting toilet bowl deodorizers after an excessive amount of wrappers were found under the patient's bed. Initial management centered on starting parenteral high lipid concentration nutrition as well as n-acetylcysteine for possible antioxidant benefits. Magnetic resonance imaging (MRI) of the brain obtained in the first 24 hours of admission exhibited hyperintensity of the corpus callosum. The patient became increasingly catatonic over the following 48 hours; a subsequent MRI brain revealed worsening hyperintense lesions seen in the corpus callosum. Of note, the diffusion restriction in the splenium of the corpus callosum was observed to be significantly worse from the MRI just three days prior. Her catatonia worsened, ultimately requiring a percutaneous endoscopic jejunostomy tube for nutrition. Urine PDCB concentration obtained upon presentation resulted as 1,000 mg/L (ref: <25 mg/L); repeat urine concentrations one month into the patient's hospital stay were 990 mg/L. The patient died on hospital day 37 from respiratory failure and aspiration pneumonitis.
Case Discussion: This case is notable for an extremely elevated urinary PDCB concentration in a patient with a devastating neurological outcome. Previous reports have described PDCB toxicity as a rare, but potentially life threatening condition, particularly when neurotoxicity occurs. The mechanism of toxicity is not well understood but is suspected to be derived from cerebral oxidative damage. A coasting phenomenon has been postulated, with slow release of PDCB from adipose tissue as oral nutrition decreases, contributing to the long-term adverse effects seen in PDCB toxicity. The management of PDCB toxicity is not well described and prognosis can vary. Our patient's case is particularly notable for the progressive leukoencephalopathy demonstrated in the corpus callosum on serial MRIs only days apart. This indicates that rapid progression of this toxicity may occur, particularly with massive ingestion.

Conclusion: Practitioners should be aware of the potential for rapid neurocognitive decline in patients poisoned with PDCB. MRI imaging may be beneficial and aid with prognosis in addition to other clinical indicators.

KEYWORDS paradichlorobenzene, neurotoxicity, urinal deodorizer

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233. A 2-month old Infant with Posterior Reversible Leukoencephalopathy Syndrome Secondary to Cocaine Toxicity

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Background: Cocaine is an indirect sympathomimetic that can result in multisystem organ dysfunction in large doses. Young children with cocaine intoxication tend to have a predominance of neurologic effects ranging from encephalopathy to seizures. To date, there are no reported cases of pediatric patients with posterior reversible leukoencephalopathy syndrome (PRES) secondary to cocaine intoxication. We report a case of a 2-month-old infant who presented with hypertension, encephalopathy, and MRI findings consistent with PRES in the setting of acute cocaine toxicity.
Case Report: A 2-month-old, ex-37-week, formula-fed infant female with a history of intra-uterine methadone exposure and neonatal abstinence syndrome (NAS) presented to the Emergency Department (ED) via ambulance for the acute onset of altered mental status. Her initial vital signs were notable for the following: temperature 35.6 degrees Celsius, heart rate 176 beats per minute (> 95th percentile), blood pressure 101/43 mmHg (> 95th percentile), and irregular respirations at a rate of 22 breaths per minute. She was noted to be ill-appearing with poor perfusion and intermittent episodes of muscle rigidity and tongue thrusting. She had multiple brief periods of apnea and resultant hypoxemia for which she required emergent intubation. Gas chromatography-mass spectroscopy was positive for cocaine and cocaine metabolites (ecgonine methyl ester and benzoylecgonine), methadone and methadone metabolite. An electroencephalogram (EEG) was notable for intermittent bilateral multifocal sharp waves, and a brain MRI showed an abnormal T2 hyperintensity involving the subcortical white matter of the parietal lobes. These findings, in conjunction with her hypertension and encephalopathy, were concluded to be consistent with PRES secondary to acute cocaine exposure. A full sepsis evaluation was performed, and all infectious studies, including herpes simplex virus testing, were negative. The patient was extubated on hospital day 2, and her symptoms did not recur. She was discharged to foster care on hospital day 5.
Case Discussion: Cocaine acts as an indirect sympathomimetic by both stimulating the release and inhibiting the reuptake of serotonin and catecholamines at the presynaptic neuron. Cocaine toxicity in adults is well characterized; however, the literature on the manifestations of cocaine toxicity in children is sparse. In a small case series, young children with acute cocaine intoxication tended to show a greater predominance of neurologic symptoms, including seizure and obtundation, compared to their adolescent and adult counterparts. Our patient presented with a sympathomimetic toxidrome and dopaminergic features of cocaine toxicity including muscle rigidity and tongue thrusting movements. The apparent diffusion coefficient (ADC) image of her brain MRI demonstrated posterior vasogenic edema in the parietal lobes, which, in the absence of other causes of vasogenic edema, are consistent with PRES. The predominance of vasogenic edema in the parietal lobes is uncharacteristic of PRES in adults and represents a unique finding in this young patient.
Conclusion: Regardless of age, cocaine toxicity should be considered in a previously well child who presents with a sympathomimetic toxidrome and acute encephalopathy. This is the first documented case of PRES secondary to cocaine exposure in an infant.

KEYWORDS PRES, Cocaine, Infants

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234. Thirteen Cases of Death Camas Poisoning in Northern Arizona

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Background: Death camas refers to a number of poisonous plants in the family Melanthiaceae belonging to Toxicoscordion, Aniclea, Stenanthium, and Zigadenus genera (formerly all grouped under the Zigadenus genera) and are found throughout the United States. Death camas contain the sodium channel opener zygacine and a number of other toxic steroidal alkaloids. The death camas have a similar appearance to Camassia spp. and Allium spp. resulting in the accidental poisoning of livestock, grazing wildlife, and humans. The published literature on human exposure is limited to a number of case reports and small case series.
Case Series: We report on a case series of two clusters of death camas ingestion, comprising data from 13 individuals, who all exhibited known symptoms of death camas poisoning. Symptoms included nausea, vomiting, bradycardia, and hypotension. All victims saw resolution of their symptoms after supportive care, with the exception of one 58 year old man with a self-reported large ingestion who was admitted to the intensive care unit for persistent bradycardia and hypotension along with a new onset left bundle branch block on electrocardiogram. This patient was treated with atropine, epinephrine, and intravenous fluids with resolution of his vital sign abnormalities and electrocardiogram findings and was discharged within 48 hours.Discussion: The individuals in this case series demonstrated the classic symptoms of death camas ingestion and one patient exhibited reversible ECG conduction abnormalities. Treatment with supportive care for mild ingestions and atropine and epinephrine for the patient with a large ingestion resulted in resolution of symptoms within 48 hours.
Conclusion: Death camas species are occasionally mistaken for edible foraged plants and groups of patients often present with nausea and vomiting after a meal. Sodium channel activity of Toxicoscordion alkaloids can cause bradycardia and heart blocks in large ingestions. Emergency physicians should be aware of the potential for serious symptoms in patients reporting ingestion of this foraged plant species. This case series contributes the documented clinical course of a large number of patients from two clusters to the relatively limited literature.

KEYWORDS Death Camas, Toxicoscordion, Zigaden

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235. Utilization of an Interactive Voice Response with a Novel Coronavirus Hotline

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Background: Our Poison and Drug Information System (PDIS) consists of two poison control centers (PCCs) and partners with state and local Department of Health Services (DHS) to assist with care and communication to the public. Ongoing partnerships with the local DHS and other healthcare organizations allow the PDIS to assist with rapid deployment of communication surrounding endemics and other public health risks that require health advice and referral. Poison centers are well versed in telephone triage and prioritization of calls and have been instrumental in the state's response to the COVID-19 Pandemic.
Method: The initial novel coronavirus hotline was established for the state's largest county on January 26, 2020. The line utilized an interactive voice response (IVR) recording which reviewed answers to frequently asked questions (FAQs) in both English and Spanish. The FAQs were numbered prompts that allowed callers to select the desired content, as well as choose to be directed to a live PDIS specialist. The script was modified, based on questions communicated back to the DHS, by the PDIS directors and staff. A statewide COVID-19 hotline was implemented on March 11, 2020, with calls routed to the two poison centers based on caller location and assigned regions.
Results: Data obtained from the initial start of the first novel coronavirus line by our center on January 26, 2020 to May 16, 2020 resulted in a total of 71,814 calls to the COVID-19 Hotlines. Based on caller location, 12,571 of those calls were immediately transferred to our partnering poison center's separate IVR. Calls totaling 59,243 were directed to our center's IVR. Results demonstrated that 43,336 callers listened to the IVR recordings, had no further questions, and chose not to speak with a specialist. This is equivalent to 73% of the calls being managed by the IVR system. The abandoned call volume remained approximately 2-3% throughout this process.
Conclusions: Poison and Drug Information Centers have a unique opportunity to enhance their work, and funding, by working closely with the local and state health department and other organizations to assist with public health events. The use of an IVR system can assist during call surges in response to public health emergencies.

KEYWORDS Interactive Voice Response, COVID-19 Hotline, Emergency Preparedness

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236. A Poison and Drug Information System Responds to a Novel Coronavirus

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Background: In early 2020, a novel coronavirus, severe acute respiratory syndrome conronavirus 2 (SARS-CoV-2), emerged as a global public health threat. Coronavirus disease (COVID-19) cases were first detected in the United States in late January. A Poison and Drug Information System (PDIS) partnered with the state's Department of Health Services (DHS) and County Health Departments (CHDs) to develop a COVID-19 hotline as part of a state-wide response.
Method: The PDIS contacted the DHS and CHDs on 1/6/2020 about setting up a hotline to answer questions from the public and healthcare professionals throughout our state. The initial hotline went live for one CHD on 1/26/20. As the call volume rapidly increased, an automated statewide number was implemented on 3/11/2020. The COVID-19 hotline's purpose was to provide guidance to laypersons and healthcare professionals about all COVID-related medical issues (e.g. travel, testing, home treatment). Specific PDIS directors and staff were tasked with reviewing COVID-19 information and research on a regular basis to develop resources, including the hotline script and frequently asked questions, with biweekly updates. The process was dynamic and varied based on specific counties needs and resources. An interactive voice response (IVR) system was put in place for callers to listen to information, with the option to speak with a PDIS specialist. The PDIS used poison center specialists and students in clinical rotations (graduate medical and pharmacy) to operate the hotline.
Results: A call was defined as anyone dialing the automated IVR hotline and listening to the prompts. A case referred to a call managed by a hotline staff member and the generation of a PDIS chart. Between 1/26/2020 and 5/16/2020 the hotlines received 71,814 calls, of which 22,426 (31.2%) were cases. The peak 24-hour call volume was on 3/17/2020, with 5,052 calls and 974 (19.3%) cases.
Conclusions: Regional Poison Centers (RPC) can play important roles in public health threats including infectious disease outbreaks. Poison Control Centers are 24/7 and can rapidly provide surge capacity, a vital component of emergency preparedness responses. It is important for poison centers to establish partnerships with local health departments for emergency preparedness and pandemic planning.

KEYWORDS coronavirus, hotline, public health

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237. False positive opiate urine drug screen in the setting of high urine dextromethorphan levels

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Background: Dextromethorphan (DXM) is an accessible over the counter medication often available in a liquid preparation. Toxicity is seen in pediatric exploratory ingestions and from recreational use stemming from its NMDA receptor antagonist activity. Existing literature describes DXM inducing false positive Enzyme Linked Immunoassay Urine Drug Screen (EIA-UDS) testing for Phencyclidine (PCP) while false positive results for opiates are not widely reported. We describe two cases of DXM ingestion with positive EIA-UDS results for opiates, with confirmed high levels of DXM.
Case 1: A 3-year-old male presented to the Emergency Department (ED) with 3 days of fever and cough, 1 day of sleepiness. For 2 days prior to presentation he received 20 mg Q4h of DXM. Prior to presentation he experienced "shaking and staring off" for less than 30 seconds. The patient was somnolent, febrile, and hypoxic on initial evaluation. CT head, ECG and initial laboratory evaluation was unremarkable (including APAP/ASA/ETOH). UDS was positive for opiates (MedTox Scan), otherwise negative (including PCP). He was transferred to a tertiary care hospital, He was afebrile following transfer, requiring 2L supplemental oxygen for mild hypoxia. His altered mentation improved. Repeat UDS

was positive for opiates as well (Beckman Coulter AU5800). His condition improved with supportive care and he was discharged home. Urine drug testing by LC-MS/MS revealed no opiates, DXM: >1000 ng/ml, dextrorphan: 77,000 ng/mL.
Case 2: A 2-year-old female was found minimally responsive next to an open bottle of DelsymÒ. She presented to an outside hospital with agitation, rotary nystagmus, and tachycardia. UDS (Roche, Cobas 8000) was positive for opiates, otherwise negative (including PCP). She was transferred to a tertiary care center. En route she received IV lorazepam. On arrival, she was awake, interactive, tachycardic with mild nystagmus. Laboratory evaluation after transfer was unremarkable, including negative UDS (Beckman Coulter AU5800). She improved clinically over 24 hours and was discharged home. Urine drug testing by LC/TOFMS, ELISA revealed DXM >10000 ng/mL, dextrorphan >100000 ng/mL, it was negative for opiates.
Discussion: The first patient received 2-4 times the recommended dose of DXM. The second patient experienced a pediatric exploratory ingestion of DXM. Neither IBM Micromedex nor Goldfrank's Toxicologic Emergencies 11th ed. list DXM as a cause for false positive opiate testing on UDS. A previously published study has demonstrated that therapeutic doses of DXM do not induce a positive result on EIA-UDS testing. No study has been performed using higher doses of DXM, and there is no pediatric data regarding DXM and opiate assay interference. One in-vitro study demonstrated positive opiate EIA-UDS results at >400mcg/mL DXM. Interestingly, in our second case repeat EIA-UDS was negative for opiates, possibly due to metabolization of DXM to Dextrorphan between tests. These cases imply that high concentrations of DXM can precipitate false positive results for opiates on EIA urine drug testing.
Conclusions: DXM toxicity can cause a false positive opiate result on urine EIA drug testing.

KEYWORDS Dextromethorphan, Opiate, Urine Drug Screen

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238. Double Peak Serum Acetaminophen Levels following Large Ingestion of Tylenol Combination Products

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Background: Acetaminophen containing products are some of the most common medications involved in both intentional and unintentional toxic exposures. Pharmacokinetic data for acetaminophen is well described, however co-ingestion of APAP with opioids/ anticholinergic agents, especially in large overdoses, has the potential to significantly alter absorption and metabolism of acetaminophen, requiring prolonged courses of therapy.
Case: A 43-year-old female intentionally ingested 50-60 tablets of Percocet and 8 tablets of Tylenol PM in an attempt at self-harm. The ingestion time was unknown, but reportedly occurred 24-48 hours prior to hospital presentation. At initial evaluation, her APAP level was 287mcg/mL, and AST/ALT at the time was 589/203 Units/L. She was started on N-acetylcysteine and admitted to ICU with stable vital signs and normal neurological exam. Her APAP initially trended down (trough at 60mcg/mL), however her AST/ALT continued to rise, and late in hospital day (HoD) 1, she began to display progressive CNS depression resulting in intubation. Her APAP level was then noted to progressively rise over the next several hours, peaking at 302mcg/mL. Additionally, the patient's renal function began to decline and she became progressively more hypotensive, requiring vasopressor support with levophed and vasopressin. Because of declining renal function, hemodynamic instability, hyperammonemia, and development of lactic acidosis, the patient was started on CVVH and was transferred to a tertiary transplant center due to worsening LFTs. On arrival to our facility, the patient was initiated on intermittent hemodialysis and NAC was continued at a dose of 12.5mg/kg/hr. At that time labs were remarkable for pH of 7.29, lactate of 6.7, creatinine of 1.26, AST/ALT of 3290/1618, ammonia of 243, and acetaminophen of 123mcg/mL. The patient's INR peaked at 3.83 on HoD 3, Bilirubin peaked at 3.2mg/dL on HoD 4. Her APAP trended down and reached undetectable levels on HoD 5. Her vasopressors were gradually weaned off, and the patient was able to be extubated on HoD 8. AST and ALT gradually improved and fell to 18/68 on HOD 10. She was discharged home on HOD 31 in good condition.
Discussion: It is important that practitioners be aware of the potential for altered pharmacokinetics of APAP when co-ingested with opioid/ anticholinergic agents. As observed in our case, these ingestions have the potential for a prolonged period of APAP absorption, as well as the phenomenon of a double peak of serum acetaminophen levels. This second acetaminophen peak is sparsely described in the literature and must be considered in these patients when planning disposition and treatment course because these cases have the potential for significant delayed toxicity from APAP. Additionally, this phenomenon reinforces the need for repeat assessment of acetaminophen levels prior to cessation of NAC therapy.
Conclusion: Large ingestions of acetaminophen combination products containing opioids, anticholinergic agents, or other xenobiotics with the potential to slow GI motility may cause

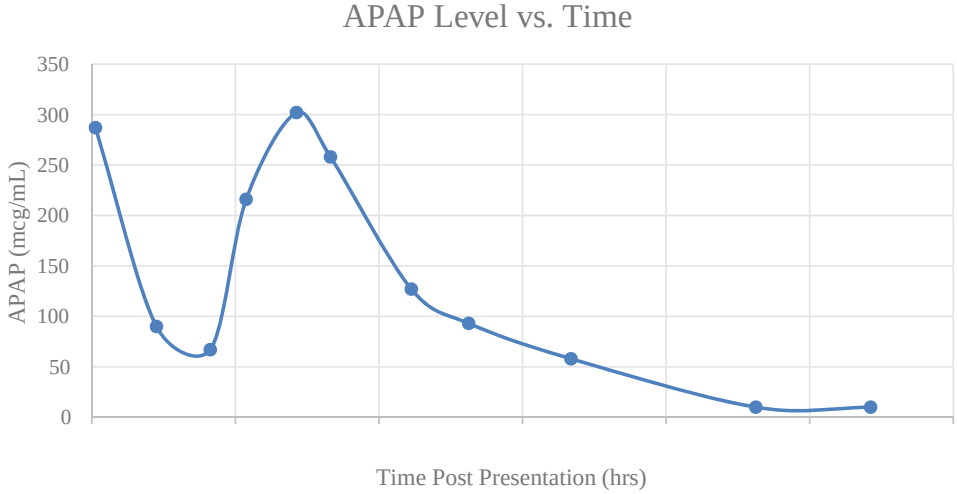

Figure 1(#238). Serum acetaminophen levels over time. Note: initial level reportedly 24-48 hours post ingestion.

delayed APAP absorption, resulting in delayed maximal serum acetaminophen concentrations as well as double peak APAP levels.

KEYWORDS Acetaminophen, Overdose, Double-peak

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239. Levothyroxine and liothyronine adverse events reported to the Food and Drug Administration

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Background: Levothyroxine (T4) and liothyronine (T3), are used alone or in combination to treat hypothyroidism and other thyroid problems. Levothyroxine must be metabolized to liothyronine, a more active form of hormone. Levothyroxine and liothyronine ingestion may result in adverse clinical effects similar to hyperthyroidism – weight loss, diarrhea, vomiting, tremor, headache, nervousness, irritability, and fever. Overdose may result in tachycardia, chest pain, trouble breathing, and confusion. The objective of this study was to compare levothyroxine and liothyronine adverse events reported to the United States Food and Drug Administration (FDA).
Methods: Data were obtained from the FDA Adverse Event Reporting System (FAERS), a national database that contains reports of drug and other biologic product adverse events and medication errors. Reports are coded using the Medical Dictionary for Regulatory Activities (MedDRA), a validated, internationally standardized medical terminology. The FAERS public dashboard was searched for all records added during 2000-2019 that reported levothyroxine or liothyronine, and the raw data for the records were downloaded. Adverse events involving both levothyroxine and liothyronine or other substances were excluded. The distribution of levothyroxine and liothyronine adverse events was determined for various factors related to patient demographics, circumstances of the exposure, symptoms, and outcome and comparisons made between the two drugs.
Results: A total of 25,080 levothyroxine and 706 liothyronine adverse events met the study criteria. Of those cases with a known patient age, the mean patient age was 53.1 years (range 0 to 103 years) for levothyroxine and 54.3 years (range 14 to 88 years) for liothyronine. Of those patients with a known sex, females accounted for 89.2% of the levothyroxine and 92.3% of the liothyronine cases. The most commonly reported reasons for use of levothyroxine and liothyronine, respectively, were hypothyroidism (37.1% vs 43.6%), thyroidectomy (9.4% vs 1.5%), autoimmune thyroiditis (6.8% vs 10.7%), thyroid disorder (4.5% vs 17.2%), and post procedural hypothyroidism (3.0% vs 0.6%). The most frequently reported reactions to levothyroxine and liothyronine, respectively, were fatigue (24.3% vs 8.6%), headache (13.9% vs 6.9%), insomnia (11.1% vs 2.8%), alopecia (9.4% vs 6.2%), weight increased (9.1% vs 6.2%), blood thyroid stimulating hormone increased (8.4% vs 0.7%), and muscle spasms (8.1% vs 2.1%). The reported outcomes for levothyroxine and liothyronine, respectively, were not serious (43.5% vs 80.5%) and serious (56.5% vs 19.5%): hospitalized (7.4% vs 5.1%), disabled (1.7% vs 1.4%), life threatening (0.9% vs 1.4%), required intervention (0.7% vs 0.3%), congenital anomaly (0.3% vs 0.0%), unspecified other outcomes (47.1% vs 14.3%), and died (1.5% vs 0.1%).
Discussion: The patterns of levothyroxine and liothyronine adverse events were similar with respect to patient demographics. However, the two drugs differed with respect to reason for use and reactions. Moreover, a higher proportion of levothyroxine adverse events had serious outcomes, particularly those classified as unspecified other outcomes. It should be noted that the levothyroxine or liothyronine may not have caused the reported adverse event. The adverse event may have been related to an underlying condition, another drug, or other reasons.

KEYWORDS levothyroxine, liothyronine, adverse events

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240. Levothyroxine and liothyronine ingestions reported to poison centers

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Background: Levothyroxine (T4) and liothyronine, a synthetic form of triiodothyronine (T3), are used alone or in combination to treat hypothyroidism and other thyroid problems. Levothyroxine is the more common form of thyroid replacement therapy, but it has roughly 20% of the biological activity of T3. Levothyroxine and liothyronine ingestion may result in adverse clinical effects similar to hyperthyroidism – weight loss, diarrhea, vomiting, tremor, headache, nervousness, irritability, and fever. Overdose may result in tachycardia, chest pain, trouble breathing, and confusion. This study compares levothyroxine and liothyronine ingestions reported to poison centers.
Methods: Cases were levothyroxine and liothyronine ingestions reported to a large, statewide poison center system during 2000-2018. Ingestions involving levothyroxine-liothyronine combination products and co-ingestants were excluded from the study. The distribution of cases by demographic and clinical factors was determined and comparisons made between the two drugs.
Results: A total of 11,189 levothyroxine and 141 liothyronine ingestions met the study criteria. Children age 0-5 years accounted for 59.6% of the levothyroxine and 66.7% of the liothyronine ingestions; 58.8% of the levothyroxine and 52.5% of liothyronine patients were female. The ingestion was unintentional in 96.0% of the levothyroxine and 97.2% of the liothyronine ingestions; 95.1% of the levothyroxine and 95.0% of the liothyronine ingestions occurred at the patient's own residence. The management site was on site for 85.3% of the levothyroxine and 90.8% of the liothyronine ingestions. The medical outcome was no effect, minor effect, not followed-non toxic, or not followed-minimal effects possible in 96.7% of the levothyroxine and 98.6% of the liothyronine ingestions. No deaths were reported. The most common adverse clinical effects reported with ingestions of levothyroxine and liothyronine, respectively, were tachycardia (1.1% vs 1.4%), vomiting (1.0% vs 0.7%), agitated/irritable (0.7% vs 1.4%), hypertension (0.4% vs 0.7%), nausea (0.4% vs 0.7%), and dizziness/vertigo (0.4% vs 0.0%). The most frequent treatments reported with ingestions of levothyroxine and liothyronine, respectively, were dilute/irrigate/wash (33.5% vs 36.9%), food/snack (13.3% vs 14.9%), activated charcoal (3.5% vs 2.1%), other emetic (1.2% vs 1.4%), and cathartic (1.2% vs 0.0%).
Discussion: The patterns of ingestions of levothyroxine and liothyronine used alone without co-ingestants were similar. Most patients were young children and female. Most ingestions were unintentional and occurred at the patient's home. The vast majority of levothyroxine and liothyronine ingestions did not result in serious outcomes and could be managed outside of a healthcare facility. Further study using these data will look at the variables of intentional overdoses, misuse, and dose-effect on outcome.

KEYWORDS levothyroxine, liothyronine, poison centers

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241. Anaphylaxis from Protamine Reversal of Heparin after Sensitization from Daily NPH Insulin Use

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Background: Protamine, originally derived from salmon sperm but now made predominantly via recombinant technology, is a protein that binds to heparin to form a neutral, stable salt and thus is commonly given to neutralize anticoagulation induced by heparin. Although protamine is thought to be generally safe, adverse reactions occur including hypotension, bradycardia, and anaphylaxis. Here, we report a case of protamine administration leading to cardiac arrest.
Case Report: A 68-year-old woman with a history of peripheral artery disease (PAD) and diabetes mellitus (DM) type II treated with daily isophane insulin presented to our Emergency Department (ED) via Emergency Medical Services (EMS) from an outside day surgery center in cardiac arrest. EMS reported that the patient was having an outpatient lower extremity angiogram and femoral endarterectomy for her severe PAD. It was a routine procedure and the patient went to the recovery area when the procedure was completed. The patient had been on heparin during the procedure, but after the procedure, bleeding was noted from the right groin puncture site, and protamine was given. After the protamine administration, the patient became flushed and tachycardic. She then seemed to have breathing difficulty and shortly thereafter went into cardiac arrest. When EMS arrived the patient was noted to be in a bradycardic pulseless electrical activity cardiac arrest. En route to the ED, EMS administered three 1 mg doses of epinephrine IV, performed chest compressions, and placed a laryngeal mask airway.
On arrival to the ED, bedside ultrasound revealed cardiac standstill and standard ACLS protocol was followed. The patient was given an additional 3 rounds of 1 mg epinephrine, 1 gram of calcium chloride, and 100 mEq of bicarbonate, all IV. She then had return of spontaneous circulation, but remained markedly hypotensive and required both epinephrine and vasopressin infusions. Given the concern for potential anaphylaxis, the patient was also given 50 mg diphenhydramine IV and 125 mg methylprednisolone IV. Shortly after diphenhydramine administration, the patient's vitals signs stabilized and vasopressors were rapidly weaned. The patient was completely off vasopressors and extubated on hospital day 2. The only etiology of her cardiac arrest was found to be a likely anaphylactic reaction to protamine.
Case Discussion: Protamine is a manufactured protein that has two uses in humans. The commonly known use of protamine is to neutralize heparin thus reversing anticoagulation. Less commonly known is that when protamine is added to insulin that is injected subcutaneously it allows the insulin to be released more slowly over time. Intermediate-acting isophane insulin, also known as neutral protamine Hagedorn (NPH) insulin, contains protamine and therefore, patients on NPH can form protamine antibodies predisposing them to anaphylactic reactions when protamine is given for reversal of anticoagulation. The patient's regular NPH insulin use likely predisposed her to this severe anaphylactic reaction.
Conclusion: Although anaphylaxis following protamine administration is rare, it is an important consideration in patients with hemodynamic instability following administration. Patients with previous protamine exposure, including NPH use may be at increased risk of severe anaphylaxis following protamine administration.

KEYWORDS protamine, anaphylaxis, NPH insulin

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242. Successful Use of Buprenorphine/Naloxone in the Treatment of Tianeptine Withdrawal

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Introduction: Tianeptine abuse continues to pose a developing public health risk in the United States. Withdrawal patterns from tianeptine abuse can be severe and may be compounded by its strong activity at the mu opioid receptor. Previous work has primarily emphasized benzodiazepines for withdrawal symptoms. This report presents a case in which buprenorphine/naloxone was successfully used in the treatment of tianeptine withdrawal.
Case: A 35 year-old female with past medical history of depression and opioid use disorder presented to the emergency department with severe anxiety. She had been abusing tianeptine (15 pills, twice daily) obtained from a local gas station for several weeks in an attempt to wean off opioids. She abruptly discontinued her tianeptine and clonazepam 36 hours prior. Initial symptoms were notable for nausea, vomiting, mydriasis, facial flushing, and dyspnea. She exhibited hypertension (138/57) and EKG showed sinus tachycardia to 105 bpm, QTc 425 msec, and QRS 102 msec. Mild tremors were evident in the bilateral upper extremities. Ancillary studies obtained in the emergency department were otherwise unremarkable.
The patient was placed on Clinical Institute Withdrawal Assessment for Alcohol (CIWA) protocol, admitted for further management, and given an additional five doses of lorazepam 1mg intravenously scheduled every six hours. The addiction medicine service was consulted with recommendations for initiation of a buprenorphine/naloxone taper which was begun at 8mg/2mg sublingual twice daily and weaned over four days. During the first twenty-four hours of the buprenorphine/naloxone regimen her outward clinical signs of withdrawal showed marked improvement. Subjectively, she reported significant improvements in her anxiety although her nausea persisted. She was subsequently discharged to an outpatient rehabilitation center in stable condition.
Discussion: Tianeptine, known also as "Red Dawn," "Za-Za," and "Tianna," is an atypical synthetic antidepressant. Currently unregulated by the Food and Drug Administration (FDA), tianeptine has emerged onto the market by way of sale in local gas stations and grown in popularity given its antidepressant and opioid agonist properties. The ease of its accessibility and relative affordability poses a developing public health risk and the opioid-like effects it produces has contributed to growing misuse and diversion.
Common symptoms of tianeptine withdrawal include agitation, hypertension, tachycardia, diaphoresis and tremors. Yet, treatments for withdrawal patients vary. One 2018 study of nine patients with tianeptine toxicity described five patients undergoing withdrawal; benzodiazepines were most frequently utilized as a treatment modality.
Our case illustrates a patient suffering from tianeptine and benzodiazepine withdrawal with a positive temporal improvement in symptoms after initiation of buprenorphine/naloxone. Similarly, another recent report described success in eliminating cravings for tianeptine with buprenorphine/naloxone 2 mg/0.5 mg without adverse effects. Until this time, the use of opioid agonists had been primarily anecdotal as few cases in the literature describe its successful use in treatment of tianeptine use disorder.
Conclusion: As our understanding of the abuse potential of tianeptine grows, further research is needed to describe the potential efficacy and safety of buprenorphine in reducing the withdrawal symptoms described in our case.

KEYWORDS tianeptine, Withdrawal, buprenorphine

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243. Parenteral Qiazol® Lysis Reagent Exposure

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Background: Parenteral exposure to Qiazol®, a general protein denaturant used in the extraction of DNA and RNA, has not been previously reported. A single case report of guanidine thiocyanate ingestion resulting in neurological impairment has been identified in the literature. Qiazol® is composed of two active ingredients, guanidine thiocyanate 10–25 % and phenol 25–50 %. Guanidine thiocyanate is a chaotropic agent. Both compounds interact with water molecules associated with protein molecules causing protein denaturation due to conformational changes. The guanidine thiocyanate-phenol reagent and the combination of extraction and chaotropic disruption yields higher amounts of RNA and DNA. A review of the manufacturer's documentation raised concern for potential tissue necrosis.
Case Report: A 28 year-old-male presented to an acute care facility after an accidental injection of Qiazol® to his fingertip in a research lab. The patient inadvertently punctured the volar surface of the fourth finger of his non-dominant hand through his glove. He stated that the majority of the reagent had already been used and estimated the amount remaining in the syringe at a few microliters. He also stated that a drop splashed into his mouth and another onto his face. He immediately began irrigation at the work site. On ED arrival, a 1 x 1 cm ecchymosis was noted on the finger, four small areas of erythema were evident on his face and he was complaining of facial "burning". He had no evidence of oral irritation (erythema, drooling, etc.). Additional irrigation was performed, digital photographs of the exposure sites were obtained and a medical toxicologist was consulted. A search of the medical literature and the manufacturer's related publications revealed no case reports of parenteral exposure to this product; however, the mechanisms of action of the product's components suggested potential for severe tissue necrosis. The manufacturer was contacted and stated no parenteral exposures worldwide had been reported to them. The patient was discharged from the ED and ultimately did well with minimal discomfort and full use of his hand. The toxicologist reviewed serial digital photos of the exposure sites throughout the patient's ED and post-discharge course.
Case Discussion: This is the first documented case of parenteral exposure to a combination of guanidine thiocyanate and phenol. Minimal symptoms occurred and there was no loss of mobility, likely due to the small amount of reagent injected. Limited data exist regarding treatment recommendations for dermal and/or parenteral exposures. With the advent of COVID-19 and the need for diagnostic testing, the use of lysis reagents is likely to increase and therefore more exposures are possible.
Conclusion: Parenteral exposure to guanidine thiocyanate and phenol is a rare event. Poison center staff and health care practitioners may be unfamiliar with the possible risks associated with this reagent. All such exposures should raise concern for tissue destruction. A limited amount of material injected and swift decontamination may have protected this patient from significant injury.

KEYWORDS parenteral, phenol, guanidine thiocyanate

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244. Dietary Supplements: A New Year's Resolution Gone Bad

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Background: Brief dietary/herbal supplement and anabolic steroid use led to massive hypertension precipitating biopsy-proven acute interstitial nephritis (AIN), leading to catastrophic renal failure and pulmonary hemorrhage in this young patient seeking to lose weight and improve conditioning. While use of these agents have been reported to cause acute kidney injury (AKI), rhabdomyolysis and multiorgan system failure through a variety of mechanisms, several extreme features distinguish this case.
Case Report: A normally healthy 29-year-old male presented to a clinic 4 weeks after making a New Year's resolution to rapidly lose 20 pounds. His regimen included daily exercise, a 1000 kcal diet and 12 days use of *Garcinia cambogia*, creatine powder, linoleic acid, L-carnitine, testosterone, and a performance supplement containing yohimbine and caffeine. He had gastroenteritis the first week and noted nausea during the second week but continued his rigorous diet and exercise regime. He developed dyspnea, malaise and headache 10 days prior to presentation on day 27. He had been coughing rusty brown sputum that he attributed to the supplements, though his RN fiancee recognized hemoptysis. On emergency department presentation, he had a BMI of 28 with a bp of 247/170 and HR 150; tachypnea was also noted. CXR revealed mild pulmonary edema and echocardiography showed normal wall motion, an ejection fraction of 65%, elevated pulmonary artery systolic pressure and mildly enlarged left atrium. Renal ultrasound was unremarkable. Significant admission labs: creatinine 10.5 mg/dL, CK 1200 U/L, troponin 0.35 ng/mL and BNP >32,000 pg/mL. Admitted to critical care, he was treated with several antihypertensives, diuretics and oxygen. Pulmonary edema improved but hypertension persisted with BP's 160-186/94-114, and he was transferred to a tertiary level hospital on hospital day 3. Renal failure persisted with creatinine >10 mg/dL, BUN >90 mg/dL. and anemia (hemoglobin 8.6 g/dl, hematocrit 27.7%); CK normalized. WBC and granular casts were present on urine microscopy. Urine catecholamines were normal, and extensive immunologic/serologic workup revealed no alternative etiologies for AKI. On day 5 hemodialysis was initiated and on day 8 he became oliguric requiring thrice-weekly hemodialysis. He was administered amlodipine, carvedilol, labetalol and bumetanide; hydralazine was subsequently added. Renal biopsy revealed thrombotic microangiopathy (TMA) with AIN and scarring in 5 of 6 glomeruli. He was discharged on hospital day 27 dialysis-dependent with non-oliguric renal failure. Four months later renal function has not improved and he has been referred for evaluation for kidney transplantation.
Case Discussion: Nephrologists attributed this patient's renal injury to malignant hypertension caused by his use of dietary and performance enhancing supplements. Literature review reveals that in the majority of cases, patients suffering renal injury had ingested supplements and/or anabolic steroids for considerably longer periods of time before AKI development.
Conclusion: Though the patient reported taking only the "recommended" amount of each supplement, his regimen created the "perfect storm". Brief use of a combination of dietary/herbal/steroid supplements caused TMA and AIN leading to dialysis and possible kidney transplantation. Public and professional education regarding the dangers of taking multiple weight loss and bodybuilding supplements is paramount.

KEYWORDS anabolic steroids, renal injury, dietary supplements

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245. Changes in prescription opioid exposures reported to poison centers following the emergence of the COVID-19 pandemic

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Background: Poison centers provide valuable information to the public regarding toxic exposures. In addition, poison centers provide geographically-specific and timely data on the misuse of substances such prescription opioids. Similar to other medical service providers, concern regarding poison centers' capacity to provide standard care arose with the emergence of the COVID-19 pandemic. We examined changes in exposures reported to poison centers in the first 17 weeks of 2020 (December 29, 2019 through April 25, 2020) to assess the impact of COVID-19 pandemic on collection of data on prescription opioid exposures.
Methods: The Researched Abuse, Diversion and Addiction-Related Surveillance (RADARS) System receives weekly data from participating poison centers on exposures involving prescription opioids. We evaluated trends in the number of exposures across all ages involving ten prescription opioids (oxycodone, fentanyl, hydrocodone, morphine, hydromorphone, oxymorphone, methadone, buprenorphine, tramadol, and tapentadol) from 48 participating centers. Spline regression models assuming a Poisson distribution were used to identify time points where trends in exposure case counts significantly changed in 2020. The average exposures per week during each identified time period in 2020 were compared to the same timeframe in 2019. Changes in exposures by caller site, exposure reason, and medical outcome were evaluated.
Results: In 2020, two points were identified where trends in prescription opioid exposures significantly changed; resulting in three time periods. From week 1 through week 10 (December 29th through March 7th), the number of exposures involving prescription opioids showed a nonsignificant increase. From week 11 through week 14 (March 8th through April 4th), exposures decreased 6.0% each week on average. From week 15 through week 17 (April 5th through April 25th), exposures increased by 3.4% each week on average. In 2020, the average number of weekly exposures from week 1 through week 10 was 6.9% higher than in the same weeks in 2019. From week 11 through week 14, the average number of exposures per week was 6.2% lower than the same weeks in 2019. From week 15 through week 17, average number of exposures per week was 10.4% lower than the same weeks in 2019. Calls originating from health care facilities, intentional misuse, and suspected suicidal exposures decreased more than 20% relative to 2019. Unintentional general and intentional abuse exposures were consistently greater in 2020 than 2019.
Conclusions: Beginning in early March, exposure calls involving prescription opioids decreased each week through the beginning of April. In early April, calls increased each week. The most significant reductions relative to 2019 were in suspected suicidal exposures and among calls originating from health care facilities. Unintentional general exposures and intentional abuse exposures in 2020 were greater than 2019 and remained relatively stable. Further evaluation is needed to determine the extent to which these observations represent behavior changes among the general population or exposures not captured due to taxed resources at poison centers and health care facilities.

KEYWORDS Prescription opioids, COVID-19, Epidemiology

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246. Predicting Opioid Overdose Risk in Adults Discharged with a New Prescription Opioid

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Background: US adults fill more than 191 million opioid prescriptions annually. Opioid overdose (OD) is a leading cause of death in the US. The Risk Index for Overdose or Serious Opioid-induced Respiratory Depression (CIP-RIOSORD) is a validated tool that calculates a risk class (highest class for OD is 7) for a patient's probability of experiencing an opioid OD within the next six months. Our objectives were to identify: (1) the proportion of adults discharged from the emergency department (ED) with a prescription opioid who were at risk for an opioid OD as measured by CIP-RIOSORD, and (2) to determine their CIP-RIOSORD risk class (or average predicted probability for an OD).
Methods: This study is a secondary descriptive analysis of data collected from a prospective observational study of patients ≥18 years of age returning to the ED within 30 days of initial index visit. Sociodemographic variables, comorbidities, medication history, and ED returns within 30 days after discharge were collected from patient interviews and chart reviews. This study included patients who reported no use of opioids at home and were discharged home with a new opioid prescription.
Results: Of the total 67 visits in which a new prescription opioid was issued, 40 (60%) were for patients not reporting current use of opioids at home. Most of these visits were by males (19, 47%) and African Americans (29, 73%). The average age was 47 years (range 19-81). Twenty-two (55%) of these patients met at least one CIP-RIOSORD predictive factor (range 1-5) for OD. The most common predictive factor was antidepressant use (17%), followed by history of bipolar disorder or schizophrenia (11%), substance use (11%), and benzodiazepine use (11%). The distribution of risk classes during these visits included 18 (45%) patients in class 1, 1 (2%) class 2, 6 (15%) class 3, 4 (10%) class 4, 5 (13%) class 5, 4 (10%) class 6, and 2 (5%) in class 7. Fifteen (37%) patients had a 15. 1% to 83. 4% average predicted probability of experiencing an OD (CIP –RIOSORD risk class 4 to 7).
Conclusion: Our findings illustrate a considerable proportion of ED patients were discharged with a new opioid prescription despite having a high-predicted probability for an OD within 6 months. CIP-RIOSORD should be further studied as a potential tool for EDs to utilize prior to prescribing opioids to reduce risk of opioid overdose.

KEYWORDS opioid, overdose, risk

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247. A Kick-Off of Case Data

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Background: Poison Control Center (PCC) case volume has been known to fluctuate in response to chronological factors such as time of day and holidays and events such as recalls, acts of chemical or bioterrorism, or epidemics. Major sporting events and their impact on various forms of workflow among healthcare professionals has previously been investigated. However, effects of the National Football League, the most watched sporting league in the United States, on PCC case volume has not been studied. This study's goal was to examine the overall case volume trends following the kick-off times of an NFL team representing the region of two PCCs.
Methods: This was a retrospective chart review of all cases at two regional PCCs via their electronic databases on Sundays between February 10, 2019-February 2, 2020. All human exposure cases documented in 1-hour increments were included. Sundays without a home NFL football game were compared to Sundays with a game.
Results: 10,690 human exposure cases were documented for all Sundays between the two PCCs, with an average of 207.3 cases per day. Case volume was lowest at 05:00 with an average of 1.5 calls, followed by an increase throughout the day, peaking at 20:00 with 16.8 cases. For all 35 Sundays without a game, the average number of calls was 202.3, compared to 212.4 cases per day for the 17 Sundays with a game. A difference was noted in the Sundays without a game in the spring and summer with 199.3 cases per day, compared to Sundays without a game in the fall and winter with 210.8 cases per day.
Sundays in the fall and winter without a football game had an average of 10.1, 10.6, 9.0, 13.2, and 20.3 cases starting at the hours of 12:00, 14:00, 15:00, 17:00, and 19:00, respectively. A noon kick-off time showed no difference in the average case per hour at kick-off with 10.8 calls and peaked at 17.1 cases at 20:00. A 15:25 kick-off time demonstrated slightly higher calls at the 15:00 hour with 11 cases and peaked at 20.7 cases at 20:00. The 19:15 kick-off time showed 18.3 cases received that hour and peaked at 19.3 cases at 20:00. The playoff games had a kick-off time of 14:05 with an average of 7.5 cases received during this hour and peaked at 16.5 cases at 18:00. Superbowl Sunday kick-off was 17:30 and had 16 cases that hour, peaking at 19 cases at 18:00. Case volumes on Sundays with a game during the regular season was higher than case volumes on Sundays encompassing the playoffs and Superbowl with 216.1 versus 201.5 cases, respectively.
Conclusion: Overall case volume seemed to be impacted more by the season, fall and winter, as opposed to whether a football game was scheduled, despite the perception otherwise. The only Sundays with a decrease in cases during the fall and winter season were those with a playoff game and the Superbowl.

KEYWORDS Poison Control Center, Human Exposures, Football

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248. Acute generalized exanthematous pustulosis associated with Loxosceles spider bite

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Background: Acute generalized exanthematous pustulosis (AGEP) is a relatively rare condition characterized by small non-follicular pustules on a background of diffuse erythema, almost always drug-induced, although several case reports exist of AGEP occurring in response to a bite from spiders of the Loxosceles genus.
Case Report: A 19 year old woman with no known past medical history presented to an emergency department (ED) in middle Tennessee with 3 days of fever and non-follicular pustular rash with surrounding erythema on her torso with surrounding erythema. She developed a painful necrotic ulcer over her left hip during the same time. She had been prescribed doxycycline by another ED 24 hours after the pustularis rash emerged, and denied any other new medications recently. She denied known brown recluse exposure or bites, but she recounted a recent trip to many national parks and stated spider sightings were common in her rural home.
Vitals were notable for temperature 38.5 degrees C (101.3 degrees F) and mild tachycardia with heart rate 109 beats per minute. Pustular lesions and diffuse erythema were seen on physical exam, as well as the described necrotic lesion with surrounding blanching skin to the left hip. Labs were notable for leukocytosis (20,100/mcL) with significant neutrophilia (18090/mcL). CRP was elevated (89.7 mg/L). Biopsy of the pustular lesions revealed intradermal neutrophils and eosinophils, as well as dyskeratotic keratinocytes, consistent with AGEP. Biopsy of the necrotic lesion revealed necrosis of collagen and eccrine sweat glands with intradermal neutrophils and eosinophils, consistent with brown recluse spider bite.
Patient was admitted to the hospital and started on empiric broad spectrum antibiotics due to fever and lack of improvement on doxycycline. After biopsy results returned consistent with AGEP, antibiotics were discontinued, and she was switched to 60mg prednisone daily and discharged after remaining afebrile and clinically improved.
Case Discussion: This patient's clinical and histological findings were highly suggestive of AGEP, and although she was exposed to doxycycline which is known to cause AGEP itself, she developed the rash prior to exposure, so by far the most likely cause is envenomation by the *Loxosceles* spider, suggested by history and necrotic lesion although no spider was identified.
The evidence relating *Loxosceles* bites to AGEP is sparse and mostly in the form of case reports and case series. As of yet, most of these cases were identified outside of North America. The proposed mechanism involves sphingomyelinase in *Loxosceles* venom leading to increased release of cytokines like interleukin-8 and granulocyte-macrophage colony-stimulating factor (GM-CSF), both of which are believed to play a role in the peripheral blood neutrophilia and dermal neutrophils.
Conclusion: We present a case of biopsy confirmed AGEP related to aas a result of *Loxosceles* envenomation. This must be recognized as although it presents with fever and diffuse skin changes, it is inflammatory rather than infectious in nature and requires treatment with steroids.

KEYWORDS Loxosceles, AGEP, Derm

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249. COVID-19 Associated Exposures Over Time by Substance, Age, Outcome, and Region

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Objectives: On 23-Jan-2020, the National Poison Data System (NPDS) Rapid Coding Committee activated Novel Coronavirus (COVID-19) with Product code 7325206. Based on NPDS exposure data, we wished to determine which substance exposures were most strongly associated with the COVID-19 pandemic and which age group, outcome and geographic area were most affected in the US.

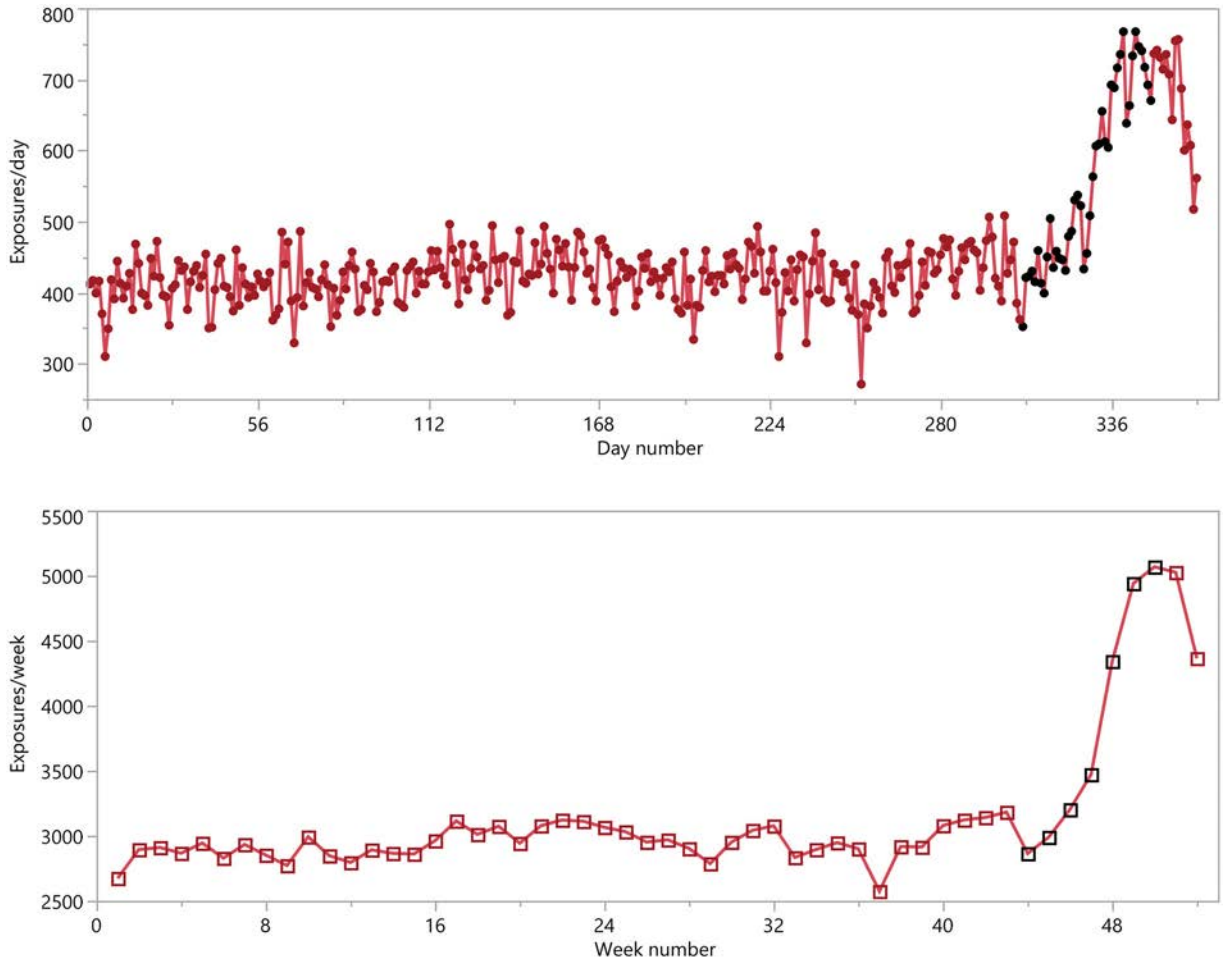

Figure 1(#249). Exposures to Substances Associated with COVID-19 (all 18 Generic Codes) for 16-Apr-2019 through 13-Apr-2020 by Day and by Week (16-Feb-2020 through 29-Mar-2020 shown in black).

Table 1(#249). Generic Code Increases sorted by Substance Category and % Increase over the 42 days (16-Feb-2020 through 29-Mar-2020).

Substance Category	Generic Code Name	% Increase/ 42 days	Absolute Increase/ 42 days	Mean Exposures /day
Cleaner	Wall/Floor/Tile/All-Purpose Cleaning Agents: Alkalis	89.1%	16.52	18.5
Cleaner	Anionic or Nonionic Hand Dishwashing Detergents	63.9%	11.52	18.0
Cleaner	Miscellaneous Cleaning Agents: Alkalis	52.9%	9.23	17.5
Cleaner	Miscellaneous Cleaning Agents: Other or Unknown Hous	33.3%	4.33	13.0
Cleaner	Soaps (Bar, Hand or Complexion)	31.3%	11.33	36.2
Disinfectant	Disinfectants: Other or Unknown	161.0%	67.45	41.9
Disinfectant	Rubbing Alcohols: Isopropanol without Methyl Salicylate	95.9%	19.70	20.5
Disinfectant	Isopropanol (Excluding Rubbing Alcohols and Cleaning A	93.6%	14.13	15.1
Disinfectant	Bleaches: Hypochlorite (Liquid and Dry)	89.9%	97.29	108.2
Disinfectant	Hydrogen Peroxide 3%	61.3%	14.99	24.5
Disinfectant	Mouthwashes: Ethanol Containing	53.0%	8.14	15.3
Disinfectant	Peroxides	48.6%	7.47	15.4
Disinfectant	Hand Sanitizers: Ethanol Based	38.0%	32.21	84.9
Medication	Multiple Vitamin Tablets: Pediatric Formulations withou	77.9%	42.85	55.0
Medication	Multiple Vitamin Tablets: Adult Formulations without Ir	52.2%	13.78	26.4
Medication	Albuterol	39.0%	5.42	13.9
Medication	Vitamin D	38.9%	7.71	19.8
Medication	Leukotriene Antagonist or Inhibitor	37.9%	5.71	15.0

Table 2(#249). Generic Code Categories, Age Group, Outcome and Single Digit Zip sorted by % Increase over the 42 days (16-Feb-2020 through 29-Mar-2020).

Parameter	% Increase /42 days	Exposures/ day (mean)	Increase /42 days	Lower 95% CI	Upper 95% CI	RSquare	P-value
Generic Code Category							
Viral Diseases	213.8%	55.2	118.1	71.1	165.2	0.392	0.0000
Disinfectants	80.2%	325.8	261.4	227.2	295.5	0.853	0.0000
Medications	58.0%	130.2	75.5	55.2	95.7	0.580	0.0000
Cleaners	51.3%	103.3	52.9	40.4	65.4	0.641	0.0000
Age Group							
Unknown adult (>=20 yrs)	164%	41.8	68.6	58.1	79.0	0.810	0.0000
60 - 69 years	139%	29.1	40.6	33.5	47.8	0.762	0.0000
50 - 59 years	139%	32.6	45.3	37.5	53.0	0.772	0.0000
70 - 79 years	137%	18.7	25.5	20.6	30.3	0.731	0.0000
40 - 49 years	133%	34.0	45.2	35.8	54.6	0.697	0.0000
30 - 39 years	132%	43.3	57.1	45.4	68.7	0.705	0.0000
0-5 years	51%	273.3	140.0	111.1	168.8	0.700	0.0000
Medical Outcome							
More serious	92.8%	15.4	14.3	7.0	21.7	0.275	0.0003
Less serious	82.7%	598	495	419	570	0.811	<.0001
Region (first digit zip code)							
8	108.3%	72.0	78.0	56.9	99.1	0.576	0.0000
0	103.1%	40.4	41.7	28.2	55.1	0.488	0.0000
1	88.8%	53.5	47.5	39.9	55.2	0.793	0.0000
2	87.3%	64.4	56.2	43.9	68.4	0.677	0.0000
6	80.9%	36.3	29.4	20.8	37.9	0.540	0.0000
5	79.6%	28.0	22.3	15.7	28.9	0.530	0.0000
3	78.1%	81.4	63.6	35.6	91.7	0.338	0.0000
9	77.5%	87.4	67.7	55.6	79.9	0.755	0.0000
4	64.9%	55.4	35.9	25.4	46.5	0.534	0.0000
7	61.2%	60.8	37.2	27.2	47.2	0.581	0.0000

Methods: We examined all 1089 NPDS generic codes (GCs) over 16-Feb-2020 through 29-Mar-2020 (43 days during which the COVID Cases increased) and looked for increase via linear regression for the 100 GCs with the most exposures during this period. Descriptive statistics and change over time via linear regression were via SAS JMP (12.0.1).
Results: Exposures for the 100 GCs with the most cases ranged from 12.6 to 170 exposures/day. The top 24 GCs by % increase over these 43 days all had an associated p-value <0.05. Of these 24, 18 GCs were assigned to the 3 categories – Cleaners, Disinfectants or Medications (Table 1). We examined the 210,064 exposures for these 18 GCs including 3,334 exposures coded to the GC Viral Disease for 52 weeks (16-Apr-2019 through 13-Apr-2020) by GC, Outcome, Age and Zip Code. Figure 1 shows the change over time for these 18 GCs by day and by week. The GC with the greatest % increase over these 43 days was Disinfectants Other or Unknown and the greatest absolute increase was in Bleaches: Hypochlorite. The Disinfectants GC group had the highest % increase and the greatest absolute increase (Table 2). The Age Group with the greatest % increase was Unknown Adult $\geq$20 years and the greatest absolute increase was in the 0-5 y/o Age Group. More serious cases increased by 92.5% and the less serious cases increased by 82.7%. The region (first digit zip code) Zip-1 = 8 (Arizona, Colorado, Idaho, Nevada, New Mexico, Utah, Wyoming) was the largest % increase and the largest absolute increase. (Table 1)
Conclusions: The disinfectants substance category showed the largest percentage and absolute increase while hypochlorite bleaches generic code showed with the largest absolute increase. Although children age 0–5 years usually account for half of all NPDS exposures, the largest percent increase was in the adult age group $\geq$20 years suggesting more adverse use outcomes in adults. These results suggest the value of examining the exposures to associated substances reported to NPDS as a real time assessment of COVID-19 evolution in the US. The COVID-19 response has brought all aspects of poison centers to the forefront during public health events. Continual surveillance, essential public health messaging through poison center outreach and education and collaboration with local and state public health agencies to deliver safety messages on proper storage and use of products is indispensable.

KEYWORDS COVID-19, Exposure Cases, Coingestants

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250. Severe Rattlesnake Envenomation Complicated by Severe Systemic Reaction, Diffuse Myokymia, Rhabdomyolysis, and Supraventricular Tachycardia

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Background: North American rattlesnake envenomation is typically characterized by local swelling and tissue damage and hematologic toxicity. Neurotoxicity can manifest as myokymia, or rippling fasciculations of the skin. Anaphylactic or anaphylactoid reactions to venom have been reported but are typically seen in patients with previous bites or a history of snake handling and are thought to be due to prior sensitization. Treatment for rattlesnake envenomation involves administration of antivenom.

Case Report: A previously healthy 16-year-old female presented to the Emergency Department (ED) after a rattlesnake bite to her right ankle. En route to the hospital, she developed rapidly progressing local edema, and eventually developed edema of the face and neck as well as diffuse myokymia. On arrival to the ED, she was intubated for airway protection and treated with methylprednisolone, diphenhydramine, and epinephrine for presumed anaphylaxis, in addition to Anavip antivenom. Shortly after intubation, she developed supraventricular tachycardia (SVT), requiring cardioversion. She was transferred to the pediatric intensive care unit (PICU), where she continued to exhibit worsening myokymia and sinus tachycardia, complicated by hyperthermia and rhabdomyolysis, and was subsequently paralyzed with vecuronium. She was extubated on hospital day 2, but treated with additional antivenom for worsening swelling, for a total of 44 vials of antivenom. She developed an additional episode of SVT after antivenom administration that was terminated with adenosine. She never developed coagulopathy. An echocardiogram obtained during hospitalization was normal, and the patient was started on nadolol to prevent further tachydysrhythmias. Myokymia and rhabdomyolysis improved, and the patient was ultimately discharged in stable condition with outpatient electrophysiology follow-up for her SVT.
Case Discussion: In this case, a patient with no known prior exposures to rattlesnakes or antivenom developed a severe envenomation that resulted in airway compromise and severe myokymia that was complicated by hyperthermia and rhabdomyolysis. Severe myokymia contributing to respiratory failure has been previously reported. Although this patient also developed edema of the face and neck concerning for airway compromise, the severity of her myokymia may also have contributed to the development of her respiratory failure. In this case, the patient's myokymia was severe enough that she developed rhabdomyolysis and hyperthermia and was treated with paralytics to prevent progression of her toxicity. The development of SVT may have been related to the severity of her toxicity or epinephrine administration; however, she is still being evaluated for underlying cardiac disease which may have contributed. Neurotoxicity has been reported after envenomation by the Mojave rattlesnake (*Crotalus scutulatus*), Timber rattlesnake (*Crotalus horridus*), Western Diamondback (*Crotalus atrox*), and Southern Pacific rattlesnake (*Crotalus viridis helleri*). The exact mechanism of myokymia is unknown, although one proposed mechanism involves effects on axonal calcium or potassium channels. Neurotoxicity is treated with antivenom; however, there have been case reports of myokymia persisting for days despite treatment.
Conclusion: Severe rattlesnake envenomation can result in systemic toxicity and severe neurotoxicity. Patients with severe myokymia should be carefully monitored for development of impending respiratory failure and rhabdomyolysis, as occurred in this patient.

KEYWORDS Rattlesnake, Myokymia, Pediatric
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251. Phenibut Withdrawal Requiring Large Doses of Baclofen and Phenobarbital

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Background: β-phenyl-γ-aminobutyric acid, or phenibut, is a γ-aminobutyric acid (GABA) subtype B agonist. It can be easily purchased online as a supplement, often marketed as a treatment for anxiety or for nootropic effects. Withdrawal after discontinuation appears similar to withdrawal from GABA-A agonists; however, it is often resistant to traditionally used medications such as benzodiazepines. Baclofen, a GABA-B agonist that is structurally similar to phenibut and is used therapeutically to treat muscle spasticity, has been anecdotally used to treat phenibut withdrawal, although the regimens reported vary widely.
Case Report: A 24-year-old man with a past medical history of insomnia and anxiety presented to the Emergency Department (ED) with palpitations, shortness of breath, and feeling anxious. On examination, he was tachycardic, diaphoretic, and extremely anxious. He reported he had previously purchased zopiclone online for sleep but had run out of the supply after one month. He had been on numerous medications over the past year to treat anxiety and insomnia with limited success. He stated he often had to use escalating doses of these medications to manage his symptoms. In an attempt to prevent withdrawal from zopiclone, he had purchased phenibut online and was taking 2-3 grams per day for one week. His last use was 48 hours prior to arrival. He was treated with lorazepam 2 milligrams (mg), baclofen 130 mg, and phenobarbital 780 mg over 6 hours prior to achieving initial control of his withdrawal symptoms. During the second day of admission, his withdrawal symptoms recurred, and he was treated with additional baclofen 40 mg orally and phenobarbital 260 mg intravenously. He was then started on scheduled baclofen 40 mg twice daily and phenobarbital 64.8 mg orally three times a day. He was discharged on a 15-day taper of baclofen.
Case Discussion: In this case, the patient had only been on phenibut for one week prior to developing dependence and ultimately withdrawal when he discontinued use. Although he had been on zopiclone prior to this hospitalization, given that a week had passed and he only developed withdrawal symptoms after discontinuing phenibut, his withdrawal was attributed to phenibut. As his history was complicated due to having used multiple agents recently, he was treated with both a GABA-B agonist (baclofen) as well as GABA-A (phenobarbital) to control his symptoms. Despite the use of both agents, his withdrawal symptoms were difficult to control during hospitalization. GABA-B agonist withdrawal is known to be difficult to manage with GABA-A agonists such as benzodiazepines and barbiturates. This case suggests that a combination of GABA-A and GABA-B agonism may be useful in resistant cases, however frequent reassessment and re-dosing will likely be needed, especially early in the course of treatment, to manage symptoms.
Conclusion: Phenibut withdrawal may be treated with baclofen, however given the wide variety of reported doses used in the literature, careful monitoring and frequent reassessment is needed to ascertain optimal dose titration to control symptoms. Additionally, there may be a role for combined therapy with GABA-A agonists to manage recalcitrant withdrawal.

KEYWORDS Phenibut, Withdrawal, Baclofen
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252. Ethanol Breath Testing in the ED: does "poor effort" matter?

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Background: Emergency Department (ED) patients frequently get tested for the presence of ethanol (ETOH). This testing is done using either breath or blood. Breath testing is less invasive, quicker, and less costly. However, it is uncertain how accurate breath ETOH testing is compared to blood testing in the context of patients with perceived poor breath testing effort.

Methods: We conducted a retrospective chart review of all patients over a three year period (01/01/2017–12/31/2019) who had both breath and blood ETOH testing completed during their ED visit. All breath ETOH tests were completed using the Alco Sensor FS. We examined breath and blood ETOH tests to see how well they correlated for patients whose breath test effort was recorded as "poor" as compared to those whose effort was "normal". Analysis was done including 2 groups of subjects: first, all subjects with breath/blood tests within 120 minutes of one another, second, just the subjects with breath/blood tests within 30 minutes of each other. In each group roughly half of breath tests were prior to blood tests, and vice versa. Ethanol concentration differences between breath and blood were compared for those with documented normal effort and those with poor effort on the breath test; comparisons were done using a Wilcoxon Rank Sum test due to slight non-normality of the data.
Results: We included 593 subjects with both blood and breath ETOH tests conducted within 120 minutes of each other; 327 had normal breath test effort and 266 had poor effort. Of those, 108 subjects had both tests within 30 minutes of each other; 66 with normal effort and 42 with poor effort. For both 30 and 120 minutes, there was no significant difference in time between tests in the two effort groups. In the overall study population, the median time between tests was 55 minutes (IQR 45 minutes); 57 minutes in the normal effort group (IQR 48 minutes) and 54 minutes in the poor effort group (IQR 42 minutes). For the 120 minute group, the overall median difference between blood and breath ethanol levels was 0.046% (IQR 0.075), 0.033% (IQR 0.062) for those with normal effort and 0.067% (IQR 0.099) for those with poor effort, a statistically significant difference ($p = <0.0001$). For the 30 minute group, the overall median difference between blood and breath ethanol levels was 0.045% (IQR 0.079), 0.033% (IQR 0.069) for those with normal effort and 0.074% (IQR 0.099) for those with poor effort, also a statistically significant difference ($p = 0.0066$).
Conclusions: In this study, subjects with both breath and blood ETOH testing done within a single ED visit had a median difference in ETOH concentration between the breath and blood tests of 0.046%. Subjects with breath and blood ETOH testing done within 30 minutes (and within 120 minutes) of one another had significantly bigger differences in ETOH concentrations between the tests in those with perceived poor effort compared to those with perceived normal effort on the breath test. In this population, the perception of poor test effort was significant.

KEYWORDS etoh, breathalyzer, alcohol

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253. Comparative changes in patient presentations for poisoning, intoxication and withdrawal in the early days of COVID-19

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Background: Societal responses to the COVID-19 pandemic have had a substantial effect upon the number of patients seeking healthcare. There has been an overall decrease in the number of patients seen since the state declaration of a "peacetime emergency" and an increase since a subsequent declaration emphasizing the appropriateness of emergency care seeking. Societal stressors stemming from the pandemic might have been expected to result in a smaller decrease or even an increase in patients presenting with poisonings, intoxication, or withdrawal after the first declaration and an increase in presentations after the second.
Methods: We conducted an observational study, examining demographics and diagnoses for all patient visits to the ED of an urban Level-1 trauma center during three periods, before and after the state emergency declaration and after the state's appropriate emergency care declaration, comparing them to visits from similar periods in 2019. We estimated the ratios between the three periods using Poisson regression. We calculated the week to week changes with respect to 2019 for total ED visits, patient characteristics, and presentations for poisonings, overdoses, and alcohol withdrawal, and then evaluated the interactions between each factor and the overall change in ED visits.
Using an interrupted time series analysis, we periods using Poisson regression,
Results: There was a significant 35.2% drop in overall ED visits after the state declaration, with a significant 24% increase in ED visits after the appropriate emergency care declaration. While there were significant initial declines in multiple presentations and significant increases in presentations for symptoms associated with COVID-19, presentations for poisonings and withdrawal remained unchanged throughout ($p = 0.247$, 0.503), with small increases in the proportion of ED visits they represent (by 0.5, 2.1, 0.4%) after the first declaration and then declines to near their baseline proportions of visits (by 0.1, 0.3%). Though presentations for intoxication increased proportionally after the emergency declaration (by 2.1%) this was not statistically significant ($p = 0.207$). The subsequent proportionate decline (by 3.1%) in presentations for intoxication after the appropriate emergency care declaration was significant ($p = 0.022$).
Conclusions: Patient concerns about health care settings and public health have significantly altered care-seeking during the COVID-19 pandemic. Unlike the overall and differential declines in ED visits for certain demographic groups and disease processes, presentations for poisonings, intoxication, or withdrawal have remained relatively unchanged. Presentations for intoxication after a state declaration encouraging emergency care seeking declined, however, potentially through changes in patient behavior or the development of alternative resources for such presentations. Given the ongoing stressors of societal responses to the COVID-19 pandemic, there will be a need to monitor for changes in the burden of toxicologic presentations to the ED and their related morbidity and mortality.

KEYWORDS Poisoning, Intoxication, COVID-19

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254. Counties with High Hispanic Concentration Show Elevated Risk for Death and Hospitalization from Poisoning

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Objectives: To assess the associations between county-level % Hispanic population and county-level poisoning death rates and hospitalization rates, after adjusting for potential confounding county-level factors including poverty, age and urban/rural status and opioid sales.
Methods: Data on poisoning deaths and hospitalizations were collected by the Florida Department of Health and demographic data were pulled from the American Community Survey for the 67 counties of Florida over the period 2010-2015. Counties were

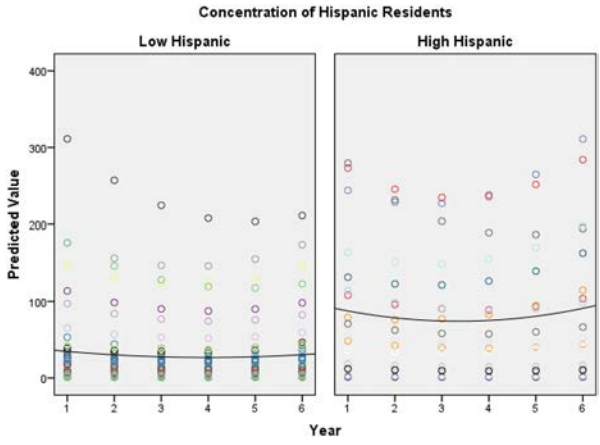

Figure 1(#254). Predicted (Modeled) Counts of Deaths from Poisoning by Florida County, Hispanic Concentration, 2009-2014

dichotomized into high vs. low % Hispanic population based on the statewide mean of 11.9% Hispanic. Opioid sales data were drawn from the Florida Prescription Drug Monitoring Program and were categorized by quartile. We modeled incidence rate ratios (IRR) using a mixed-effects Poisson regression with county-level random intercepts and random slopes on year. The model for death outcomes also included fixed-effect adjustment for year, year^2, median age, % poverty, urban/rural status, and opioid sales. The model for hospitalization included fixed-effect adjustment for year, year^2, median age, calls to poison centers, urban/rural status and opioid sales. For the hospitalization study, a separate sub-analysis was conducted using counties with greater than 10,000 residents (N = 40) that included the % uninsured, in addition to the covariates already listed.

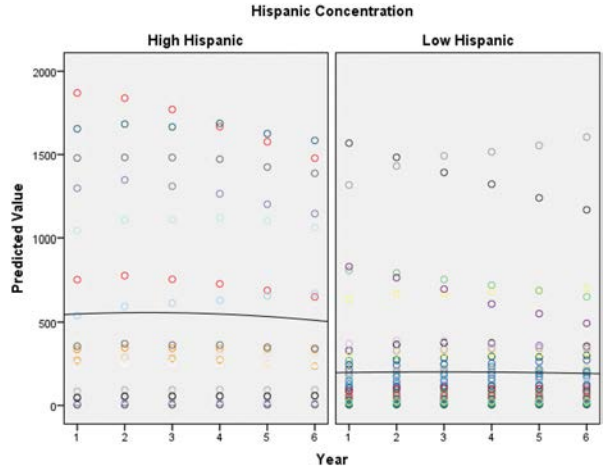

Figure 2(#254). Predicted (Modeled) Counts of Hospitalization from Poisoning by Florida County, Hispanic Concentration, 2009-2014

Results: Conditional on the random effects and after adjusting for the factors noted above, high % Hispanic counties had higher incidence rates of poisoning death (IRR 1.50, 95% confidence interval [1.18, 1.92]) and hospitalization (IRR 1.26, 95% confidence interval [1.06, 1.50]) compared to low % Hispanic counties. The sub-analysis which included % uninsured generated a lower incidence rate ratio of 1.20 (95% confidence interval [1.04, 1.38]), conditional on the random effects and after also adjusting for year, year^2, median age, calls to poison centers, urban/rural status and opioid sales.

Conclusions: These county-level results are in the opposite direction of unadjusted incidence data that describe lower death and hospitalization rates among Hispanic individuals in Florida and the U.S. One possible explanation for this discrepancy is that the poisoning events in high % Hispanic counties, after accounting for county-level attributes and random effects, could be occurring more often in non-Hispanic individuals residing in these counties. This is consistent with other research on "despair deaths" among older white populations in communities with changing demographics. These results may indicate that areas with larger minority populations warrant extra poison and drug abuse prevention attention from poison control centers and other public health agencies. These results must be interpreted with caution since ecological data cannot be used to definitively assess individual-level behavior, which was not measured in this study.

KEYWORDS epidemiology, Hispanic, poisoning

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Table 1(#254). Estimated Fixed Coefficients and Incidence Rate Ratios from the Poisson Regression (Poison Deaths).

					95% Confidence Interval			95% Confidence Interval	
Model Term	Coefficient (β)	Std. Error	t	Significance	Lower	Upper	IRR	Lower	Upper
Intercept	−8.35	0.45	−18.56	.000	−9.24	−7.47	–	9.75E-05	.001
High Hispanic Concentration	.41	.12	3.27	.001	.16	.65	1.50*	1.18	1.92
Low Hispanic (ref)	0								
Year	-.21	.02	−9.12	.000	-.25	-.16	.81*	.78	0.85
Age	-.001	.008	-.06	.95	-.02	.02	.99	.98	1.02
Poverty	-.05	.013	−3.74	.000	-.07	-.02	.95*	.93	.98
Rural	.13	.13	1.05	.29	-.11	.38	1.14	.89	1.46
Urban (ref)	0								
Opioid Pres Q1 Highest	.62	.17	3.75	.000	.30	.95	1.86*	1.34	2.58
Q2	.58	.16	3.61	.000	.26	.90	1.79*	1.30	2.45
Q3	.33	.15	2.23	.026	.04	.62	1.39*	1.04	1.86
Q4 Lowest (ref)	0								
Year*Year	.03	.003	9.18	.000	.02	.03	1.03*	1.02	1.03

Table 2(#254). Estimated Fixed Coefficients and Incidence Rate Ratios from the Poisson Regression (Poisoning Hospitalizations).

					95% Confidence Interval			95% Confidence Interval	
Model Term	Coefficient (β)	Std. Error	t	Significance	Lower	Upper	IRR	Lower	Upper
Intercept	−7.64	.26	−28.83	.000	−8.16	−7.12	–	.000	.001
High Hispanic Concentration	.23	.09	2.57	.011	.05	.41	1.26*	1.06	1.50
Low Hispanic (ref)	0								
Year	.07	.01	5.57	.000	.04	.09	1.07*	1.04	1.09
Age	-.002	.006	-.26	.792	-.014	.011	.99	.97	1.01
Poison Center Calls	.04	.007	5.85	.000	.026	.052	1.04*	1.03	1.05
Rural	-.37	.07	−5.30	.000	-.51	-.24	.69*	.60	.79
Urban (ref)	0								
Opioids Q1 Highest	.52	.12	4.34	.000	.28	.75	1.68*	1.33	2.12
Opioids Q2	.51	.11	4.43	.000	.28	.73	1.66*	1.33	2.08
Opioids Q3	.27	.11	2.51	.013	.06	.47	1.30*	1.06	1.60
Opioids Q4 Lowest (ref)	0								
Year*Year	-.006	.0012	−5.28	.000	-.009	-.004	.99*	.99	1.00

Table (#255). Qualitative Comments from Tagline Study.

If you suspected someone was poisoned, what action(s) would you take? (pre-tagline study)

"If I suspected someone was poisoned, I would initially dial 911 as it would be an emergency situation that would require immediate help." Brooke B, 20

"If I felt someone was poisoned, I would call 911 and then I would start googling other options." Victoria T, 23

"I would likely call my Dr. or 911, depending on how severe it was. If I was aware of this phone number (poison control), I would call them instead of the Dr. though." Ally R, 45

"I would call 911 to contact EMT because they are trained professionals." Danielle A, 26

"Honestly, as of right now, I would probably call 911. I don't know too much about poison control … I'm not sure what services they actually offer." Hayley S, 22

"I've just always been taught to call 911 first, and especially since I don't know a poison hotline number off the top of my head that's what I would call." Cheri B, 43

"Because I do not have the poison control number handy, I would call 911 for immediate help." Clearissa C, 65

"If it wasn't super serious I would google 'is _____ poisonous or harmful?' If it was much more serious, a poison hotline would be a good option." James B, 34

How likely would you be to call the poison control 800 number if you thought someone might be poisoned? (post-tagline study)

"I am more likely after this study, but still just not sure if calling 911 would be more direct and faster acting in an immediately pressing medical situation where those seconds do matter … " Nicole B, 24

"Now that I know the poison control number provides emergency services I would call for sure. If I did not know that, I would not call." Mitchell P, 47

"If I know that they are quicker than 911, I sure as heck would be using that number." Marianne M, 60

"I would call the number if I had access to the number. 911 is just so quick and it's in my brain." Clearissa C, 65

"It would be helpful if the number would be easy such as 911." Latoya J, 44

"Poisonings can be very stressful and scary and I might revert back to what I know which is 911." Amanda M, 25

"After this study I have been very informed on the benefits of calling the poison hotline. I do believe that if someone I know or myself has been poisoned I would be very likely to call this number because I am now aware that there are experts waiting to help with your specific poisoning case." Victoria T, 23

"If I knew the number or had it easily accessible, then I would definitely call it. Otherwise, I would contact 911 first." Alejandro Z, 40

"It would take a lot of advertising and proven results to let me know that 911 isn't my best option." David V, 46

255. Developing Taglines and Messaging to Promote the Poison Control Brand

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Background: Poison control centers nationwide face public awareness challenges. While promotion is often handled on an individual center basis, there is little research to guide poison centers in their branding and messaging efforts. A study was undertaken to solicit qualitative input from the public that could shape priority messages and help establish a tagline for poison control. The tagline would reflect the service characteristics most valued by participants and promote a call-to-action for the public that encourages poison control utilization.

Methods: Participants were recruited throughout the territory of two regional poison control centers, and they were asked to evaluate various taglines relating to poison control. Fifty-nine people participated in four online focus groups, and respondents were segmented by age: 47% were aged 19-34; 53% were aged 35-74. Participants were English-speaking residents of urban counties, two-thirds (66%) of which were female. Participants' self-reported race/ethnicity was 58% white, 25% black, and 17% Hispanic. Just over half of respondents (53%) reported having a college or post-college degree. Eight taglines were tested across the four groups to determine the importance level of various poison control service characteristics including convenience, speed of response, expertise, cost-effectiveness, and overall value.

Results: Speed of response was the characteristic most highly rated by participants. The tagline "When seconds count" was chosen as the leading tagline by nearly half of respondents (45%). Three primary reasons were given for participants' preference: the tagline plainly communicated that poison control was the place to contact for suspected poison emergencies, it elicited a strong emotional appeal, and it embodied a concise, clear, and memorable message. Particularly, "When seconds count" had a notably stronger appeal with the older cohort. Otherwise, responses were remarkably similar across geographic areas. Overall, about 40% of participants demonstrated an unclear or inaccurate understanding of what poison control centers do or how they benefit the public. Participants suggested improving awareness through mass media campaigns. After a brief overview

of poison center services at the conclusion of the study, participants reported a high likelihood to utilize poison control, with an overall rating of 4.2 out of 5.
Conclusions: Beyond identifying a preferred tagline, qualitative insight from participants indicated barriers that prohibit poison control utilization including: 1) a lack of understanding about how poison control responds to poison emergencies; 2) a lack of familiarity with the 1-800-222-1222 number; 3) the belief that 911 is the best choice in a suspected poisoning. Participants clearly regarded suspected poisonings as emergencies. They recommended easier access to poison control services either by integrating poison control with 911 or establishing a memorable 3-digit number. Participants in this study reported a likelihood to utilize poison control services after being introduced to an appropriate tagline and receiving education about poison control. However, a tagline alone is unlikely to overcome many pre-existing barriers that prevent people from contacting poison control. Further public education and greater awareness of poison control centers are suggested to complement a tagline for poison control.

KEYWORDS poison center promotion, branding, tagline
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256. Results of a Targeted Media Outreach to Low-Utilization Counties

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Background: A regional poison control center (RPCC) observed a significant drop in calls among six counties in its coverage area. The decline in the six-county area was observed over a multi-year period with calls decreasing 23% on average from the previous year. The decrease in the six-county area was non-proportional to the RPCC's overall, territory-wide drop in contact volume, which was a four percent decrease from the previous year. Typically, the RPCC has a dedicated budget for media outreach and primarily allocates outreach funds to the largest markets of its territory. To reach sharp areas of decline, the RPCC launched a targeted year-long media outreach to the six low-utilization counties.
Methods: Counties chosen for inclusion in the low-utilization outreach had greater than 100 calls per county annually and had experienced at least a 20% drop in contact volume from the previous year. Animated poison center awareness videos were created for two identical online media campaigns on Facebook. The campaigns were implemented in the six low-utilization counties as well as major designated market areas to provide a benchmark for analysis. Residents with a household income of less than $100,000 were targeted in both campaigns, and RPCC budgets for each campaign were the same ($1,100 per month). The campaigns ran online simultaneously for 12 months, and they were measured by video views, link clicks, post engagements, and shares. Monthly call volume to the RPCC was also assessed in the low utilization and major market areas both pre and post campaigns.
Results: Low utilization and major market areas demonstrated a similar level of campaign activity and engagement. Residents in lower-utilization counties were as likely to view the animated videos as were residents of major designated market areas (139,161 lower-utilization video views/140,083 major market video views). In six months out of 12, video views in the low-utilization counties exceeded those in the major markets. Residents of lower-utilization counties were also nearly as likely (80%) to share campaign content as the major market group and were 66% as likely to click through an advertisement to the poison center website. During the calendar year of outreach, poison center contact volume in lower-utilization areas increased in five of the six counties from a range of 6-31% from the previous year when no media outreach was conducted.
Conclusions: The degree to which the campaigns influenced behaviors and poison center contact volume is unknown. However, this study demonstrated comparable interaction rates between residents in lower-utilization counties and residents in major market areas. Residents in lower-utilization areas were as likely or nearly as likely to act on a campaign advertisement as residents in the major market areas. Lower-utilization counties in this study were also rural counties, suggesting that rural residents can benefit from an online outreach. Targeting lower-utilization areas of a poison control center territory can be an effective outreach strategy. More research is needed to determine the long-term effects of a lower-utilization county outreach.

KEYWORDS media outreach, low utilization areas, poison center promotion
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257. Fully Immersive Simulation (FIS) During Advanced Hazmat Life Support (AHLS) Course

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Background: AHLS courses throughout the world are conducted using a series of 4 tabletop simulations in order to further provide a case-based more real-life experience within the basic course materials. We sought to determine if a FIS component would lead to greater participant satisfaction and subjective determination of retained course materials.
Methods: During two administrations of the national AHLS course, a FIS simulation occurred substituting for the noxious gas tabletop simulation. The remainder of the AHLS materials and tabletop exercises were unchanged from previous AHLS courses at our site. Using an alternative location, a simulated life event took

Table 1(#257). Participant Perception of FIS Session.

Question	Session 1 (n = 20) (Agree and Strongly Agree)	Session 2 (N = 15) (Agree and Strongly Agree)
Have had previous HaxMat training?	66%	50%
Did that previous training have a Hand On component?	100%	66%
Prior to this class did you feel prepared to manage a HazMat patient at work?	55%	33%
Prior to this class, I thought I could provide patient care and protect myself when managing a HazMat Patient.	55%	33%
I feel prepared to handle a HazMat Patient at my work.	88%	83%
I think I can provide patient care and protect myself when managing a HazMat patient.	66%	100%
I believe the fully immersive simulation (FTX) can prepare me to manage a HazMat Incident.	89%	100%
I believe the FTX enhanced my learning of the didactic material	78%	83%
I retained more of the didactic material than I expected	89%	100%

place, with live protective gear, decontamination materials, simulated and live moulage patients, and simulated treatment materials. A 30 minute debrief session occurred after the FIS session.
Results: 35 total subjects participated in the FIS event, 20 in one session, and 15 in the second session. The sessions were separated by 1 year. Those participating voluntarily agreed to be surveyed regarding the FIS session at a later time. Six months after each AHLS class with FIS, the students were contacted via email with a survey to determine how they perceived their knowledge and retention of material and if the exercise benefited their retention. The results of the survey questions are in Table 1. Discussion: Students largely perceived that prior to the class they were able to manage a single or multiple HazMat patient well. At the end of each class, 89-100 percent of the students reported that they are better able to manage a HazMat patient, and they believed that the FIS was instrumental in their knowledge retention.
Conclusion: FIS training, when possible, should be incorporated into HAZMAT training programs in order to increase subjective perception of learned material from the standardized AHLS course.

KEYWORDS AHLS, Simulation, Education

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258. An Increase in Foraging Misadventures Associated with the COVID-19 Pandemic

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Background: Each year, misadventures from foraging results in calls to poison centers and hospitalizations. In the spring, *Allium tricoccum*, commonly referred to as ramps or leeks is mistaken for Veratrum species, commonly referred to as false hellebore. Veratrum alkaloids are thought to cause toxic effects through prolonging the opening of sodium channels resulting in cardiotoxic effects. In the spring of 2020, during the height of the COVID-19 pandemic, our poison center appreciated an anecdotal increase in calls prompting this review.
Methods: Calls coded as plant exposure were abstracted from our data collection system from 3/14/2020 through 5/15/2020 and compared to the same time period from 2015 through 2019. From this dataset, Veratrum coded calls were analyzed separately with the inclusion of clinical effects coded in symptomatic calls. **Results:** There was 30 plant exposure calls in 2020 compared to an average of 14 in the previous 5 years. See Figure 1 for exposures and coded outcomes. Of the 30 calls in 2020, 18 calls were Veratrum exposure calls, and 14 reported symptoms. In the previous 5 years, an average of 2.2 calls regarding Veratrum occurred. In all Veratrum calls from 2015-2020, 24 calls reported clinical effects. The most common clinical effects coded were; gastrointestinal, 25%; bradycardia, 12%; hypotension, 9%; oral irritation, 9%. Others occurring in 7-8% of cases included hypoglycemia, mydriasis, and dizziness and vertigo.
Discussion: Plant foraging exposures and specifically Veratrum species exposures increased calls to our poison center in 2020 during the COVID-19 pandemic. We hypothesize this increase is due to more people staying home and subsequently foraging as a hobby. Poison prevention messaging should include messages for foragers to prevent exposures during these times. After exposure, patients should be evaluated for common effects including gastrointestinal, bradycardia, hypotension, oral irritation, hypoglycemia, mydriasis, and dizziness and vertigo.

KEYWORDS Veratrum, Foraging, Covid-19

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259. Acute Rivaroxaban Overdose Confirmed with Heparin Anti-Xa Activity and Serum Concentrations in an Adolescent Patient

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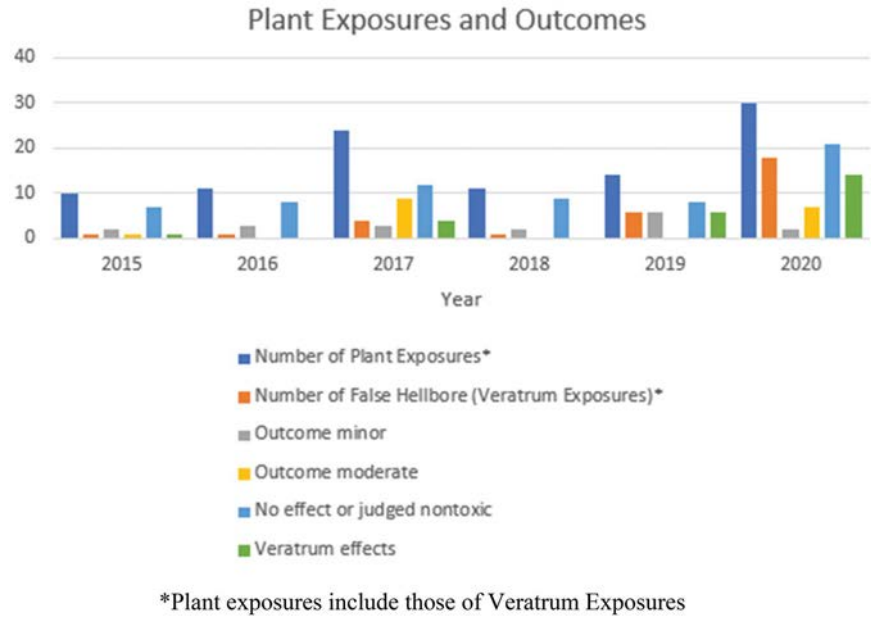

Figure 1 (#258).

Table 1(#259). Coagulation Studies During Admission.

Hospitalization Day	PT (seconds) (Reference range: 8.8 – 12.3)	aPTT (seconds) (Reference range: 23.6 – 35.8)	INR (Reference range: (0.8 – 1.13)	Heparin Anti-Xa (IU/mL) (Reference range: 0.30 – 0.70)	Rivaroxaban Concentration (ng/mL) (Reference range: 8 – 160)
1 (4 hrs post-ingestion)	31.3	37.7	2.80	4.82	940
1 (16 hrs post-ingestion)	N/A	N/A	N/A	0.99	110
2 (28 hrs post-ingestion)	12.9	25.4	1.14	0.15	26

Background: Rivaroxaban is a direct-acting oral anticoagulant (DOAC) that selectively inhibits Factor Xa activity. Intentional overdose of rivaroxaban could lead to significant coagulopathy and major bleeding events. Previous case reports suggest that acute overdose of rivaroxaban is benign, but clinical data in children and adolescents are limited. We report a single case of intentional overdose of rivaroxaban in an adolescent girl confirmed by blood concentrations and managed with expectant therapy alone.
Case Report: A 16-year-old girl, weight 77kg, with a history of deep vein thrombosis and pulmonary embolism secondary to oral contraceptive use maintained on rivaroxaban therapy presented to the Emergency Department (ED) after intentional ingestion of ten to fifteen 20 mg rivaroxaban tablets in a suicide attempt. Her vital signs and physical examination were unremarkable on presentation. Initial laboratory studies revealed the following: PT 31.3 sec (reference range: 8.8–12.3 sec); INR 2.80 (reference range: 0.8–1.13); aPTT 37.7 sec (reference range: 23.6–35.8 sec); heparin anti-Xa assay (Anti-Xa) 4.82 IU/mL (reference range: 0.30–0.70 IU/mL). She had normal kidney function. Whole blood rivaroxaban concentrations were drawn in the ED as well as 16 and 28 hours post-ingestion. A single dose of 77g activated charcoal was given in the ED 1.5 hours after presentation, and the patient was admitted to the Pediatric Intensive Care Unit for observation. She did not receive any reversal agents or blood products and had no bleeding events throughout her hospital course. Despite initially elevated coagulation parameters obtained at four hours post-ingestion, heparin anti-Xa activity decreased by 79.5% and 96.9% at 16 and 28 hours post-ingestion, respectively. Similarly, the rivaroxaban concentration decreased by 84.8% and 97.2% at 16 and 28 hours post-ingestion, respectively (Table 1). PT, aPTT, and INR normalized by 28 hours post-ingestion (Table 1). She was discharged on hospital day 2 with psychiatry outpatient follow-up.
Discussion: There are several case reports of adults ingesting acute overdoses of DOACS with benign outcomes. However, there are few to none, to our knowledge, of these cases reported in children and adolescents. Activated charcoal may have benefited this patient by decreasing absorption of rivaroxaban as it has been shown to potentially reduce plasma concentrations of rivaroxaban up to 8 hours post-ingestion. In an otherwise healthy pediatric patient, activated charcoal and conservative therapy following acute rivaroxaban overdose were sufficient to normalize coagulation studies by hospital day 2, and the patient suffered no bleeding complications.
Conclusion: In the setting of acute single overdose of rivaroxaban, numerical coagulopathy may occur. In this case of a healthy adolescent girl with normal renal function, ED administration of activated charcoal and expectant management was associated with a benign outcome. Administration of blood products or reversal agents may not be necessary for an acute overdose of rivaroxaban in uncomplicated pediatric patients.

KEYWORDS intentional overdose, adolescent, poison control center

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260. Envenomation by the Mexican Beaded Lizard (Heloderma horridum)

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Introduction: The Heloderma spp., or beaded lizards, are a genus of venomous lizards found in semi-arid climates of the western hemisphere. They are carnivorous and oophagic lizards characterized by osteoderms and bead-like scales which give the lizards their characteristic skin texture. Their venom glands run along the length of each mandible. The venom of Heloderma spp. is a complex mixture of toxins most notably containing kallikrein-like serine proteases and phospholipase A2 enzymes. The venom is excreted onto grooved fangs and administered via a chewing action. While envenomation by Heloderma suspectum (Gila monster) is well described in the medical literature, published information on envenomation by other members of the Heloderma genus is lacking. We present an unusual case of envenomation by Heloderma horridum (Mexican beaded lizard).
Case: We present the case of a 68 year old man with a history of asymptomatic right bundle branch block who was envenomated by a captive 21 year old Heloderma horridum measuring 78 cm in total length with a body mass of 1817 g. The lizard was being held by the patient when it was able to bite a small fold of skin on the patient's non-dominant hand. It estimated that the lizard was able to bite down with a 3-4 tooth segment (6-8 total) adjacent to the venom gland and was attached for 10 seconds before the hand was ripped away. The patient secured the lizard, cleaned the wound, and took a dose of ibuprofen for the developing pain. About 30 minutes after the bite, he began to feel light-headed. He sat down subsequently syncopized while seated. He briefly regained conscious, again syncopized, regained consciousness again, and syncopized a third time. Emergency services were called and he was found awake, diaphoretic, and hypotensive with a blood pressure of 80's/50's with a heart rate in the 40's. He was transported to the emergency department and given intravenous fluids. On arrival to the emergency department, his symptoms were improved and his vital signs had normalized. He noted a severe sharp, burning pain at the site of the bite which subsided within 3 hours of the bite. A complete blood count, complete metabolic panel, troponin, and creatine kinase were unremarkable. An EKG showed a right bundle branch block. An x-ray of the hand showed some subcutaneous air and no retained foreign body. Given the patient's significant initial symptoms, he was hospitalized for observation overnight. He was prescribed a short course of prophylactic antibiotics and discharged home the next day. Over the next 2 days post-discharge, he developed some edema, dull pain, and tenderness in the hand which persisted for approximately 1 week before ultimately fully recovering.

Discussion: Heloderma horridum envenomation is rare; we present a case with unusually detailed pre- and post-hospital information available. Treatment focuses on removal of the lizard and management based on the literature available for treatment of Horridum suspectum envenomation. Treatment focuses on management of potential complications such as pain, angioedema or anaphylaxis, hypotension, retained tooth, and systemic venom effects.

KEYWORDS Heloderma, Beaded lizard, Toxinology

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261. Toxicology Telemedicine Consultation For COVID-19 Related Iatrogenic Withdrawal Syndromes

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Background: Iatrogenic withdrawal syndromes have been described in intubated intensive care unit (ICU) patients who receive sedatives for prolonged periods. Factors that have been linked to increased risk for iatrogenic withdrawal syndromes include higher opioid doses, longer duration of sedation with benzodiazepines, propofol, and opioids, use of neuromuscular blockade, longer duration of ventilation, and presence of acute respiratory distress syndrome (ARDS). The coronavirus disease of 2019 (COVID-19) pandemic has resulted in an increasing number of patients with ARDS requiring prolonged ventilation and sedation, putting them at risk for iatrogenic withdrawal syndromes. Use of methadone to treat iatrogenic dependence has been previously described, but similar use of buprenorphine, and telemedicine consultation of toxicologists for this indication has not. Our tertiary care center expanded its ICU capacity, continued to accept transfers during the pandemic, and saw high volumes of intubated COVID-19 patients. In March 2020, a Toxicology and Addiction Medicine consultation service at this center began receiving consults for iatrogenic dependence and withdrawal in patients who did not have a history of preexisting substance dependence.
Methods: Retrospective Chart Review.
Results: To date, the service has consulted on 37 cases of iatrogenic dependence in COVID-19 patients, 25 males and 12 females, with a median age of 58 years old. Methadone was used primarily to facilitate weaning of continuous opioids in patients who were still receiving high doses of opioids. Buprenorphine was used primarily for patients who were experiencing withdrawal, pain, or agitation after opioids had been discontinued. Additional adjuncts utilized included as-needed benzodiazepines, scheduled benzodiazepine tapers, scheduled clonidine, and scheduled and as-needed antipsychotics. Due to personal protective equipment preservation and infection control considerations, these consults were done via telemedicine consultation with the medical team based on information from the electronic medical record, medication administration record, and information obtained from the care team. Twenty-three patients (median age 58) were treated with methadone; of those patients, 17 were successfully weaned off of continuous sedation and 6 patients died. Nine patients (median age 55) were successfully weaned off of continuous sedation using buprenorphine. Five patients were determined not to qualify for either treatment due to contraindications or lack of dependence. One patient was determined to primarily be experiencing benzodiazepine dependence and was treated with phenobarbital. Further characterization of patients' treatment courses and demographics will be reported.
Conclusions: Intubated patients with COVID-19 are at risk for iatrogenic withdrawal syndromes. Toxicologists consulting via telemedicine can effectively direct specialized treatment for these patients.

KEYWORDS Withdrawal, COVID-19, Telemedicine

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262. Methadone Protocol Use for Iatrogenic Withdrawal Syndromes in COVID-19

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Background: Iatrogenic withdrawal syndromes have been described in intubated intensive care unit (ICU) patients who receive sedatives for prolonged periods. The coronavirus disease of 2019 (COVID-19) pandemic has resulted in an increasing number of patients with ARDS requiring prolonged ventilation and sedation, putting them at risk for iatrogenic withdrawal syndromes. Use of methadone to treat iatrogenic dependence has been previously described in both adult and pediatric patients, but, outside of research studies, protocolization of methadone use for adult patients with iatrogenic opioid dependence is not well described. Methadone has a prolonged half life and variable pharmacodynamics and pharmacokinetics which make its use by inexperienced clinicians challenging. Methadone use in intubated patients can decrease length of ventilation by allowing more rapid tapering of continuous sedation. In March 2020 a Toxicology and Addiction Medicine consultation service at a tertiary care center began receiving consults for iatrogenic dependence and withdrawal in patients with no history of preexisting substance dependence. A protocol and order set were developed to standardize the use of methadone for intubated patients with iatrogenic opioid dependence due to sedation who are progressing to extubation. The protocol's goal was to replace high dose continuous opioid infusions with methadone and as-needed IV push opioids. Inclusion criteria include improving respiratory and medical status, opioid infusion for >5 days, and current dose of 100 mcg/hr fentanyl or 1.5 mg/hr hydromorphone or equivalent. If patients meet inclusion criteria, methadone is started at 10-15 mg every 6 hours in addition to an as-needed IV push opioids. After 24 hours the soft maximum rate on their continuous opioid infusion begins being decreased by 25%-50% of initial infusion rate daily. This change allows the infusion rate to be increased above the soft maximum but requires an order to do so. To ensure safety, orders are placed for daily QTc monitoring and consultation with Addiction Medicine/Toxicology or Palliative Care for monitoring of methadone appropriateness. To date, this protocol has been used 37 times. Further characterization of order set use will be reported.
Case Reports:
Examples of protocol use include: a 60 year old man receiving propofol infusion, as-needed lorazepam, dexmedetomidine infusion, and fentanyl infusion at 300 mcg per hour with difficult to control agitation when his sedation was decreased. He was started on methadone 10 mg every 6 hours. Over the next 3 days he was successfully titrated off of continuous sedation, and over the following 2 days he was rapidly tapered off of methadone with assistance from Addiction Medicine/Toxicology consultation. This contrasts with a similar case of a 63 year old man who had been intubated for 9 days on fentanyl up to 300 mcg/hr in addition to dexmedetomidine infusion and as-needed lorazepam. The patient received methadone 10mg q6 and was rapidly tapered off of his opioid infusions over two days, but continued

on methadone and subsequently suffered prolonged sedation which may have delayed extubation.
Conclusion: Protocolization of methadone use with specialist consultation for iatrogenic opioid dependence may increase safe use of methadone for this purpose.

KEYWORDS Methadone, Withdrawal, COVID-19

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263. Buprenorphine Use for Iatrogenic Withdrawal Syndromes Related to COVID 19

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Background: Buprenorphine is available in several formulations including sublingual (SL) for opioid use disorder (OUD) and intravenous (IV) for pain. To avoid precipitating withdrawal, buprenorphine induction frequently occurs after a prolonged period of abstinence from full agonist opioids. Microdosing methods have been described for starting low dose buprenorphine shortly after discontinuing, or while patients still receive, full agonist opioids. The buprenorphine dose is then uptitrated in a way that does not precipitate withdrawal. While IV buprenorphine is an option in some induction protocols, it's use for microdosing and its use in iatrogenic withdrawal syndromes (IWS) has not been thoroughly described. With increasing prevalence of prolonged intubation during the Corona Virus Disease of 2019 (COVID-19) pandemic, the Toxicology/Addiction Medicine Consult service at our tertiary medical center has increased our use of buprenorphine for IWS. We report a representative case series to discuss the use of buprenorphine in intubated patients with and without OUD .
Case Reports:
OUD patient on buprenorphine with COVID-19: A 70 year old man with OUD on 10 mg SL buprenorphine daily presented with COVID-19 requiring intubation. Buprenorphine was initially held and a fentanyl infusion was briefly used. Fentanyl was discontinued and buprenorphine 0.3 mg IV every 4 hrs prn pain was added prior to SL buprenorphine being reordered. The patient had multiple extubations with reintubation before being discharged after tracheostomy on SL buprenorphine 8 mg twice daily. Sedation regimens included buprenorphine 2-4 mg SL every 6 hours and IV 0.3 mg every 4 hours prn pain with dexmedetomidine and propofol infusions and buprenorphine 2 mg every 6 hours with hydromorphone, midazolam, and dexmedetomidine infusions. Adequate sedation was achieved with all of these sedation regimens.
Non-OUD COVID-19 patient with iatrogenic dependence: A 64 year old woman with no history of OUD presented with COVID-19 and was intubated and treated with multiple sedatives and opioids for 21 days. Continuous opioids were discontinued but the patient had increasing agitation requiring intermittent doses of IV hydromorphone and lorazepam and continuous dexmedetomidine. Following our typical approach, the team was advised to avoid full agonist opioids for 4 hours before buprenorphine 0.3 mg IV every 4 hrs was started and her agitation improved. The standing buprenorphine dose was titrated to address her pain and agitation which were well controlled with buprenorphine, dexmedetomidine, and quetiapine. She required tracheostomy and her buprenorphine was transitioned to prn before discontinuation without incident prior to discharge.
Case Discussion: While buprenorphine microdosing can be done with small SL doses, we have found it easier to titrate dosing and administer IV to patients who cannot cooperate with SL dosing. The rapid onset of the IV formulation can also be useful for analgesia for patients regardless of previous buprenorphine treatment. We have also successfully used buprenorphine in a similar fashion for patients who were recently extubated and experiencing IWS.
Conclusion: Buprenorphine in SL or IV formulations can facilitate sedation, analgesia, and treatment of both preexisting and iatrogenic opioid dependence and withdrawal in critically ill patients.

KEYWORDS Buprenorphine, Withdrawal, COVID-19

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264. Naloxone for Opioid Overdose 101 Online Training

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Background: The Utah Poison Control Center (UPCC) with the Utah Department of Health (UDOH) Violence and Injury Prevention Program developed a short 20 minute naloxone e-Learning training program for public safety/first responders and general public. The purpose of the web based training is to decrease opioid overdose deaths by training laypersons how to use naloxone.
Methods: The UPCC team created an initial storyboard for the naloxone training. A diverse advisory board was assembled from the community (Police, Fire/EMS, clinical pharmacist and public health) to assist in development and provide feedback throughout the project. The advisory board finalized objectives, made sure key content was covered in plain language and tailored the information to be applicable for both lay public and law enforcement audiences. In addition to the development of the "Naloxone for Opioid Overdose 101" online training, naloxone administration demonstration videos (with closed captioning) were created by the UPCC and embedded in the training via YouTube. The four videos give instructions on use of 4 forms of naloxone: Narcan® nasal spray, intramuscular injectable, nasal atomizer and EVZIO® auto injector.
A pilot test was completed with individuals from the general public, law enforcement, UPCC naloxone advisory board, members of the Utah Coalition for Opioid Overdose Prevention (UCOOP) Harm Reduction subgroup and other subject matter experts. Pilot feedback was reviewed and changes made to improve and finalize the training.
The training went live June 10, 2019 on the UDOH website naloxone.utah.gov/n-training and was advertised throughout the state. UDOH website has no user login or tracking to reduce any perceived barriers the general public may associate with naloxone training. Nationally, the training was listed on the Public Health Foundations learning network TRAIN (train.org). Beginning March 12, 2020 the training also became available on the Utah Department of Public Safety, Peace Officer Standards & Training (POST) learning management system (LMS) directly for law enforcement personnel across Utah. Upon completion of the training, learners receive a certificate of completion and are directed to a short optional assessment survey.
Results: As of April 30, 2020 optional survey data show 442 individuals inside Utah and 417 individuals outside Utah took the training, and represent diverse roles (Table 1). Total data shows 844 out of 859 (98%) feel more confident administering naloxone in the event of an overdose after completing the "Naloxone for Opioid Overdose 101" training. The POST LMS reports 373 public safety officers have completed the training between March 12 -

Table 1(#264). Survey Question: What group best describes your role with opioid overdose response?.

	Utah		Outside Utah		Total	
	#	%	#	%	#	%
Law enforcement	169	38.24%	36	8.63%	**205**	**23.86%**
Health care professional (pharmacist, nurse, doctor, etc.)	22	4.98%	146	35.01%	**168**	**19.56%**
General public/layperson	58	13.12%	37	8.87%	**95**	**11.06%**
Public health worker	23	5.20%	50	11.99%	**73**	**8.50%**
Other: (please specify)	38	8.60%	34	8.15%	**72**	**8.38%**
Substance use or mental health services provider	51	11.54%	15	3.60%	**66**	**7.68%**
Social service	55	12.44%	8	1.92%	**63**	**7.33%**
Emergency medical service (EMS)	5	1.13%	49	11.75%	**54**	**6.29%**
Local health department	15	3.39%	26	6.24%	**41**	**4.77%**
Fire department	1	0.23%	13	3.12%	**14**	**1.63%**
Opioid treatment provider (OTP)	5	1.13%	3	0.72%	**8**	**0.93%**
Total	**442**	**100.00%**	**417**	**100.00%**	**859**	**100.00%**

April 30, 2020 and a portion of those are included in the 859 surveys. The UDOH naloxone training website has counted 2,052 page views, illustrating that the survey has only been completed by a portion of individuals who have taken the training.
Conclusion: The "Naloxone for Opioid Overdose 101" training is broadly accessible to the public and public safety/first responders. The internet-based training is available for free around-the-clock. The optional survey suggest the vast majority (98%) of learners feel more prepared to administer naloxone after completing the online training.

KEYWORDS naloxone, overdose, training

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265. Traffic Fatalities Before and After Legalization of Adult-Use Cannabis

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Background: Over the last decade, 11 states have progressed to legalization of cannabis for adult use ("recreational use"), allowing sales through local dispensaries. The effects of legalization on traffic safety, including rates of motor vehicle collisions and associated morbidity and mortality, have not been well characterized. We sought to determine whether opening of adult-use cannabis dispensaries is associated with a change in rates of fatal motor vehicle collisions.
Methods: This is a retrospective study utilizing publicly available data sets from the National Highway Transportation Safety Administration (NHTSA) Fatality Analysis Reporting System (FARS). The Fatality and Injury Reporting System Tool (FIRST) was used to query FARS for fatal motor vehicle collisions in each state where cannabis had been legalized and for which there were at least 24 months of traffic fatality data available prior to and following the opening of that state's first recreational marijuana dispensary. At the time this study was performed, the NHTSA databases reported traffic fatality data through December 2018; thus, only four of eleven states in which cannabis was legalized met the second criteria – Washington (opened July 2014), Colorado (opened January 2014), Oregon (opened October 2015), and Alaska (opened October 2016).
Search results were filtered by "Fatal Motor Vehicle Crashes," "State," and "Year," and aggregated as monthly totals. For each state, the monthly traffic fatalities for the 24-48 months after marijuana legalization (48 months in Colorado and Washington, 36 months in Oregon, and 24 months in Alaska) were compared to the monthly traffic fatalities in the preceding 24-48 months as a historical control. An unpaired t-test was used to determine whether there was a significant difference between number of fatal crashes before and after the opening of adult-use cannabis dispensaries in each state.
Results: Three states demonstrated a statistically significant increase ($p < .05$) in traffic fatalities by month following the opening of recreational marijuana dispensaries: Colorado +9.000 (p=.0002; 95% CI 4.364-13.64), Washington +5.813 (p=.0035; 95% CI 1.963-9.662), and Oregon +7.556 (p=.0001; 95% CI 3.830-11.28). Alaska did not demonstrate a statistically significant change at +0.5417 (p=.4245; 95% CI -0.8115-1.895).
Conclusions: This retrospective analysis demonstrates a statistically significant increase in monthly traffic fatalities following the opening of cannabis dispensaries for adult use in three of four states examined. These compelling results may be associated with more drivers operating motor vehicles under the influence of cannabis. Unfortunately, limitations in the FARS dataset do not allow us to calculate crash risk after drug use. Further study is needed to estimate traffic safety risk associated with cannabis control regulations.
Limitations include an inability to determine the number of crashes known or suspected to involve cannabis, ethanol, or other drugs; exclusion of non-fatal crashes; and lack of comparison to nationwide traffic fatality trends. Future work should include a more detailed examination of both fatal and non-fatal crash data (particularly whether cannabis, ethanol, or other psychoactive drugs were involved), as well as comparison to overall trends in traffic fatalities, such as in bordering states where cannabis for adult use remains illegal.

KEYWORDS Cannabis, Traffic, Fatality

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266. Calls to Toxicology Back-up at a Regional Poison Center, 2012-2019

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Background or objectives: There has been a decline in the number of calls to regional poison centers since 2008. Some have proposed that this is offset by a rising number of intentional overdoses and complex cases that strain poison center resources. The number of calls referred to or from a healthcare facility (HCF) are sometimes considered to be a surrogate marker of these complicated cases. Most calls to poison centers are handled by Specialists in Poison Information (SPIs), however complex cases may prompt SPIs to seek consultation with a medical toxicologist. The objective of this study was to determine if back-

Table 1(#266). Total calls, calls referred to or from a healthcare facility (HCF), and consultations to toxicologists, 2012-2019.

Year	2012	2013	2014	2015	2016	2017	2018	2019
Total Calls to Poison Center	74723	73156	74084	74557	74074	73179	72480	75037
Calls referred to or from HCF	18037	18650	19189	20157	20621	20968	21079	22975
Consult to ≥1 Toxicologist	5167	4749	4642	4619	4559	4472	5052	4308
Consult to ≥2 Toxicologists	434	445	440	464	606	640	665	570

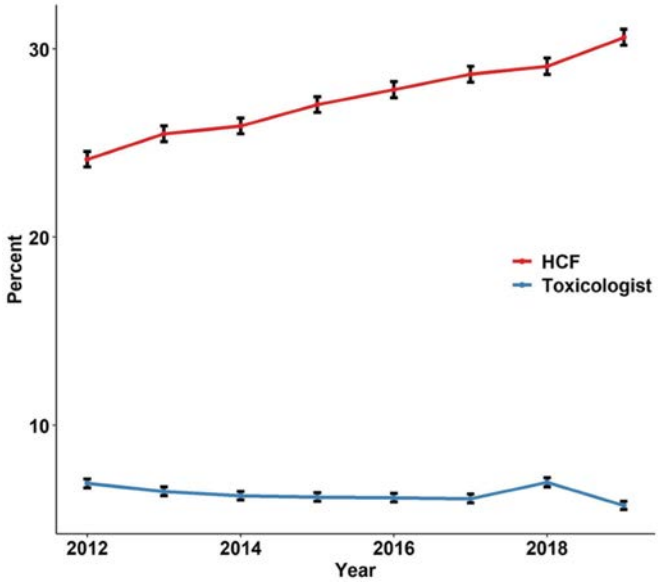

Figure 1(#266). Calls referred to or from a healthcare facility (HCF) and consultations to toxicologists, as a percentage of all poison center calls, 2012-2019.

up toxicologist consultations are increasing at a similar rate to calls referred to or from HCFs.

Methods: This is a single-center, retrospective analysis of poison center cases from 2012-2019. Cases were reviewed to determine if a medical toxicologist was consulted and if calls were referred to or managed in a HCF. Logistic and ordinal regression analyses were conducted to determine if calls referred to or from a HCF, or back-up toxicologist consultations are increasing. Analyses were performed using R v3.5.1.

Results: There were a total of 591,290 calls during the study period, with an annual mean of 73,911 calls (Table 1). Of these, 161,676 calls were referred to or from a HCF, with an annual mean of 20,209. The percentage of calls that are referred to or from a HCF increased from 2012 to 2019 (OR =1.045, 99% CI: 1.041 - 1.048, $p < .001$, Figure 1). During the study period 37,568 calls involved consultation with a toxicologist (annual mean 4,696). Calls to at least one back-up toxicologist fell from 5,167 in 2012 to 4,308 in 2019. Between 2012 to 2019 the percentage of calls involving at least one toxicologist decreased (OR =0.988, 99% CI: 0.982 - 0.994, $p < .001$).

Conclusions: The number of calls to this poison center referred to or from a HCF have significantly increased from 2012 to 2019. During this time period consultations with one or more toxicologists decreased. There is a negative correlation between the number of calls referred to or from a HCF and consultations with toxicologists. This is paradoxical as calls from a HCF are generally considered higher acuity, and therefore more likely to require consultation with a medical toxicologist. There are several possible explanations for this finding, including an increase in cases referred to a HCF by SPIs prior to consulting a toxicologist, but without a change in the underlying complexity of cases. These findings could also suggest an increasing number of low-acuity calls from HCFs, increased comfort amongst providers in managing the poisoned patient, or an increase in hospital-based protocols requiring contact with a poison center for poisoned patients. Further data extrapolation and analyses are required to explore these hypotheses.

KEYWORDS Operations, Consults, Call volume

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267. Characteristics and Trends in Lacrimator Exposures Reported to the National Poison Data System, United States, January 1, 2000-December 31, 2019

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Introduction: Tear gas (Chloroacetophenone [CN], O-Chlorobenzylidene Malonitrile [CS]) and pepper sprays (Oleoresin capsicum [OC]) are lacrimators used for riot and crowd control activities by law enforcement worldwide. With recent global protests, concern has been raised regarding the incidence and proper use of these agents. Tear gas is considered a non-lethal agent, however in certain scenarios there have been reports of serious health consequences including pulmonary edema and death. The National Poison Data System (NPDS) contains de-identified data on chemical exposures and management of calls received by all 55 US poison centers. We report characteristics and trends of exposures to lacrimators found in NPDS from the last 20 years.

Methods: We queried NPDS for human exposure call data for January 1, 2000-December 31, 2019 using the generic category codes for "lacrimators". Calls reporting animal exposure, information calls, and non-confirmed exposures where excluded. We conducted descriptive analyses of exposure data by year, age, chemical substance, intentionality, medical outcome, and exposure scenario.

Results: There were 102,359 exposures during the study period, with a mean of 4,963 per year. The year with the most exposures was 2001 with 7,098 and the year with the least number of exposures was 2019 with 3,126. From 2000 to 2019 there has been a general annual decline in exposures with a 52.6% decrease between the two years. Of exposures reporting age (n = 70,455), children (age 6-12) comprised 25.2% (n = 17,793), adolescents (age 13-19) comprised 26.2% (n = 18,470), and adults

(age 20-59) comprised 44.7% (n = 31,527). In 2000, children comprised 26% of exposures whereas in 2019 children comprised 32%. Exposure to OC was the most common (75.3%, n = 77,121) followed by CN (18.8%, n = 19,270), Other/Unknown (4.8%, n = 4,921), and CS (1.0%, n = 1,047). Exposures were reported as unintentional (77%, n = 78,944), intentional (18%, n = 78,944) and other/unknown (4.3%, n = 4,437).
The medical outcomes of all exposures showed 45.9% (n = 46,867) had minor effects, 41.8% (n = 42,807) were not followed (judged to be nontoxic or minimal effects), 4.6% (n = 4,747) had moderate effects, 0.07% (n = 72) had major effects, 3.3% (n = 3,358) had no effect, and 4.1% (n = 4,220) were unrelated or unable to follow. Of cases that reported an exposure scenario (n = 6,039), 22.4% (n = 1,352) of exposures were in "poorly ventilated areas", 8.2% (n = 498) involved product "stored within sight of child", 5.6% (n = 336) involved a "child or pet accessed product", and 5.5% (n = 335) were in "child caused exposure."
Conclusion: From January 1, 2000 to December 31, 2019 there were over a hundred thousand reported lacrimator exposures called to poison centers with a large proportion of exposures in children and adolescents.
We could not find information whether these exposures were related to their use as crowd control measures in NPDS, however the majority were reported as unintentional and likely accidental. While overall number of exposures have decreased over the past 20 years the proportion of exposures to children have increased. Of the calls reporting exposures scenarios, a large number involved exposures in a poorly ventilated areas and exposures involving children, suggesting that education is needed regarding appropriate use and storage of these chemicals to avoid dangerous exposures.

KEYWORDS Lacrimators, Tear Gas, Riot Control Agents

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268. Rabies vaccine adverse events reported to the Food and Drug Administration

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Background: Rabies is a zoonotic disease caused by a virus. All mammals, including humans, are susceptible to rabies infection, commonly transmitted through a bite or wound contact with saliva from an infected animal. Once clinical signs develop, the disease is almost inevitably fatal. Rabies can be prevented through the administration of a rabies vaccine prior to exposure or prior to the onset of clinical signs. However, the rabies vaccine itself can cause adverse events. The objective of this study was to describe human rabies vaccine adverse events reported to the United States (US) Food and Drug Administration (FDA).
Methods: Data were obtained from the Vaccine Adverse Event Reporting System (VAERS), a national database that contains reports of adverse events following vaccination. Reports are coded using the Medical Dictionary for Regulatory Activities (MedDRA), a validated, internationally standardized medical terminology. VAERS public data for the years 1991-2018 were downloaded and searched for all records that included a rabies vaccine. The distribution of rabies vaccine adverse events was determined for various factors related to patient demographics, circumstances of the exposure, symptoms, and outcome.
Results: A total of 3,246 rabies vaccine adverse events were identified; 880 (27.1%) were reported during 1991-1997, 906 (27.9%) during 1998-2004, 768 (23.7%) during 2005-2011, and 692 (21.3%) during 2012-2018. The seasonal number of adverse events was 543 (16.7%) during December-February, 839 (25.8%) March-May, 1,088 (33.5%) June-August, and 776 (23.9%) September-November. Of the 2,902 cases where the state was known, the most commonly reported states were 335 (11.5%) New York, 213 (7.3%) Texas, 213 (7.3%) Virginia, 187 (6.4%) California, 137 (4.7%) Florida, and 122 (4.2%) Pennsylvania. The most commonly reported vaccines were Imovax® (n = 1,818, 56.0%) and Rabavert® (n= 1,059, 32.6%). Of the 3,040 patients with a known age, 198 (6.5%) were 0-9 years, 298 (9.8%) 10-19 years, 912 (30.0%) 20-29 years, 667 (21.9%) 30-39 years, 511 (16.8%) 40-49 years, 288 (9.5%) 50-59 years, and 166 (5.5%) 60 years or older; the mean age was 32.8 years (range 0-90 years). Of the 3,167 patients with a known sex, 2,050 (64.7%) were female and 1,117 (35.3%) male. The adverse event resulted in an emergency department or doctor visit in 1,061 (32.7%) cases. The adverse event was classified as serious in 217 (6.7%) cases: 167 (5.1%) hospitalized, 9 (0.3%) prolonged hospitalization, 40 (1.2%) life threatening illness, 40 (1.2%) disability, and 8 (0.2%) death. The most commonly reported adverse events were 610 (18.8%) pyrexia, 608 (18.7%), headache, 534 (16.5%) nausea, 386 (11.9%) urticaria, 378 (11.6%) myalgia, 363 (11.2%) pruritis, 340 (10.5%) dizziness, 331 (10.2%) pain, 288 (8.9%) arthralgia, 264 (8.1%) vomiting, 256 (7.9%) rash, and 248 (7.6%) paraesthesia.
Conclusion: The annual number of rabies adverse events declined over the study period. The highest proportion of adverse events were reported during the summer. Most of the patients were female and age 20-39 years. Although almost one-third of the adverse events resulted in an emergency department or doctor visit, there were few serious adverse events.

KEYWORDS Rabies vaccine, Imovax®, Rabavert®

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269. Ingestion of Melia azedarach by dogs

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Melia azedarach (commonly known as chinaberry, pride of India, white cedar, umbrella tree) is a deciduous tree in the Meliaceae (Mahogany) family. The tree can reach 15 m (50 feet). Its leaves are 0.3-0.6 m (one-two feet) in length and dark green (turning yellow-gold in autumn). M. azedarach produces purple, five-petaled flowers in spring. The fruit of M. azedarach are hard, yellow to yellow-green, 1-2 cm (0.4-0.8 inches) in diameter berries or drupes on stalks. Native to Southeast Asia and northern Australia, M. azedarach was introduced to the United States in the mid-1800s as an ornamental tree. M. azedarach contains multiple limonoid tetranotriterpenes such as meliatoxins A1, A2, and A3. These chemicals are found in highest concentrations in the fruit but also can be found in the bark, leaves, and flowers. Signs observed after M. azedarach ingestion by dogs include vomiting, hypersalivation, diarrhea, abdominal pain, ataxia, seizures, tachycardia, bradycardia, cyanosis, and dyspnea. Death may occur. Symptoms may occur within 1-8 hours after ingestion. The objective of this study was to describe M. azedarach ingestions by dogs reported to poison centers.
Methods: Cases were M. azedarach ingestions by dogs reported to a large, statewide poison center network during 2000-2018. The distribution of cases was determined for various factors.
Results: A total of 49 ingestions of M. azedarach by dogs during 2000-2018 were reported. The part of the plant involved in these ingestions was reported to be the berry in 34 (69%) of the cases and unknown in the rest. Twenty-one (43%) of the ingestions occurred from March through May. Thirty-five (71%) of the ingestions were reported have occurred at the home of the dog's owner or caregiver, one (2%) at another residence, and 13 (27%)

at an unknown location. Initial signs were reported in 22 (45%) of the cases. The most commonly reported initial signs were gastrointestinal (n = 13, 27%), particularly vomiting (n = 9, 18%), and neurological (n = 11, 22%), particularly drowsiness or lethargy (n = 5, 10%) and seizures (n = 4, 8%). Other signs reported in <3 cases were hypotension, abdominal pain, weight loss, blood in rectum, diarrhea, nausea, ataxia, confusion, muscle weakness, paralysis, nystagmus, and renal failure. Twenty-four (49%) of the ingestions were not considered to be potentially serious, and 21 (43%) were considered to be potentially serious. For the remaining four (8%) cases, the ingestion was considered to have probably not been responsible for the reported signs. No deaths were reported, but the poison center network generally does not follow animal exposures to determine final outcome. Nine (18%) of the dogs were already at a veterinary facility when the poison center was contacted, 25 (51%) were referred to a veterinary facility by the poison center, and 15 (31%) had an unknown management site.

Conclusion: These cases add to the published information on canine ingestion of M. azedarach and demonstrate that ingestion of M. azedarach by dogs might result in gastrointestinal & neurological signs and have serious outcomes. Pet owners and caregivers should take care when dogs are in environments where M. azedarach is found.

KEYWORDS Chinaberry, Melia azedarach, Canine

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270. Pepper spray exposures treated at emergency departments

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Background: Pepper sprays are used as a nonlethal method to disable individuals and repel animals by causing intense irritation of mucous membranes of the eyes, nose, throat, and skin. The products can also be inhaled or ingested. Pepper sprays contain oleoresin capsicum extracted from pepper plants of the genus Capsicum. Pepper spray exposure causes almost immediate onset of symptoms, although most resolve 30-60 minutes after exposure. Dermal effects include burning pain, tingling, erythema, edema, and pruritus. Ocular exposure may result in redness, swelling, severe burning pain, tingling, and lacrimation. Inhalation of pepper spray may lead to cough, choking, burning pain, sneezing, and nasal discharge. In a portion of pepper spray exposures, serious medical outcomes that require medical evaluation may occur. The objective of this study was to describe pepper spray exposures managed at United States (US) emergency departments (EDs).

Methods: Data were obtained from the National Electronic Injury Surveillance System (NEISS), a database of consumer product-related injuries collected from the EDs of approximately 100 US hospitals. Pepper spray exposures reported during 2001-2018 were defined as those records assigned product code 1619 (Personal Protection Devices) where the record narrative also mentioned "pepper spray." The distribution of estimated pepper spray exposures was determined for various factors related to patient demographics, injury circumstances, diagnosis, and disposition.

Results: A total of 876 pepper spray exposures were identified, resulting in a national estimate of 26,191 exposures or a mean of 1,455 exposures per year. The patient age distribution was 3,555 (13.6%) 0-5 years, 5,023 (19.2%) 6-12 years, 5,235 (20.0%) 13-19 years, 5,343 (20.4%) 20-29 years, 2,895 (19.3%) 30-39 years, and 4,139 (15.8%) 40 years or older; 14,991 (57.2%) of the patients were male and 11,200 (42.8%) female. Of the 19,794 patients with a reported race, 9,904 (50.0%) were white, 6,141 (31.0%) were African-American, 113 (0.6%) were Asian, and 3,636 (18.4%) other. Of the 15,013 exposures with a reported location, 7,221 (48.1%) occurred at home, 3,475 (23.1%) other public property, 3,166 (21.1%) school, 613 (4.1%) street or highway, and 539 (3.6%) place of recreation or sports. The diagnoses were dermatitis or conjunctivitis (n = 6,112, 23.3%), poisoning (n = 5,791, 22.1%), chemical burns (n = 5,375, 20.5%), and other/not stated (n = 8,913, 34.0%). The affected body part was the head or neck (n = 15,860, 60.6%) [including the eyeball (n = 11,461, 43.8%) and face (n = 3,497, 13.4%)], other/unknown (n = 8,268, 31.6%), upper extremity (n = 877, 3.3%), trunk (n = 747, 2.9%), and lower extremity (n = 438, 1.7%). The disposition was 24,218 (92.5%) treated or examined and released, 171 (0.7%) treated and transferred to another hospital, 278 (1.1%) treated and admitted for hospitalization, 1,517 (5.8%) left without being seen, and 6 (0.0%) not recorded.

Conclusion: Pepper spray exposures treated in EDs most often involved patients who were children and male. The exposures most often occurred at home followed by public property and school. The majority of the exposures affected the head and neck, particularly the eye and face. Most patients were treated or evaluated and released from the ED.

KEYWORDS Pepper spray, Capsicum, Emergency Departments

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271. Continuing low prevalence of analytically confirmed exposure to fentanyl and fentanyl analogues in patents with suspected severe heroin toxicity in the United Kingdom

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Objective: Fentanyl and fentanyl analogues are potent synthetic opioids that have been used to fortify heroin product in the United States and Canada and have been identified analytically in samples from a high proportion of patients with severe or fatal apparent heroin toxicity in those countries. Because of this, the United Kingdom (UK) Identification Of Novel psychoActive substances (IONA) study has been recording clinical features and analytical findings for patients presenting with severe toxicity after suspected use of non-pharmaceutical opioids. This report describes the frequency of detection of fentanyl and its analogues in samples from patients presenting with suspected heroin toxicity.

Methods: With ethical approval, patients (≥16y) presenting to 29 participating hospitals with severe acute toxicity (according to specific definitions) after suspected heroin exposure were recruited with informed consent. Those lacking capacity were included with the agreement of an appropriate relative/representative but were able to confirm/refuse their own consent on recovery. Clinical features were recorded using a structured data collection sheet. Blood and urine samples were collected and analysed by liquid chromatography-tandem mass spectrometry.

Results: Clinical and analytical data are available for 77 patients (median age 38 years, range 18-62, 71% male) presenting

between January 2017 and March 2020. Of these, 61 (79.2%) were recorded as treated with naloxone, 19 (24.7%) were admitted to an intensive care unit, 10 (13.0%) were intubated and ventilated and 2 (2.6%) died. One or more conventional opioids were detected in samples from 61 (79.2%) participants including methadone (46.8%), morphine or conjugates (46.8%), codeine (33.8%), noscapine (29.9%), dihydrocodeine (15.6%), papervarine (13%), tramadol (13%), and hydrocodone (13.0%). Fentanyl or its metabolite norfentanyl were detected in samples from 3 (3.9%) participants, one in each year 2017, 2018 and 2019. None gave a history of fentanyl use, including diversion of patches. Alfentanil was detected in samples from 1 patient after administration in hospital for intubation. Although the analytical method used had very high sensitivity for detecting other fentanyl analogues, none were detected in this cohort. Multiple drug exposures were common, with other substances found including benzodiazepines (76.6%), cocaine or metabolites (61%) pregabalin (27.3%) and new psychoactive substances (15.6%), especially synthetic cannabinoids (11.7%).
Conclusions: Fentanyl and its analogues have been infrequently involved in episodes of suspected severe heroin toxicity in the UK over the period 2015-2019. However, there is an ongoing risk that fentanyl or its analogues may appear in the local heroin supply and continuing vigilance remains essential.

KEYWORDS Heroin, Fentanyl, Drugs of misuse

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272. Large Drip Coffee, Add Ricin and Cyanide? Castor Bean and Cherry Pit Brewed With Coffee in Self-harm Attempt

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Background: Ricin, the highly toxic protein derived from *Ricinus communis,* manifests toxicity through disruption of protein synthesis. Castor beans contain 1-5% ricin and ingestion results in varied degrees of toxicity depending on preparation and dose. We report a case of sequential ricin and amygdalin ingestion after brewing castor beans and cherry pits with coffee in a self-harm attempt.
Case: A 36-year-old male reported that he ground 50 castor beans in his coffee grinder, mixed the product with coffee grounds, brewed two large cups of ricin-coffee mixture, and drank them. He woke up the following day without ill effects so he repeated the procedure with 80 cherry pits in attempt at a cyanide ingestion. A few hours later he called 911, wanting to be in a hospital for his anticipated death. Hazmat arrived and field testing was positive for ricin in the old coffee grounds. He received 50g of activated charcoal, underwent hazmat decontamination, and arrived in the emergency department asymptomatic. His vital signs were BP 126/94mmHg, pulse 87, respiratory rate 16, SpO2 96% on room air. Initial labs were notable for a WBC of 12.84 K/cu mm and a lactate of 3.8mmol/L, which decreased to 1.3mmol/L with intravenous fluids. He was admitted for monitoring. On Hospital day(HD) #2 his lactate rose again to 2.7mmol/L, and later dropped to 1.5mmol/L with fluids. His WBC peaked at 18.43 K/cu mm on HD #2 and fell to 12.83 K/ cu mm on HD #3. He was subsequently medically cleared and transferred to inpatient psychiatry.
We sent blood and urine samples to the state health department for analysis. Urine at 37.5 hours and 64 hours after ingestion showed ricinine concentrations of 291ug/L and 144ug/L, respectively. Blood was tested for cyanide on samples from HD # 1, 2, and 3. All samples had detected cyanide that was below the level of quantification (<25ug/L).
Discussion: Case reports of castor bean and cherry pit ingestion indicate that mastication is necessary for release and absorption of ricin and amygdalin, respectively. Ricin can be inactivated via heating at 80 degrees Celsius for 10 minutes. Amygdalin is degraded via isomerization when boiled for 3 minutes. Most coffee makers reach temperatures higher than 80 degrees Celsius for brewing purposes, but brewing usually lasts less than 10 minutes. We hypothesize that the patient's preparation process of grinding, heating, brewing, and pouring castor beans and cherry pits through a coffee filter may have decreased the total amount of metabolically active ricin and amygdalin in the ingested products, thus attenuating a potentially toxic exposure.
Conclusion: We report a case of attempted ricin and amygdalin ingestion via extraction through a coffee brewer. This was a non-fatal ingestion.

KEYWORDS ricin, amygdalin, self-harm

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273. Methotrexate Ingestion Calls to a regional poison center from 2009-2019

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Background: Methotrexate is a chemotherapeutic and immunomodulating drug with an uncommon dosing schedule. Its once weekly dosing can result in errors as most medications are taken daily. However, given methotrexate's inhibition of DNA, RNA, and protein synthesis, this dosing error can prove clinically significant and sometimes fatal. We sought to describe methotrexate ingestions reported to a poison center from 2009-2019.
Methods: Our poison center database was queried for any ingestion from 2009-2019 that included "methotrexate" in the substances field. Exclusion criteria were non-human cases or information calls. Data was abstracted from the poison center chart by two trained abstractors and entered into a standardized Excel spreadsheet. If there was uncertainty regarding the case classification, cases were discussed jointly by the abstractors until a classification was agreed upon.
Results: We identified 146 methotrexate cases from 2009-2019. Of all methotrexate cases with an indication listed (99%; 144/146), 50.7% (73/144) of patients were taking methotrexate for rheumatoid arthritis. Other indications for methotrexate prescriptions included psoriasis (17.8%) and Chron disease (6.8%). After excluding 37 calls for non-human exposures, the final sample included 109 cases. Twenty-three cases were intentional ingestions and 86 were unintentional ingestions. Of those unintentional ingestions, 40 were ingestion of a second dose, 27 were ingestion of multiple additional doses and 12 were ingestion of a single incorrect dose. 41 patients (38 %) were hospitalized. There were 2 deaths, and both deaths occurred in patients who were using methotrexate at the incorrect frequency. One of the deaths was methotrexate administered daily for a week by a nurse at a care facility, the other death was self-administered methotrexate. More than 50% of hospitalized patients received leucovorin treatment.
Discussion: We identified 86 cases of unintentional mis-dosing associated with methotrexate. The majority of these patients were treated for rheumatoid arthritis. Over one-third (38%) of unintentional mis-dosing were admitted to the hospital and

treated with leucovorin. Two deaths were associated with mistaking the once-weekly methotrexate dose for once-daily dosing.
This study has several limitations. Poison center calls are not a complete account of cases in the catchment area. A number of cases that were deemed low risk were closed after the initial call and there is no follow up data available. Additionally, unless patients disclose their medication administration errors, they may present with sequelae of methotrexate toxicity complicated by systemic infection or kidney injury. Thus, methotrexate toxicity may be missed or underreported.
Conclusion: Methotrexate is a medication with an uncommon dosing frequency, which can result in administration errors. Consequences of inappropriately taking methotrexate can result in death. Clinicians should be aware of methotrexate's potential dangers and should thoroughly educate patients and providers administering medications on methotrexate's dosing frequency. Future efforts towards a safer medication packaging system may be beneficial.

KEYWORDS methotrexate, dosing

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274. A Case Report of Serum Sickness following Administration of Crotalidae Immune F(ab')2 (Equine) to a Child

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Background: Since the introduction of Fab antivenom (FabAV) for treatment of North American rattlesnake envenomation, serum sickness reactions are uncommon. A clinical trial comparing FabAV with the newer F(ab')2 antivenom (Fab2AV) showed a similarly low rate of serum sickness. The first year of commercial use of Fab2AV was in 2019 and serum sickness has not been reported outside the clinical trial. We describe a pediatric case of serum sickness following administration of Fab2AV for a rattlesnake envenomation.
Case Discussion: A healthy 7-year-old boy presented to an emergency department (ED) three hours after a right leg rattlesnake bite by a native species in Arizona while hiking. Realization of envenomation was delayed and occurred only after gradual onset of pain and swelling. Once recognized, a tourniquet was applied to the leg and was not removed until arrival in the ED 20 minutes later. Physical examination revealed puncture wounds on the posterior calf, proximal swelling to 20cm from the punctures, and right inguinal tenderness. Labs showed a leukocyte count of 18.2K/μL, hemoglobin 12.0gm/dL, platelet count 22K/μL and fibrinogen 179mg/dL. The leg was placed in a posterior noncompressive splint, and 10 vials of Fab2AV were administered. Over the subsequent three days, an additional 28 vials of antivenom were administered for swelling, pain, hypofibrinogenemia and thrombocytopenia. He had no immediate reactions to antivenom administration. His hemoglobin dropped to 7.4gm/dL but slowly improved without transfusion. He was discharged home on hospital day 5. Two days later, his mother noted decreased activity and appetite, irritability, and development of a pruritic erythematous maculopapular rash centered around the envenomation site that progressed proximally onto his abdomen over the next several hours. Additionally, he had an elevated temperature of 99.7°F while receiving acetaminophen 320mg every 6 hours. Retrospective review of labs revealed eosinophil count 0.40K/μL on admission which increased to 0.82K/μL at hospital discharge and 0.89K/μL the following day. Prednisolone 0.5mg/kg twice daily, diphenhydramine 12.5mg every 6 hours, and acetaminophen 320mg every 6 hours were prescribed for five days for presumed serum sickness. Labs drawn three days into therapy showed eosinophil count 0.01K/uL. The rash had nearly receded on the final day of therapy. No rebound of symptoms occurred after completion of the 5-day course of therapy.
Discussion: Serum sickness is a type III hypersensitivity reaction due to immune complex deposition that is an anticipated delayed reaction after administration of heterologous serum proteins. The whole IgG antivenom used to treat North American rattlesnake envenomation prior to 2000 frequently led to severe serum sickness that was treated with 2-3 weeks of corticosteroids. The currently available Fab and Fab2 antivenoms have a low risk of serum sickness, but providers should continue to counsel patients to monitor for such reactions after discharge. A shorter course of corticosteroids was effective in this patient.
Conclusions: Assessment for serum sickness should continue to be part of post-discharge care for all rattlesnake envenomation patients who have received antivenom.

KEYWORDS Serum sickness, Antivenom, Rattlesnake envenomation

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275. Chloroquine Toxicity and Death After Ingestion of an Aquarium Disinfectant to Prevent Infection by Novel Coronavirus

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Background: Amid the global pandemic caused by the novel coronavirus (SARS-CoV-2), sources have speculated on the potential benefits of medications for the treatment of SARS-CoV-2. Chloroquine, an antimalarial and antirheumatic medication, has garnered attention, and its purported benefits are widely publicized. We report two cases of chloroquine toxicity following ingestion of an aquarium disinfectant containing 98% weight by weight chloroquine phosphate in a misguided attempt to prevent SARS-CoV-2 infection.
Case Report: A husband and wife each consumed a teaspoonful of disinfectant containing chloroquine phosphate dissolved in liquid. Within 20 minutes of ingestion, the wife developed nausea, vomiting and diarrhea, while the husband experienced only diarrhea. The wife called emergency medical services 90 minutes after the ingestion when the husband developed dyspnea. On arrival to the emergency department (ED), he was unresponsive, seized and developed pulseless cardiac arrest. Cardiopulmonary resuscitation was performed, and sodium bicarbonate, atropine, epinephrine, magnesium sulfate, calcium chloride, diazepam and dextrose were administered (doses unknown). Despite initial return of spontaneous circulation, recurrent cardiac arrest resulted in his death approximately 3.5 hours after the ingestion. Continuous cardiac monitoring during resuscitation revealed a wide QRS >160ms with multiple rhythms, including idioventricular tachycardia, ventricular tachycardia with bigeminy and sinus tachycardia. On arrival to the same ED, the wife was awake and alert but with protracted nausea and vomiting. Her initial electrocardiogram (ECG) showed sinus tachycardia with QRS 108ms and QTc 456ms. She received magnesium sulfate 2g and sodium bicarbonate 50mEq bolus followed by an infusion (150mEq in dextrose 5% water at 175mL/h). She was transferred to the Medical Toxicology service at a tertiary referral hospital where ECG revealed QRS 99ms and QTc 558ms. Potassium chloride 60mEq and magnesium sulfate 2g were administered, and sodium bicarbonate infusion was continued. Although the wife did not experience hemodynamic instability, she had more

severe gastrointestinal toxicity than her husband. Her symptoms gradually resolved over 48 hours. ECG at the time of discharge revealed QRS 99ms and QTc 433ms. Serum chloroquine concentration in the husband obtained 5.5 hours after ingestion was 6200ng/mL; concentration in the wife obtained 14.5 hours after ingestion was 440ng/mL. Discussion: Chloroquine toxicity is potentially fatal and characterized by nausea, vomiting, diarrhea and precipitous decompensation due to cardiovascular collapse. These cases highlight the differences in serum concentrations and subsequent outcomes. The peak concentration of chloroquine occurs within 1-2 hours of ingestion, and the half-life is 3-5 days. Considering these pharmacokinetic properties, it is unlikely that the 9-hour disparity between the patients' levels explains the difference in clinical outcomes. It is possible that the wife's more severe gastrointestinal toxicity lead to decreased absorption of chloroquine and therefore less systemic toxicity. **Conclusion:** During this time of heightened public fear, it is important to effectively communicate the dangers of using unproven therapies in a self-directed manner to prevent or treat infection by SARS-CoV-2. Use of self-administered substances, whether prescribed medications or household products, can result in morbidity and fatality. Accurate guidance is crucial for public safety during these challenging times.

KEYWORDS Chloroquine toxicity, SARS-CoV-2, Unintentional overdose

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276. Time to Burn? Characteristics of Hydroxocobalamin Administration in an Academic Medical Center

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Background: Hydroxocobalamin is indicated for known or suspected cyanide poisoning and its package insert states it should be given "without delay" if there is clinical suspicion of cyanide poisoning. We sought to evaluate the time to administration and clinical characteristics when hydroxocobalamin was administered in a quaternary care academic medical center with an American College of Surgeons level one trauma and burn center.
Methods: This study was Institutional Review Board approved. The electronic medical record was queried for patient encounters where hydroxocobalamin was administered from January 1, 2007 to December 31, 2018. The charts were extracted by the authors after 2 rounds of training to ensure inter-rater reliability. Data points collected included age, sex, time of hospital arrival, admitting diagnosis, medical outcome, discharge date, hospital length of stay (LOS), time of hydroxocobalamin administration, hydroxocobalamin dose, use of amyl nitrate or sodium thiosulfate or hyperbaric oxygen therapy, initial carboxyhemoglobin level, initial and maximum cyanide, methemoglobin, and serum lactate levels, initial and nadir pH, lowest serum bicarbonate level, initial heart rate (HR), and initial and lowest systolic blood pressure (SBP). All data were entered into an Excel spread sheet (Microsoft Corp, Redmond, WA).
Results: 56 cases were identified. 93% (n = 52) were adults (age ≥19). The average age of the adults was 52 years (SD 14.6) and of the children was 3.5 years (SD 3.9). 70% of cases were male (n = 39). 46% (n = 26) of cases were transfers. The average hospital LOS was 282 hours (SD 423) and 89% (n = 50) were admitted to a critical care unit. Burn (n = 16), inhalation injury (n = 15) and smoke inhalation (n = 7) accounted for 68% of the admitting diagnoses. The average time from hospital arrival to hydroxocobalamin administration was 819 minutes (SD 3985). This includes one case where hydroxocobalamin was given 29955 minutes after admission for suspected cyanide toxicity from nitroprusside. When this case was excluded, the subsequent average time for hydroxocobalamin administration was 289 minutes (SD 407). In 21% (n = 12) of cases, hydroxocobalamin was given within 60 minutes of hospital arrival. In all cases, 5 grams of hydroxocobalamin was given. 20% (n = 11) of patients died. Time to hydroxocobalamin administration was significantly longer in death cases (538 mins, SD 769) versus those that survived to discharge (227 mins, SD 226) . Cyanide levels were obtained in 17 cases (30%) and were measurable in 9 cases (including 3 deaths), but none had levels considered toxic (average 0.084 mcg/mL, SD 0.051). Amyl nitrate and sodium thiosulfate were never given. Hyperbaric oxygen therapy was used 4 times. Four patients (7%) presented with an initial SBP below 90 mmHg and all survived. Table 1 lists the mean values for other clinical and laboratory characteristics stratified by all cases, cases that survived, and those that died.
Conclusions: In this study, there was a significant delay in the administration of hydroxocobalamin after hospital arrival. Cases that resulted in death had significantly longer times to hydroxocobalamin administration. Further studies are warranted to validate this single center study and identify reasons for this delay in hydroxocobalamin administration.

Table 1(#276). Mean Clinical and Lab Characteristics of Patients Receiving Hydroxocobalamin.

Clinical or Lab Characteristic (mean)	All Cases (n = 56)	Survived (n = 45)	Death (n = 11)
Initial Carboxyhemoglobin % [SD]	7.9% [9.1]	8.1 [9.5]	7.0 [6.6]
Initial pH [SD]	7.31 [0.125]	7.35 [0.1]	7.18 [0.13]
Lowest pH [SD]	7.24 [0.15]	7.28 [0.1]	7.06 [[0.19]
Initial Serum Lactate (mg/dL) [SD]	4.3 [3.8]	3.6 [3.5]	6.7 [4.0]
Maximum Serum Lactate (mg/dL) [SD]	6.1 [6.3]	4.0 [3.4]	13.1 [8.7]
Minimum Serum Bicarbonate (mEq/L) [SD]	17.7 [4.6]	18.8 [4.2]	13 [3.5]
Initial Methemoglobin % [SD]	2.7 [3.5]	0.56 [0.32]	5.3 [4]
Maximum Methemoglobin % [SD]	3.2 [4.2]	0.56 [0.32]	6.6 [4.6]
Initial Heart Rate [SD]	101 [25]	100 [25]	107 [26]
Initial SBP (mmHg) [SD]	140 [32]	139 [32]	144 [34]
Lowest SBP (mmHg) [SD]	87 [20]	89 [18]	77 [25]

KEYWORDS Hydroxocobalamin, Cyanide, Methemoglobin

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277. Critical Antidotes for Critical Access Hospitals

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Background: There are approximately 1350 Centers for Medicare & Medicaid Services designated critical access hospitals (CAH) in the United States. These small hospitals play a vital role in the care of poisoned patients in rural areas, yet prior studies have demonstrated that smaller hospital size is associated with stocking deficiencies of certain antidotes. We sought to evaluate the antidote stocking levels of a midwestern state's critical access hospitals.
Methods: This was an instituional revew board exempt study. A survey was sent to the pharmacy director of every hospital in a Midwestern state with 83 designated critical access hospitals. The survey asked whether 45 different antidotes were stocked. This survey did not ask how frequently the antidotes were used. If the survey was not returned within 1 month, follow up calls were conducted till the survey was completed and returned. All data was entered into Microsoft Excel (Microsoft, Redmond, WA) for analysis.

Table 1(#277). Antidotes Included on Survey.

Antidotes on Survey	
AC w/o sorbitol	Glucarpidase
AC WITH sorbitol	Hydroxocobalamin
Crotalidae Immune F(ab')2 (Equine)	Idarucizumab
Andexanet Alfa	L-Carnitine
Atropine	Methylene blue
Antivenin (Latrodectus mactans) (Equine)	NAC (any form)
Calcium Chloride	Naloxone
Calcium Gluconate	Octreotide
CaNaEDTA	Prothrombin Complex Concentrate
Crotalidae polyvalent immune fab [Ovine]	Physostigmine
Cyanide Antidote Kit (Lily kit)	Potassium Iodide
Cyproheptadine	Pralidoxime
Dantrolene	Protamine
DFO	Prussian Blue
Diazepam/ Lorezepam	Pyridoxine
Digoxin Immune Fab (Ovine)	Sodium Acetate
Dimercaprol (BAL)	Sodium Bicarbonate
Ethanol	Sodium Nitrite
Flumazenil	Sodium Thiosulfate
Folic Acid	Succimer
Folinic Acid	Uridine Triacetate
Fomepizole	Vitamin K
Glucagon	

Results: One hundred thirty-three hospitals completed the survey for a 100% respondent rate. Of these, 83 were designated critical access hospitals. The CAH had an average of 24.5 inpatient beds (SD 15) and 3.8 ED beds (SD 3.25). Table 1 lists the antidotes which were surveyed. CAHs had a mean of 16.8 (SD 4.8) of the 45 antidotes in stock. The highest number of antidotes stocked was 30 by 2 CAH facilities. There was no single antidote which was stocked by all CAHs. Naloxone had the highest reported stocking rate (99%, n = 82) followed by glucagon, sodium bicarbonate and vitamin K at 98%, (n = 81). Succimer, uridine triacetate, glucarpidase, and Prussian blue were not stocked by any CAH. Several antidotes which are generally considered time sensitive were found to be rarely stocked, including potassium idodide (5%, n = 4), fomepizole (7.2%, n = 6), hydroxocobalamin (10%, n = 8), prothrombin complex concentrate (13%, N =11), and digoxin immune fab (28%, n = 23). Chelators as a group were rarely stocked. Only 4 CAH (5%) reported stocking either CaNaEDTA, succimer, dimercaprol or Prussian blue. There was no correlation between number of antidotes stocked and number of inpatient beds (correlation coefficient 0.1) or emergency department beds (correlation coefficient 0.22).
Conclusions: Critical access hospitals reported low overall levels of antidote stocking. In particular, several time sensitive antidotes and chelators were rarely, if ever, reported as being stocked. Further studies are warranted to investigate the reasons behind the low antidote stocking rates and develop contingency plans for poisoned patients who may present to these hospitals.

KEYWORDS Poison Control Center, Antidote, Critical Access Hospital
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278. Characteristics and Trends of Adult Crotalid Bites Reported to the NPDS from 2006 to 2018

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Background: Bites from North American crotalids (rattlesnakes, copperheads and cottonmouths) have the potential to cause significant morbidity and occasional mortality. However, they remain low incidence events with unique geographical distributions. We sought to examine the geographical trends and clinical characteristics of adult crotalid bites reported to the National Poison Data System (NPDS) from 2006 to 2018.
Methods: The NPDS was queried for all snake bites reported between January 1, 2006 to December 31, 2018. Cases involving patients 19 years of age or greater and coded as involving copperheads, rattlesnakes, cottonmouths or unknown crotalids were included for analysis. All data in the NPDS data set was analyzed using IBM SPSS Statistics for Mac, Version 25.0 (Armonk, NY).
Results: 36835 cases were reported. The average age was 45.4 years (SD 15.5) and 69% (n = 25588) were male. There was a low of 2259 cases reported in 2006 and a high of 3217 cases reported in 2016. Overall, reported crotalid bites increased by 2.7% per year over the study period. Copperheads comprised 44.8% (n = 16508) of total cases, while rattlesnakes made up 30.9% (n = 11400) of cases. Cottonmouths accounted for 6.5% (n = 2396) of cases. Copperhead cases increased by 5.9% per year but rattlesnake cases demonstrated a mild decline of 0.8% per year over the study period. Every state reported at least one case during the study period. Texas reported the most total cases with 5945 followed by North Carolina with 4203. North Carolina and Oklahoma saw the greatest percent increase over the study period with 8.2% and 7.9% yearly increases, respectively. Texas reported the most copperhead bites with 3308 and California reported the most rattlesnake bites with 2500 case over the study period. Florida had the most cottonmouth bites with 702. Moderate medical outcomes occurred in 52% (n = 19154) of cases and increased 4.7% per year while major outcomes occurred in 4.7% (n= 1710) of cases and remained relatively unchanged (0.48% annual increase) during the study period. In total, 49% (n = 17963) were admitted to a critical care unit during the study period and this increased at 1.2% per year. Thirty-two deaths were reported with a high of 6 in 2015. Sixty-two percent (n = 20) of all deaths were in rattlesnake cases. Antivenom was given in 49% (n = 17969) of total cases and its use increased by 3.06% per year over study period. Copperhead bite cases demonstrated a 6.9% per year increase in antivenom use during the study period.
Conclusions: Adult crotalid snake bites reported to the NPDS have increased over the last 13 years driven largely by increases in reported copperhead bites. North Carolina saw the largest increase over the study period. Antivenom used also increased over the time period driven largely by its use in copperhead cases. However, major medical outcomes and deaths remained stable and rare.

KEYWORDS Copperhead, Rattlesnake, Antivenom
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279. Characteristics and Trends of Pediatric Crotalid Bites Reported to the NPDS from 2006 to 2018

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Background: Bites from North American crotalids (rattlesnakes, copperheads and cottonmouths) have the potential to cause significant morbidity and occasional mortality, particularly in pediatric patients. However, they remain low incidence events with unique geographical distributions. We sought to examine the geographical and clinical characteristics and trends in pediatric crotalid bites reported to the National Poison Data System (NPDS) from 2006 to 2018.
Methods: The NPDS was queried for all snake bites reported between January 1, 2006 to December 31, 2018. Cases involving patients less than 19 years of age and coded as involving

copperheads, rattlesnakes, cottonmouths or unknown crotalid were included for analysis. All data in the NPDS was analyzed using IBM SPSS Statistics for Mac, Version 25.0 (Armonk, NY).
Results: 10118 cases were reported. The average age was years 11 years (SD 5.4) and 64% (n = 6463) were male. There was a low of 657 cases reported in 2006 and a high of 924 cases reported in 2012. Overall, there was a 1.2% per year increase in reported cases. Every state reported at least one case during the study period except Alaska, Vermont, and Maine. Texas reported the most total cases with 1608 followed by North Carolina with 1183. Virginia and North Carolina saw the greatest percent increase over the study period with 9.8% and 6.0% yearly increases, respectively. Over the study period Texas reported the most copperhead bites with 885 while California reported the most rattlesnake bites with 537. Florida reported the most cottonmouth bites with 148. Forty-five percent (n = 4538) of all bites were reportedly due to copperheads which increased on average of 3.3% a year. In contrast, rattlesnake cases accounted for 26% (n = 2582) of total cases and remained essentially stable during the study period (0.09% yearly increase). Cottonmouth bites accounted for 5.8% (n = 591) of all cases. Moderate medical outcomes occurred in 58% (n = 5905) of cases and increased by 3.2% per year while major outcomes were seen in 4% of cases and declined by 1.5% per year over the study period. 5745 case (57%) were admitted to critical care units during the study period and increased by 1.7% per year. A total of 2 deaths were reported over the 13 years, both in rattlesnake cases. Antivenom was given in 53% (n = 5368) of cases and its use peaked in 2012 when it was administered in 523 cases. Overall use of antivenom increased slightly over the study period with 1.6% per year increase seen.
Conclusions: Pediatric crotalid snake bites reported to the NPDS demonstrated a slight increase over the last 13 years driven primarily by increase in copperhead cases. Virginia saw the greatest increase in cases over the study period. Antivenom use increased slightly, however, major medical outcomes and death remained rare over the study period.

KEYWORDS Copperhead, Rattlesnake, Antivenom

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280. To Give Antivenom or Not? Comparison Of Adult Crotalid Bites Reported to NPDS That Did Or Did Not Receive Antivenom Therapy

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Background: Crotalid bites are rare but have potential to cause significant morbidity and even mortality. Appropriate antivenom therapy is considered an effective treatment but controversy remains as to who should receive it. We sought to compare characteristics of adult crotalid bites reported to the National Poison Data System (NPDS) that did or did not receive antivenom therapy.
Methods: The NPDS was queried for all snake bites reported between January 1, 2006 to December 31, 2018. Cases involving patients 19 years of age or greater and coded as involving copperheads, rattlesnakes, cottonmouths or unknown crotalids were included for analysis. All data in the NPDS data set was analyzed using IBM SPSS Statistics for Mac, Version 25.0 (Armonk, NY).
Results: 36835 case were identified. Of these, 17969 were documented as receiving antivenom and 18866 did not receive antivenom. Table 1 compares trends and key characteristics between these two groups. While the number of cases receiving antivenom increased over the study period, there was only 2 years where more than 50% of cases received antivenom (2012, 2016). In total, cases involving rattlesnake bites accounted for most antivenom administration (n = 7009) followed by copperheads with 6755 cases. Cases involving rattlesnake bites were the most likely to receive antivenom with 61% (7009/11400) cases being documented as receiving antivenom. Only rattlesnake bites received antivenom therapy more than 50% of the time. Copperhead cases were the least likely to receive antivenom therapy, with 41% (6755/16508) of cases being treated. Overall, cases that received antivenom were statistically more likely to report moderate or major medical outcomes and to be admitted to a critical care unit (p = 0.0001). However, there was no statistically significant difference in the rates of deaths between the two groups.
Conclusions: While use of antivenom increased over the study period, more than half of crotalid bites reported to the NPDS did not receive antivenom therapy. Cases that did receive antivenom therapy were associated with higher rates of moderate and major outcomes. There was no difference in deaths reported between those that received antivenom and those that did not. Further studies are warranted to determine clinical factors associated with adult crotalid bites receiving or not receiving antivenom therapy.

Table 1(#280). Trend and Clinical Characteristics of Adult Crotalid Bites Reported to NPDS.

	Received Antivenom	Did NOT Receive Antivenom
Total Number of Cases	17969	18866
Age (SD) for all years	46.05(16.71)	43.05(18.24)
% Male	69.40%	69.50%
% Copperhead (n)	38% (6755)	51% (9753)
% Rattlesnake (n)	39% (7009)	23% (4391)
% Cottonmouth (n)	6% (999)	7% (1397)
% Other Crotalid (n)	18% (3206)	18% (3325)
Number in 2006	1052	1207
Number in 2007	1163	1257
Number in 2008	1123	1309
Number in 2009	1340	1279
Number in 2010	1312	1322
Number in 2011	1365	1466
Number in 2012	1548	1534
Number in 2013	1460	1532
Number in 2014	1477	1528
Number in 2015	1396	1558
Number in 2016	1611	1606
Number in 2017	1565	1643
Number in 2018	1557	1625
Minor outcome	2778	7300
Moderate outcome	12829	6325
Major outcome	1530	180
Admitted to critical care	9204	1117
Deaths	18	14
Received vasopressors	247	15
Received antibiotics	2068	1795

KEYWORDS Rattlesnake, Copperhead, Antivenom

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281. Antivenom for the Kids? Comparison Of Pediatric Crotalid Bites Reported to NPDS That Did Or Did Not Receive Antivenom Therapy

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Background: Crotalid bites are rare but have potential to cause significant morbidity and occasional mortality. Timely antivenom

Table 1(#281). Trend and Clinical Characteristics of Pediatric Crotalid Bites Reported to NPDS.

	Received Antivenom	No Antivenom
Total Number of Cases	5368	4750
Age (SD) for all years	10.55 (5.21)	11.87 (5.26)
% Male	63.50%	64.30%
% Copperhead (n)	40% (2149)	50% (2389)
% Rattlesnake (n)	32% (1717)	18% (865)
% Cottonmouth (n)	5% (282)	6% (309)
% Other Crotalid (n)	23% (1220)	25% (1187)
Number in 2006	333	324
Number in 2007	370	345
Number in 2008	363	315
Number in 2009	446	337
Number in 2010	421	372
Number in 2011	405	392
Number in 2012	523	401
Number in 2013	479	370
Number in 2014	433	379
Number in 2015	388	335
Number in 2016	408	407
Number in 2017	387	416
Number in 2018	412	357
Minor outcome	791	1966
Moderate outcome	4088	1817
Major outcome	369	41
Admitted to critical care	2493	349
Deaths	2	0
Received vasopressors	31	0
Received antibiotics	489	381

therapy is an effective treatment for these envenomations but controversy remains as to who should receive it. We sought to compare trends and characteristics of pediatric crotalid bites reported to the National Poison Data System (NPDS) that did or did not receive antivenom therapy.

Methods: The NPDS was queried for all snake bites reported between January 1, 2006 to December 31, 2018. Cases involving patients less than 19 years of age and coded as involving copperheads, rattlesnakes, cottonmouths or unknown crotalid were included for analysis. All data in the NPDS data search was analyzed using IBM SPSS Statistics for Mac, Version 25.0 (Armonk, NY).

Results: 10118 case were identified. Of these, 5368 were documented as receiving antivenom and 4750 did not receive antivenom. Table 1 compares trends and key characteristics between these two groups. The number of cases receiving antivenom increased over the study period and there was only 1 year when less than 50% of cases received antivenom (2017). Cases involving rattlesnake bites were the most likely to receive antivenom with 1717 of 2582 cases (66%) being treated. In both copperhead and cottonmouth cases antivenom therapy was given less than 50% of the time (47% and 48%, respectively). Copperhead bites, however, were the most common snake bite to be treated with antivenom (40% of all antivenom cases, $n = 2149$). Cases that received antivenom were statistically more likely to report moderate or major medical outcomes and to be admitted to a critical care unit ($p = 0.0001$). The only 2 deaths reported occurred in the antivenom treated group.

Conclusions: Use of antivenom in pediatric crotalid bites reported to the NPDS increased over the study period and more than half of these pediatric crotalid bites received antivenom therapy. Cases that did receive antivenom therapy were associated with higher rates of moderate and major outcomes. Further studies are warranted to determine clinical factors associated with receiving or not receiving antivenom therapy.

KEYWORDS Copperhead, Rattlesnake, Antivenom

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282. K2 for Kids: Unintentional ingestion of 5F-MDMB-PICA in a 12-month-old

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Background: Synthetic cannabinoid receptor agonists (SCRA) are a diverse group of chemicals with variable potency. While their use as substances of abuse is well known, there remains limited published literature on unintentional exposures to SCRAs. Methyl N-{[1-(5-fluoropentyl)-1H-indol-3-yl]carbonyl}-3-methylvalinate (5F-MDMB-PICA) is a recently described SCRA with limited human toxicity data. We present an analytically confirmed case of a 12-month-old girl exposed to 5F-MDMB-PICA.

Case Report: A 12-month-old, 12 kilogram girl with no medical history was brought to the emergency department by her mother for altered mental status. Approximately 1 hour prior, the mother found the child with "glassy eyes" and inability to stand. She had several episodes of emesis and then became "limp." The mother suspected an ingestion of a friend's "bead of K2" though no ingestion was witnessed. Initial vital signs were a pulse of 121 beats per minute, blood pressure 115/57 mmHg, respiratory rate of 36 breaths per minute with a 99% O2 saturation on room air and a temperature of 36.7° C. Her exam was significant for drowsiness though she would temporarily wake to painful stimuli. She had "constricted pupils" but no nystagmus. She would not stand. Laboratory testing was significant only for an elevated glucose of 119 mg/dL on a complete chemistry panel and a pH of 7.28 with a 54 mmHg pCO2 on a venous blood gas. A targeted rapid gas chromatography/mass spectrometry (GC/MS) urine drug screen was negative. She received 250 ml of normal saline intravenously and was admitted for observation. Her blood pressure (132/77 mmHg) and heart rate (194 bpm) peaked approximately 4 hours after arrival and slowly returned to normal. She received maintenance intravenous fluids but no medications. She remained altered with periods of agitation and somnolence which resolved approximately 20 hours after presentation. She was discharged with child protective services after a 32-hour hospital stay. Serum from presentation was tested by liquid chromatography quadrupole-time-of-flight mass spectrometry (LC-QTOF/MS) (LC 1260-QTOF 6550, Agilent Technologies, Santa Clara, CA) and detected 5F-MDMB-PICA at 4.6 ng/mL. No other substances were detected.

Case Discussion: 5F-MDMB-PICA is structurally similar to 5F-MDMB-PINACA but the indazole has been replaced by an indole group. It is believed to be a potent agonist at the cannabinoid-1 receptor. 5F-MDMB-PICA was first identified in 2017 and has since gained popularity. In 2018 it was listed as a Drug Enforcement Agency Schedule I controlled substance in the Unites States. There remains little published literature on its human toxicity and this is the first report of an analytically confirmed unintentional pediatric exposure. Like other reports of unintentional SCRAs exposures, 5F-MDMB-PICA appears to be a potent substance capable of causing significant central nervous system effects in a pediatric patient. And, similar to other SCRAs, the low concentrations and volatility of 5F-MDMB-PICA may make detection by commonly used GC/MS and LC/MS/MS methods a challenge.

Conclusions: This unintentional 5F-MDMB-PICA exposure in a pediatric patient resulted in self-limited but somewhat prolonged altered mental status. Health care providers should be aware of the potential threat 5F-MDMB-PICA and other SCRAs pose to children.

KEYWORDS 5F-MDMB-PICA, Synthetic cannabinoid receptor agonists, Quadrupole-time-of-flight mass spectrometry

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283. Pressure necrosis from kratom overdose requiring fasciotomy

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Background: It is well known the use of kratom *Mitragyna speciosa*, can result in seizures, opioid toxidrome, hepatotoxicity, and infectious complications from bacterial contamination. Reports of morbidity and mortality associated with kratom may be confounded by co-ingestants. We report a case of severe rhabdomyolysis and pressure necrosis leading to fasciotomy in a patient who was using kratom.
Case Report: A 31 year-old male with a history of sporadic cocaine insufflation, ethanol and prescription opioid and heroin use, presented to the ED of a local hospital after loss of consciousness for 6 hours. He admitted smoking kratom prior to the event. When he awoke he noticed severe left leg pain and edema. In the ED he was found to have rhabdomyolysis (CPK >18,000 IU/L), acute renal injury (creatinine 2.9 mg/dL), hyperkalemia (5.7 mEq/L), hypocalcemia (5.5 mEq/L) liver injury (AST 1,144 IU/L, ALT 239 IU/L), serum lactate of 4.3 mmol/L, no ethanol was detected and the urine drug screen was negative. The initial ECG revealed peaked T waves, QRS 92 ms, QTc 442 ms. He was treated with 4L of NS and one ampule of sodium bicarbonate IV. Over the next three hours his left leg became severely enlarged and "rock hard." Pulses could not be detected and he was taken to the OR. There necrotic muscle was noted, and he received a four compartment leg fasciotomy and thigh fasciotomy. After transfer to a tetriary center, his presenting serum potassium was 5.5 mEq/L, creatinine 2.18 mg/dL, CPK, > 128,000 IU/L, serum phosphorus 5.2 mg/dL, AST 3,455 IU/L, ALT 700 IU/L, calcium 5.0 mg/dL, magnesium 1.5 mg/dL, PT 16.8 s. Because of the severe rhabdomyolysis and oliguria CRRT was required for 48 hours. All laboratory values and clinical status improved, and he was discharged 18 days later. A serum and urine sample from the first day of presentation were analyzed for mitragynine and 7-hydroxymitragynine using an UPLC-MSMS method. Both samples were positive for mitragynine and 7-hydroxymitragynine. The serum mitragynine was 5 ng/mL, and the urine mitragynine 6 ng/mL. Three hundred prescribed and OTC substances were screened by immunoassay in the urine and if positive confirmed by GCMS. This testing qualitatively revealed caffeine and venlafaxine and metabolites.
Discussion: Rhabdomyolysis is not generally associated with kratom use, but there are numerous reports of opioids and sedative-hypnotics resulting in prolonged periods of immobilization and crush injuries resulting in rhabdomyolysis. Like opioids, kratom is known to have a high affinity for the mu-opioid receptor at high doses. Venlafaxine has been reported to cause rhabdomyolysis as a component of serotonin toxicity and possibly direct muscle toxicity, but never to this degree or requiring fasciotomy. Our patient denied overdose on venlafaxine and did not have the expected clinical effects, but admitted to kratom use.
Conclusion: This case report highlights the profound sedative effect of kratom and the potential to lead to crush injuries resulting in rhabdomyolysis and compartment syndrome requiring fasciotomy.

KEYWORDS Kratom, Crush injury, Fasciotomy

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284. The Power of Engagement - tweetchats increase Altmetric-scored dissemination of promoted journal manuscripts

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Background: Many journals utilize social media to disseminate and discuss published manuscripts. In 2017 the American College of Medical Toxicology (ACMT) initiated a recurring interactive chat on Twitter, aggregated using the hashtag #firesidetox, to generate discussion on manuscripts published by the Journal of Medical Toxicology (JMT). While #firesidetox has garnered worldwide participation, it is unknown to what degree social media attention to manuscripts increases their dissemination. In this investigation, we sought to determine the impact of #firesidetox on Altmetric scores, a measure that aggregates social media, print and news media, and citations of manuscripts. We additionally sought to measure the number of times featured manuscripts were accessed.
Methods: We performed a systemic examination of consecutive manuscripts discussed in the #firesidetox tweetchat from January 1, 2017 to February 29, 2020. We gathered Altmetric scores and number of times manuscripts were accessed and compared them with all other manuscripts published in the same volume and issue. Access information was gathered through Springer Nature's JMT website. Next, we calculated a mean Altmetric score for each issue that had a featured #firesidetox manuscript, and a mean access score excluding the featured manuscript. In order to control for time exposed to readership, we compared raw Altmetrics and accesses of each featured manuscript to mean scores in the same issue.
Results: During the study period, 11 out of 77 manuscripts from 8 separate issues of the JMT were discussed during a #firesidetox tweetchat. Tweetchat featured manuscripts had a higher mean Altmetric score by 47 on the date of review (65+/-20.6 compared to 18 +/-4.8), and had 571 more accesses (1201 compared to 630) than other manuscripts published in the same issue of JMT and not discussed in a Tweetchat.
Conclusion: Manuscripts published in JMT discussed during the #firesidetox tweetchat had higher Altmetric scores and higher mean number of accesses compared to other manuscripts published within the same issue. Whether that significant finding reflects importance of topic, expertise of authors, or popularity of discussants deserves further examination. Tweetchats provide a promising method for increasing dissemination of manuscripts in the future.

KEYWORDS Twitter, Altmetric, Tweetchat

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285. Robocough Killer: Death from Ingestion of 10 Grams of Dextromethorphan

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Background: Dextromethorphan is a cough suppressant found in over 120 over-the-counter cold formulations, alone or in combination with other drugs. It is commonly abused for its euphoric effects and audiovisual hallucinations, often referred to as robo-tripping. Although dextromethorphan is structurally similar to opioids, high doses produce effects similar to ketamine and PCP. Death from dextromethorphan poisoning is rare: 11,931 cases involving dextromethorphan were reported to US Poison Centers in 2017, but no deaths were reported. We report a death from ingestion of a highly concentrated single ingredient dextromethorphan product to spotlight this product's danger for regional Poison Centers.
Case Report: A 25 year-old man presented to an emergency department reporting he drank 24 bottles of Robocough® (10.8 grams dextromethorphan hydrobromide; 450 mg/45mL bottle) in a suicide attempt. Time of ingestion was unknown, but on initial presentation he was awake and ambulating without assistance. Initial heart rate was 127 beats/minute and blood pressures were recorded in the 90s/50s mm/Hg range. Within an hour of presentation he suffered a cardiac arrest; resuscitation efforts failed. A full autopsy was not completed, but the local medical examiner documented the manner of death as suicide caused by dextromethorphan intoxication.
Case Discussion: A normal therapeutic dose of dextromethorphan is 30 mg every 6-8 hours, with a maximum dose of 120 mg per day. Doses greater than 200 mg cause euphoria and hallucinations, and doses greater than 500 mg cause dissociative sedation. Much of this dissociation is caused by dextromethorphan's major metabolite, dextrorphan, which is a potent NMDA-receptor antagonist produced via the CYP 2D6 pathway. Robocough® is a concentrated cough suppressant available online and at a small number of pharmacies. Each bottle contains 45 mL of 10 mg/mL dextromethorphan hydrobromide and includes a 30mL cup with a small delineating line near the bottom marking 3mL (see Image 1). This unique formulation is 3-10 times more concentrated than other dextromethorphan hydrobromide products. The recommended dose is 30mg/3ml, making dosing in this disproportionately large cup implausibly awkward. However, 30ml (a full cup) or even 45ml (a full bottle) would conveniently provide an ideal dose to cause euphoria. The product may be purchased in units of 5, 12, 24, 48 and 96 bottles at the retail website, www.robocough.com. Ninety-six bottles of Robocough® would provide a person with 1,440 therapeutic doses, or a minimum 360 day supply. While patient instructions do not explicitly endorse the illicit use of Robocough®, its concentrated formulation and graphics commonly associated with the illicit use of dextromethorphan strongly suggest the true intended use of this product is for the purpose of intoxication. As such, the Robocough® formulation represents a public health risk both by promulgating dextromethorphan use disorders as well as by making a concentrated drug readily available to suicidal patients.
Conclusions: Robocough® is a dangerously concentrated dextromethorphan product likely intended for abuse. Poison Centers should be aware of the high risk of accidental and intentional overdoses associated with this product, which in this case resulted in death.

KEYWORDS dextromethorphan, abuse, public health

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286. Tongue Trouble? Atypical Epinephrine Auto-Injection Tolerated by Toddler

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Background: Epinephrine auto-injectors (e.g. Epi-Pens®) are commonly prescribed to treat anaphylaxis. In 2017, there were more than 1.6 million prescriptions dispensed in the United States. In 2019, there were nearly 1,500 accidental epinephrine auto-injector exposures in children less than 6 years-of-age reported to U.S. Poison Centers, the majority of which were benign cutaneous exposures. Accidental tongue injections, however, are rare. Here, we report a case of a toddler that injected an adult-strength Epi-Pen® into his tongue.
Case Report: A 3-year-old boy placed his mother's Epi-Pen® auto-Injector 0.3mg/3ml in his mouth; it punctured his tongue and deployed. The mother reported tongue bleeding immediately after injection. He vomited within a few minutes of the exposure and had some immediate respiratory changes described by the mother as "wheezing." He was transported to the emergency department (ED) by ambulance where a physical exam revealed a puncture wound on his tongue. The child was awake and alert, breathing and talking normally. Initial vital signs were: pulse 146 beats/minute, blood pressure 119/88 mmHg, respiratory rate 19 breaths/minute. His tongue stopped bleeding, did not become notably swollen, and never showed any signs of pallor or ischemia. He was monitored in the ED for two hours, where he was able to eat and drink normally, and was discharged home without further complications. The ED staff verified that the Epi-Pen® had fully discharged its 0.3 mg contents.
Discussion: Epinephrine is a potent fast acting vasoconstrictor commonly used to counteract anaphylaxis. The half life is less than 5 minutes. Unintentional subcutaneous and intramuscular injections can (but rarely) cause local tissue ischemia. Alternatively, when systemic absorption occurs from accidental injection effects include hypertension, tachycardia, nausea, vomiting, diaphoresis, pallor, headache, anxiety and difficulty breathing. The blood supply to the human tongue is ample, making ischemic vasoconstriction unlikely. Regarding systemic absorption, venous drainage of the tongue occurs via the lingual vein, which runs along the inferior surface of the tongue. Given the length of the auto-injector needle it is unlikely that this exposure would lead to significant systemic absorption as most of the epinephrine would diffuse into local tissue, similar to most accidental auto-injector epinephrine exposures. While the child in our case experienced tachycardia and vomiting which could be due to epinephrine, these effects may also have stemmed from pain or anxiety. Wheezing would not be a typical side effect of epinephrine and is not likely explained by this exposure; the exact etiology of the symptoms described by the mother is unclear but may have been referred upper airway noise. Regardless, the child's lungs were clear in the emergency department. Ultimately in this case the local injection was well tolerated both ischemic and systemic absorption perspectives.
Conclusions: We present an accidental injection of a 0.3 mg Epi-Pen® auto-injector into the tongue of a toddler that resulted in no significant injury. More data are needed to determine if accidental tongue injections from epinephrine auto-injectors are routinely benign.

KEYWORDS epinephrine, pediatric, poison center

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287. Rethinking Home Managed Poison Center Cases: Are Follow-Up Calls Necessary?

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Background: Approximately 75% of the calls to our Regional Poison Center (RPC) are managed by Specialists in Poison Information (SPIs) outside of a health care facility, including calls from the general public seeking guidance on potentially toxic exposures. Currently, follow-up protocols exist for hydrocarbon and mushroom exposures, but it is unclear if these follow-up calls result in any change in management.
Objective: Evaluate if the follow-up protocols at our RPC for hydrocarbon and mushroom exposures result in management changes.
Methods: All home-managed hydrocarbon and mushroom exposure cases from 2019 were abstracted. These substances were chosen based on observation from SPIs and medical toxicologists that follow-up calls infrequently changed management. Variables of interest included time of exposure, time of follow-up call, substance, clinical effects, and outcome.
Results: In 2019, there were 369 total hydrocarbon exposures reported to our RPC. Excluded were hospital-based calls (n = 5, 1.4%), isolated dermal, otic, and ocular exposures (n = 82, 22.2%), unknown exposure time or time >24 hrs (n = 34, 9.2%), exposures that were referred to hospital immediately (n = 12, 3.3%), had no call back (n = 113, 30.6%), caller did NOT want call-back (n = 28, 7.6%) and calls lost to follow up (n = 24, 6.50%). The final number of exposure cases available for analysis was 71. Of those, 46 (64.8%) were male, 23 (32.4%) were female, and 2 (2.8%) were unknown sex. Most exposures were pediatric (n = 38, 53.5%). Gasoline was the most frequent hydrocarbon type reported (n = 26, 36.6%). Follow-up calls were made 59 (83.1%) times, while 12 (16.9%) exposures were called back more than 1 time. Only one case resulted in a referral to a health care facility for a persistent cough, 3 days post-exposure, which resulted in a negative work-up and lack of symptoms upon presentation to the emergency department.
In 2019, there were 73 total mushroom exposures reported to our RPC. Excluded were isolated dermal exposures (n = 4, 5.5%), unknown exposure time or time >24 hrs (n = 1, 1.4%), exposures that were referred to hospital immediately (n = 6, 8.2%), had no call back (n = 17, 23.3%), caller did NOT want call-back (n = 1, 1.4%) and calls lost to follow up (n = 14, 19.2%). The final number of exposure cases available for analysis was 30. Of those, 9 (30%) were male and 21 (70%) were female. Most exposures were pediatric (n = 26, 86.7%). Most mushroom exposures were of unknown mushroom type (n = 26, 86.7%). Follow-up calls were made 26 (86.7%) times, while 4 (13.3%) exposures were called back more than 1 time. No cases with callbacks resulted in a referral to a health care facility.
Conclusion: Hydrocarbon and mushroom exposure calls do not require follow-up calls. Seeking feedback from SPIs on anecdotal observations is a reasonable approach for targeted evaluation of poison center guidelines. Using data driven guidelines to reduce the number of unnecessary calls for SPIs handling an increasing number of more complex hospital cases is good practice.

KEYWORDS Hydrocarbon, Mushroom, Follow-up

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288. Medication adverse events involving priapism reported to the Food and Drug Administration

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Background: Priapism is a persistent, often painful, penile erection not associated with sexual stimulation that lasts more than 4 hours. The condition requires immediate medical attention to prevent long-term complications. Certain medications may increase the risk of priapism, including antipsychotics and antidepressants (e.g., risperidone, olanzapine, clozapine, chlorpromazine, quetiapine, sertraline, citalopram, escitalopram, lithium, fluoxetine, trifluoperazine, pericyazine), vasoactive erectile agents (e.g., alprostadil, papaverine), alpha-adrenergic receptor antagonists (e.g., doxazosin, tamsulosin, terazosin, prazosin), antihypertensives (e.g., hydralazine, propranolol), anticoagulants (e.g., heparin, warfarin), hormones (e.g., testosterone), phosphodiesterase type 5 inhibitors (e.g., sildenafil, tadalafil), and attention deficit hyperactivity disorder medications (e.g., methylphenidate, atomoxetine). The objective of this study was to characterize medication adverse events involving priapism reported to the United States Food and Drug Administration (FDA).
Methods: Data were obtained from the FDA Adverse Event Reporting System (FAERS), a national database that contains reports of drug and other biologic product adverse events and medication errors. Reports are coded using the Medical Dictionary for Regulatory Activities (MedDRA), a validated, internationally standardized medical terminology. The FAERS public dashboard was searched for all records added through 2019 that reported "priapism" in the Reactions text field, and the raw data for the records were downloaded. Cases initially received by the FDA during 2000-2019 and involving only a single suspect product were included in the study. Records where the patient sex was listed as "female" were excluded.
Results: A total of 1,912 medication adverse events met the study criteria. Of the 217 different suspect products reported, the most frequently reported were trazodone (n = 251, 13.1%), quetiapine (n = 154, 8.1%), sildenafil (n = 154, 8.1%), risperidone (n = 124, 6.5%), tadalafil (n = 107, 5.6%), olanzapine (n = 65, 3.4%), aripiprazole (n = 58, 3.0%), ziprasidone (n = 55, 2.9%), alprostadil (n = 53, 2.8%), and tamsulosin (n = 51, 2.7%). Of the 1,375 patients with a reported age, 20 (1.5%) were 0-5 years, 83 (6.0%) 6-12 years, 111 (8.1%) 0-19 years, 175 (12.7%) 20-29 years, 267 (19.4%) 30-39 years, 335 (24.4%) 40-49 years, 220 (16.0%) 50-59 years, 109 (7.9%) 60-69 years, 47 (3.4%) 70-79 years, and 8 (0.6%) 80 years or older; the mean age was 39.4 years (range 0-95 years). Of 1,303 cases with a reported reason for use, the most frequently reported reasons were 152 (11.7%) depression, 149 (11.4%) erectile dysfunction, 142 (10.9%) schizophrenia, 108 (8.3%) insomnia, and 81 (6.2%) bipolar disorder. The most frequently reported adverse reactions aside from priapism were 99 (5.2%) erectile dysfunction, 53 (2.8%) pain, 36 (1.9%) headache, 32 (1.7%) increased erection, 29 (1.5%) painful erection, and 29 (1.5%) penile pain. The reported outcomes were 270 (14.1%) not serious, 668 (34.9%) hospitalized, 246 (12.9%) required intervention, 124 (6.5%) disabled, 18 (0.9%) life threatening, 8 (0.4%) died, and 964 (50.4%) unspecified other outcomes.
Conclusion: The most commonly reported medications in adverse events involving priapism had been previously associated with the condition. It should be noted that the drug or other product may not have caused the reported adverse event. The adverse event may have been related to an underlying condition, another drug, or other reasons. The information in the reports has not been independently verified.

KEYWORDS Priapism, FDA, Adverse Event

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289. Tianeptine exposures reported to poison centers

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Background: Tianeptine (Coaxil®, Stablon®) is an atypical tricyclic antidepressant. Marketed in Europe, Asia, and Latin America, the United States Food and Drug Administration (FDA) has not approved tianeptine for medical use and it is an unscheduled pharmaceutical agent. At higher doses, it is reported to be a mu-receptor opioid agonist, giving it a potential abuse effect. Adverse exposures and deaths have been reported with recreational use of the drug. The objective of this study was to characterize tianeptine exposures reported to a statewide poison center network.
Methods: Cases were tianeptine exposures reported to a large, statewide poison center network during 2015-2018. Cases were identified by searching for all records with the PoisIndex code for tianeptine or mention of the drug in the Verbatim Substance text field. Exposures involving substances in addition to tianeptine and exposures not followed to a final medical outcome were included. The distribution of the cases was determined for various factors related to patient demographics, exposure circumstances, management, and outcome.
Results: A total of 18 tianeptine exposures were identified: 1 in 2015, 5 in 2016, 5 in 2017, and 7 in 2018. The mean patient age was 36 years (range 20-64 years); 14 (78%) of the patients were male and 4 (22%) female. Sixteen (89%) of the exposures occurred by ingestion alone, 1 (6%) by inhalation alone, and 1 (6%) by unknown route. Nine (50%) of the exposures were intentional abuse or misuse, 3 (17%) suspected attempted suicide, 1 (6%) therapeutic error, 1 (6%) adverse reaction, 2 (11%) withdrawal, and 2 (11%) unknown reason. Fourteen (78%) of the exposures occurred at the patient's own residence, 2 (11%) at another residence, and 2 (11%) at an unknown location. The management site was 14 (78%) already at or en route to a healthcare facility, 2 (11%) referred to a healthcare facility, and 2 (11%) managed on site. The medical outcome was 1 (6%) no effect, 1 (6%) minor effect, 9 (50%) moderate effect, 1 (6%) major effect, 2 (11%) not followed-minimal clinical effects possible, and 4 (22%) unable to follow-potentially toxic; no deaths were reported. The most common clinical effects were tachycardia (n = 7, 39%), hypertension (n = 4, 22%), and drowsiness/lethargy (n = 4, 22%). The most common treatments were intravenous fluids (n = 10, 56%), benzodiazepines (n = 5, 28%), and oxygen (n = 4, 22%).
Conclusions: Most tianeptine exposures involved patients who were male and all were adults. The majority of exposures were intentional, ingestions, and occurred at the patient's own residence. Most of the exposures were managed at a healthcare facility and resulted in serious outcomes.

KEYWORDS Tianeptine, Poison center, Coaxil

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290. Speech Disturbance in Adult Chronic Lead Poisoning-Resolution with Chelation

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Background: Speech impediments (including stuttering) have been described in children who have developed lead encephalopathy. However, stuttering and speech fluency impairment due to chronic lead exposure in an adult with resolution due to chelation has not been described. We describe such a case, treated with standard course of oral succimer.
Case Report: The patient is a 48-year-old male with a past medical history of asthma and sciatica, he was not taking any prescription medication. He presented with a five-year history of exposure to lead at the indoor gun range where he worked. Over the last five months of exposure, he developed headaches, short-term memory deficits, and paranoid ideation. His physical examination was remarkable for flat affect, slow speech pattern, and slow gait. Venous blood lead level (BLL) was 45 mcg/dl, zinc protoporphyrin level (ZPP) of 74 mcm/zpp/mol heme, and urine aminolevulinic (ALA) acid level of 21 nmol/ml (normal <15). His blood ALA, complete blood count (CBC), and urine analysis were all within normal limits. A complete neurological workup performed by a Neurologist, including two MRIs, was unremarkable.
The patient (70kg) was initially started on 700mg of succimer TID, but he was unable to tolerate this due to persistent vomiting. He then was started on succimer 500 mg TID for five days, followed by 500 mg bid for 14 days, which he was able to tolerate. This course of treatment resulted in a resolution of all symptoms and a significant improvement of BLL (6.7 mcg/dl) and ZPP (45 mcmol ZPP/mol heme) within forty days. However, four months later, his symptoms recurred with marked stuttering to the point that the patient was unable to articulate any words at all. His BLL had rebounded to 26 mcg/dl despite being off work since his initial presentation. Succimer was restarted at the same dose as his initial course, and by the time of his next follow-up appointment, all of his symptoms had resolved with a virtually clear speech pattern. His repeat BLL at that time was 5.4 mcg/dl, with a ZPP of 31 mcmol ZPP/mol heme.
Case Discussion: Stuttering is thought to be related to impairments in the frontal lobe, particularly Broca's area. It appears that chronic lead exposure may have widespread effects in these areas. Our patient did not have other speech deficits such as aphasia, or anomia. Stuttering due to lead poisoning in an adult was only described once, this was due to acute occupational exposure from sandblasting (over a 45-day period) with a BLL of 111 ug/dl. The outcome of treatment was not documented in those cases.
Conclusion: Speech disturbance in an adult patient with chronic lead exposure is not a well described clinical manifestation of toxicity. The disturbance may be responsive to chelation with succimer therapy.

KEYWORDS Lead, Stuttering, Chelation

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291. You Don't Know the Haff of It: A Family Outbreak

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Background: Haff disease is a syndrome resulting from consuming certain types of fish contaminated with an as-of-yet unidentified toxin. The syndrome, which often develops 6-21 hours after ingestion, is characterized by myalgias, rhabdomyolysis, and dark urine, but can also cause gastrointestinal distress, chest discomfort, and other symptoms. Beyond the fact that the toxin appears to be heat stable, little else is known. Buffalo fish, salmon, or crayfish are most commonly implicated. Clinicians in the emergency department (ED) are uniquely positioned to identify toxic outbreaks such as these, and can help prevent further spread through taking early action.
Case details: Three patients from one family with similar presentations were reported to the regional poison center. The two parents both had hypertension and hyperlipidemia (both taking an antihypertensive medication and a statin); their adult daughter was otherwise healthy. They had all eaten lunch consisting of buffalo fish purchased from a local grocery store. The parents

had fried their portions in oil whereas the daughter used an air fryer without oil, but all ate approximately similar sized portions. Within a few hours, they developed nausea, vomiting, shortness of breath, and myalgias. Initially, the 75-year-old father presented to the ED where he was treated symptomatically, after which he felt better and was discharged home. His wife, 69 years old, and his adult daughter, 36 years old, then presented to the same ED. Due to their complaints of muscle aches and generalized weakness, a CPK was checked and found to be elevated. The father was then called to return to the ED. Initial CPK levels were: 2,767 U/L for the mother, 1,916 U/L for the father, and 1,186 U/L for the daughter. The poison center reported the cases to the department of public health. The patients were all admitted, treated with IV fluids, and monitored for worsening rhabdomyolysis. The CPK levels for the mother, father, and daughter peaked at 19,946 U/L, 30,253 U/L, and 56,768 U/L respectively. All were discharged within a few days after symptom resolution and no change in renal function.

Case Discussion: The department of public health's response involved going to the grocery store and having the buffalo fish pulled from the stock. A public health alert was released to spread awareness within medical care settings. No further cases were reported to the poison center or the department of public health. Due to the prompt recognition by the ED physician of a cluster of cases consistent with Haff disease, local authorities were notified and involved early. Much remains unknown regarding Haff disease and it is unclear how the method of food preparation or how patient medications may relate to the severity of rhabdomyolysis or symptoms that develop.

Conclusions: The astute clinician plays an important role in early recognition of outbreaks of toxic exposures. Additionally, the roles of the regional poison center and local departments of public health in taking swift action are integral to preventing further widespread toxic exposure during outbreaks.

KEYWORDS Haff disease, Buffalo fish, Rhabdomyolysis

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292. Psychiatric Evaluation of Patients with Ecstasy Use from the Poison Control Perspective

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Background: Ecstasy, molly, and MDMA are widely used terms for 3,4 methyeledioxy-methamphetamine (MDMA) which is used recreationally for its euphoric and hallucinogenic effects. There are many substances that can be substituted for MDMA including amphetamines, methamphetamines, hallucinogenic tryptophans, and cathinones. All of these substances have prominent neuropsychiatric effects. Management of the acute, short-term psychiatric effects is well described, but information on longer-term effects with need for psychiatric consultation is not well described.

Objectives: This retrospective review analyzed regional poison center (RPC) cases of reported MDMA use to determine the incidence of neuropsychiatric effects and concomitant psychiatric consultation or admission.

Methods: 163 cases exposure coded as "ecstasy," "molly," or "MDMA" were obtained from the RPC database for the 2019 calendar year. Cases were excluded if the patient was lost to follow up, did not present to the hospital, was less than 12 years old, pregnant, or was intubated at any point during their stay (i.e. unable to self-report their symptoms). 125 cases remained. Charts were reviewed for neuropsychiatric symptoms such as agitation or hallucinations, co-ingestants, history of prior psychiatric illness, and whether the presentation was associated with a self-harm attempt. For the purposes of evaluating the frequency of urgent psychiatric consultation and psychiatric admission, an additional 18 cases were excluded where it was unclear if any psychiatric consultation was obtained.

Results: The average age of the patients was 25.1 years with an age range of 14 to 53 years. 77 of the 125 cases (62%) were male patients. 54 of 125 cases (43%) had no co-ingestants involved. 36% of all cases were admitted for medical reasons. For patients admitted to a medical service during their stay, a psychiatry consult was obtained in 24% of cases, with 13% of all medically admitted patients ultimately being admitted to psychiatry. For patients only managed in the emergency department, a psychiatry consult was obtained in 23% of cases with 12% of all ED patients being admitted to psychiatry. 60% of the patients who received a psychiatric consultation had presented to the hospital after a self-harm attempt. Patients with a history of psychiatric illness were more likely to have a psychiatry consult (44%) compared to those patients without a history of psychiatric illness (22%) (χ^2 $p = 0.03$). It was not noted by Poison Center Staff if any patients discharged had follow up with a mental health professional.

Conclusion: Many cases of reported MDMA use present with neuropsychiatric effects. Patients with a history of psychiatric disorder appear more likely to get a psychiatric consultation, although it is unclear if this is due to the acute neuropsychiatric effects of their ingestion as opposed to their underlying condition. A large number of these cases require mental health evaluation, but the long-term handoff to psychiatric care, and rate of continued neuropsychiatric effects needs better definition from the Poison Center perspective.

KEYWORDS Ecstasy, MDMA, Neuropsychiatric effects

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293. Substantial improvement in plaque psoriasis symptoms after inadvertent secukinumab subcutaneous overdose without adverse effects

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Background: Secukinumab is a monoclonal antibody with selective binding to interleukin-17A cytokine that prevents interaction with the interleukin-17 receptor. Subcutaneous dosing of 150-300mg weekly for 4 weeks followed by 150-300 mg every 4 weeks is FDA approved for plaque psoriasis. The development of Behçet Disease, systemic lupus erythematosus, and palmoplantar pustulosis is well-described in the setting of chronic secukinumab therapy. However, little is known regarding acute secukinumab overdose.

Case Report: A 40-year-old, 1.83m tall, 150kg male with chronic psoriasis was to inject 2 syringes of secukinumab (150mg/syringe) subcutaneously weekly for 5 weeks. He inadvertently injected 1 syringe daily for 1 week before discovering his error. By day 7, facial and forehead redness and scalp and post-auricular scabbing had completely resolved. His skin was described as the "best it had looked in a long time." Telephonic follow-up on days 13 and 38 revealed no adverse effects and no signs or symptoms of infection. No laboratory tests were completed. His physician planned to restart weekly secukinumab injections 6 weeks after his last dose.

Case Discussion: Secukinumab has been studied at various doses for multiple indications. Proof-of-concept studies using intravenous doses of 3mg/kg (psoriasis) and 10mg/kg (rheumatoid arthritis, uveitis) demonstrated no increase in adverse effects compared to placebo. Similar adverse event profiles were seen in the MEASURE-1 trial using three intravenous doses (10mg/kg) every 2 weeks with subsequent subcutaneous dosing (75mg or 150mg subcutaneously) as in the MEASURE-2 trial which used only subcutaneous dosing. Phase-2 clinical trials in adults utilized two 30mg/kg IV doses of drug secukinumab separated by 29 days without any documented adverse effects.
To our knowledge, we report the longest duration of secukinumab overdose. Our patient received a total of 7mg/kg subcutaneously over 7 days. If administered all at once, we would anticipate it would compare to ~5.4mg/kg intravenous dose (assuming 77% bioavailability) and would expect adverse effects similar to standard subcutaneous doses. Secukinumab reaches peak plasma level 6 days post-dose and has an elimination half life up to 31 days, likely explaining our patient's persistent beneficial result without subsequent doses. Lack of adverse effects at higher doses for other indications made it reasonable to restart subcutaneous injections at his next due dose.
Conclusion: We report a case of subcutaneous overdose of 7 mg/kg secukinumab over 7 days without adverse effects and resolution of chronic psoriasis at the 38-day follow-up. We recommend consideration of secukinumab dosages used for other disease-states to assess potential adverse-events from inadvertent dosing errors.

KEYWORDS secukinumab, psoriasis, overdose

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294. Comparison of opioid exposures managed at military and Veterans Affairs hospitals

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Background: Little information exists on opioid exposures managed at military and Veterans Affairs (VA) hospitals. Like all members of society, active duty military and their family members, as well as both former and retired military personnel, are at risk from opioid use and abuse, which can result in serious injury and death. The objective of this study was to describe opioid exposures reported to poison centers that were managed at military and VA hospitals.
Methods: Cases were opioid exposures among patients aged 18 years or older reported to a statewide poison center network during 2000-2018 where management occurred at a military or VA hospital. The distribution of exposures for various demographic and clinical factors was determined for military and VA hospitals, and comparisons were made between the two groups. Rate ratios and 95% confidence intervals were calculated. (*Denotes a statistically significant difference.)
Results: Of 836 opioid exposures, 584 (69.9%) were managed at military hospitals and 252 (30.1%) at VA hospitals. The most common opioids managed at military and VA hospitals, respectively, were hydrocodone (34.6% vs 43.7%)*, tramadol (24.8% vs 27.4%), oxycodone (24.1% vs 6.3%)*, and codeine (12.5% vs 8.3%). Males accounted for 45.0% of the military hospital patients and 80.2%* of the VA patients. The mean age for military hospital patients was 31.8 years and 48.1 years for VA patients. The reasons for opioid exposures managed at military and VA hospitals, respectively, were intentional (88.7% vs 86.1%), comprised of suspected attempted suicide (71.6% vs 59.5%)*, intentional misuse (7.4% vs 11.5%), intentional abuse (4.5% vs 9.5%)*, and intentional unknown (5.2% vs 5.6%); and unintentional exposures (5.3% vs 10.3%)*. The exposure route was ingestion in 98.6% of military and 97.6% of VA exposures. The medical outcome was serious (moderate effect, major effect, death, unable to follow-potentially toxic) in 40.9% of military and 38.1% of VA hospital opioid exposures. Deaths occurred in 3 (0.5%) military vs 2 (0.8%) VA hospital patients. The most commonly reported clinical effects among opioid exposures managed at military hospitals and VA hospitals, respectively, were drowsiness/lethargy (46.4% vs 48.0%), tachycardia (24.7% vs 16.7%)*, hypertension (10.4% vs 11.5%), vomiting (8.9% vs 4.8%)*, confusion (6.2% vs 9.9%), and agitation/irritability (5.7% vs 10.7%)*. The most frequently reported treatments among opioid exposures managed at military hospitals and VA hospitals, respectively, were intravenous fluids (46.9% vs 56.0%)*, activated charcoal (28.3% vs 34.1%), naloxone (23.1% vs 25.4%), cathartic (19.9% vs 24.6%), and oxygen (15.9% vs 19.0%).
Conclusions: A number of differences were observed between opioid exposures managed at military and VA hospitals. These differing patterns of opioid exposures may need to be considered in the education, prevention, and treatment of opioid exposures at these hospitals and among the populations they serve.

KEYWORDS military hospital, Veterans Affairs hospital, opioid

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295. Meth in Hand: Rise of Methamphetamine Exposures Reported to a State Poison Center Between 2012 and 2019

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Background: Psychostimulant use across the United States (US) has increased sharply in the past decade. Methamphetamine use in particular has exhibited a stark rise, with higher prevalence in the western US. Methamphetamine exposures reported to our state poison center have surged; this is consistent with national trends, indicating an emerging public health threat extending across the country. Myriad factors have contributed to methamphetamine's popularity, including increased accessibility and higher potency while remaining low cost. Our objective was to review the prevalence and characteristics of amphetamine-based exposures and subset of methamphetamine exposures reported to our poison center between 2012 and 2019.
Methods: Retrospective review of amphetamine-based and methamphetamine-based case exposures reported to the state poison center from 2012-2019. ToxSentry® database was queried for substances "amphetamine-ALL" and "methamphetamine"; age, reason of exposure (intentional versus unintentional), route of exposure, and reported co-exposures were recorded.
Results: A total of 7818 amphetamine-based exposures were reported to the state poison center from 2012-2019, peaking in 2015-2017 (Figure 1), remaining stable thereafter. In adults (age >18), 3318 were reported accounting for 42% of total amphetamine exposures. An increase in exposures of 41.3% (346 to 489)

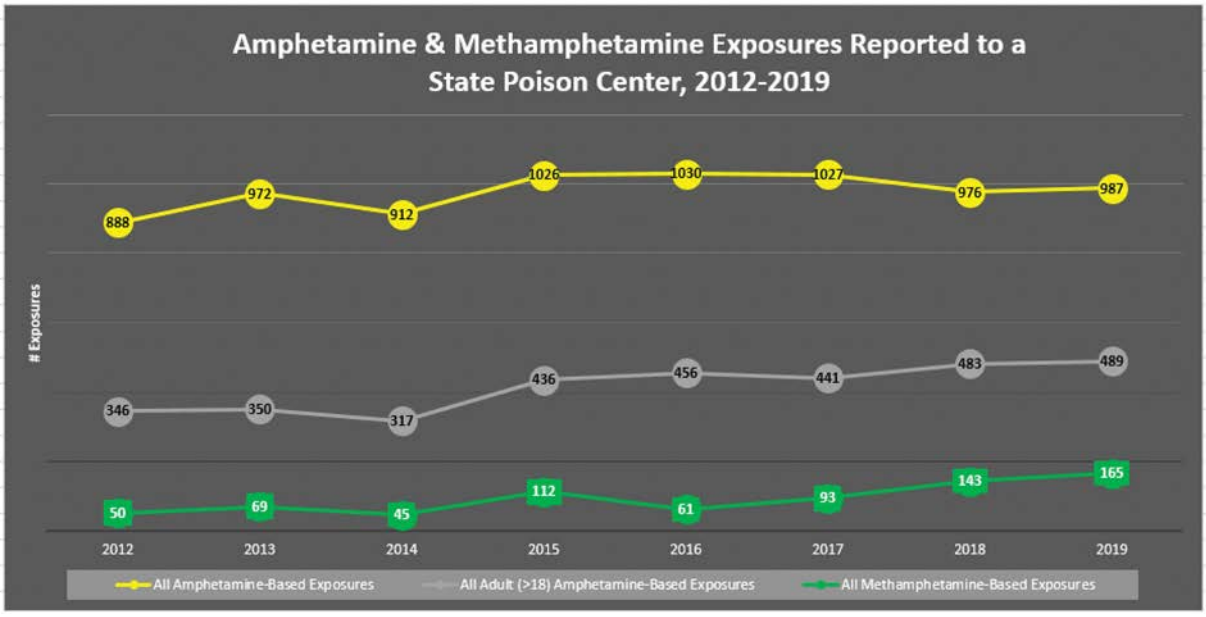

Figure 1 (#295)

occurred in the adult population, with progressive increases in annual reported numbers.

Cumulative methamphetamine reported exposures totaled 738. Methamphetamine exposures rose markedly from 50 in 2012 to 165 in 2019, representing a 3.3-fold increase; consistent with a rate increase from 0.51 to 1.65 per 100,000 residents. Methamphetamine reported exposures predominantly occurred in the 25-34 year-old age group. Ingestion and inhalation were the most common routes of exposure; cumulative ingestion exposures outnumbered all other routes of exposure. Reports of intravenous methamphetamine use did not reveal a consistent trend. Co-exposures were reported in 40.9% of cases, with the most commonly occurring substances being (in descending order) THC, heroin, amphetamines, and cocaine. Intentional exposures to methamphetamine outnumbered unintentional or unknown exposures 2 to 1. Exposure cases primarily involved males (461 vs. 277 females), consistent amongst annual state poison center and national trends.

Conclusion: The prevalence of psychostimulant use has increased across the US, with methamphetamine use representing the largest increase among this drug class. Although all amphetamine-based exposures reported to our poison center have risen during the study time period, exposure increases have been relatively stable since 2016. Conversely, methamphetamine reported exposures to our poison center have surged during this timeframe, supporting national reports of a potential emerging methamphetamine epidemic. This supports the utility of data and real-time toxicosurveillance provided by poison centers in helping to detect and track new or growing public health threats. Furthermore, this study demonstrates how poison center data can help inform local and national health agencies of drug use trends requiring close scrutiny and public health action.

Methamphetamine reported exposures to the state poison center have progressively increased despite stable reports of amphetamine exposures. This strengthens the case for utility of poison center data in supporting the detection of emerging public health threats, informing public health action, and development of mitigation efforts.

KEYWORDS Methamphetamine, Poison Center, Epidemiology

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296. State Psychostimulant Age-Adjusted Mortality Rate Correlates with Methamphetamine Poison Center Calls

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Background: Deaths attributable to psychostimulants with abuse potential have increased in the United States (US) in recent years. Methamphetamine use in particular has risen sharply. This study evaluated the correlation between amphetamine- and methamphetamine-related case exposures reported to our state poison center coinciding with psychostimulant age-adjusted mortality

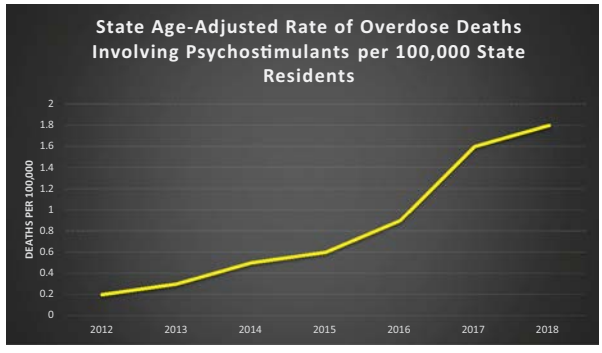

Figure 1(#296). Age-adjusted rate of overdose deaths involving psychostimulants per 100,000 state residents.

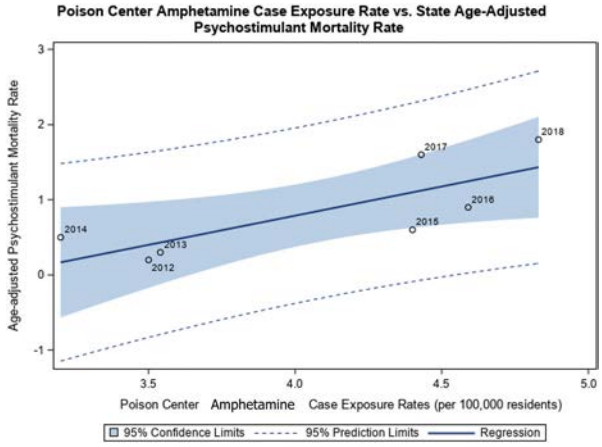

Figure 2(#296). Linear regression of poison center amphetamine case exposure rate vs. state-adjusted psychostimulant mortality rate.

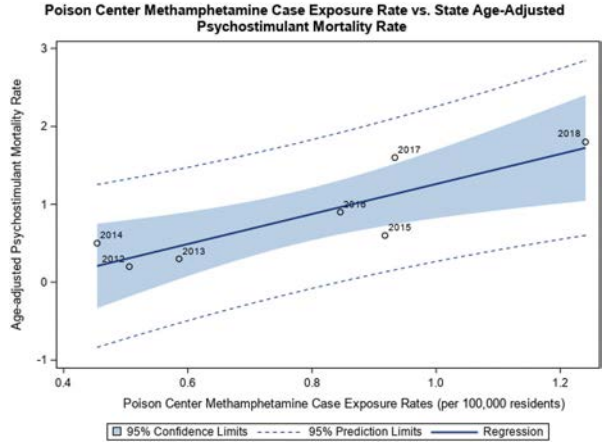

Figure 3(#296). Linear regression of poison center methamphetamine case exposure rate vs. state-adjusted psychostimulant mortality rate.

rates from the State Department of Health and Human Services (DHHS).

Methods: Amphetamine and methamphetamine exposures reported to our poison center from 2012 to 2018, queried from ToxSentry® database, were compared to DHHS reports on resident death certificates ("Vital Statistics") with attributed death due to "overdose, regardless of intent" (ICD-10 codes X40-X44, X60-X64, X85, Y10-14) and related cause of death attributed to psychostimulants with abuse potential (T43.6).

Linear regression assessed goodness-of-fit. Slope with standard error and adjusted R^2 were reported. Psychostimulants included methamphetamine, 3,4-methylenedioxy-methamphetamine (MDMA), dextroamphetamine, levoamphetamine, methylphenidate, and caffeine.

Results: Psychostimulant deaths reported by DHHS increased from 17 to 265 between 2012 and 2018. Average age-adjusted rate of psychostimulant-involved overdose deaths per 100,000 state residents rose from 0.2 to 1.8 (Figure 1). The majority of psychostimulant-related deaths also involved opioids (71-82%). Most psychostimulant-involved overdose deaths were non-Hispanic white (79%), males (66%), occurring in the 25-34 & 35-44 year-old age groups (28% & 27%, respectively).

Amphetamine-related case exposures reported to our poison center totaled 6,831 between 2012 and 2018. Methamphetamine case exposures reported increased from 50 to 143 between 2012-2018 with 573 cumulative exposures. Normalized methamphetamine exposure rates per 100,000 state residents climbed from 0.51 to 1.43 during the study time period. Linear regression of state poison center amphetamine exposure rates with state health department reported age-adjusted psychostimulant mortality rates yielded a slope of 1.93, SE 0.5, p-value 0.035, and adjusted R^2 0.5 (Figure 2).

Linear regression of state poison center methamphetamine exposure rates with state health department reported age-adjusted psychostimulant mortality rates yielded a slope of 0.78, SE 0.27, p-value 0.012, and adjusted R^2 0.7 suggesting a strong correlation (Figure 3).

Conclusion: Psychostimulant use and associated deaths in the US are increasing and is an evolving public health threat. Our state demonstrates consistency with national trends and data from our poison center correlates strongly with state-reported age-adjusted psychostimulant mortality rates. Poison center data is easily accessible and readily compiled in contrast to state health department mortality statistics. Thus, poison center data allows for real-time toxicosurveillance and is therefore more temporally sensitive to emerging drug trends. Strengthening collaboration between poison centers and state health departments is critical for detection and mitigation efforts. Frequent appraisal of poison center data in combination with state health department vital statistics can help detect and anticipate methamphetamine disease burden. Robust collaborative efforts can thereby inform resource allocation along with prevention and response strategies.

Psychostimulant use and overdose deaths continue to rise statewide and across the US. Methamphetamine comprises the largest increase in this drug class. Passive reporting of our poison center data correlates strongly with state health department mortality statistics demonstrating continued utility of poison center toxicosurveillance.

KEYWORDS Psychostimulants, Methamphetamine, Amphetamine

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297. Take This, Stay Up All Night, & Call Me In The Morning: Correlation Between State Amphetamine & Opioid Prescription Trends and Amphetamine Exposures from 2012-2019

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Background: Prescription stimulants are Schedule II controlled substances, commonly prescribed for attention-deficit hyperactivity disorder or narcolepsy. Although effective, they carry a high abuse potential. Transitioning from prescription drugs to lower-cost, higher-potency, and readily-available illicit drugs is a well-described phenomenon for opioids; the same may be true for stimulants (i.e. transition from methylphenidate to methamphetamine). Additionally, reports of stimulants being used to augment and/or supplant opioid effects – or to allow an opioid user to be more "functional" - are common. Recent legislative efforts to curb the opioid epidemic, including limiting supplies of prescription opioids, may contribute to the increase in popularity of abuse and misuse of prescription and illicit stimulants. We evaluated state prescription trends of prescription stimulants and opioids with prescription and illicit amphetamine-based exposures reported to our state poison center over time.

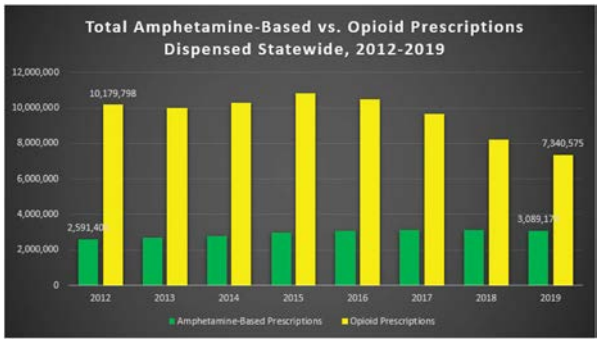

Figure 1(#297). Amphetamine-Based vs. Opioid Prescription Trends Statewide, 2012 to 2019.

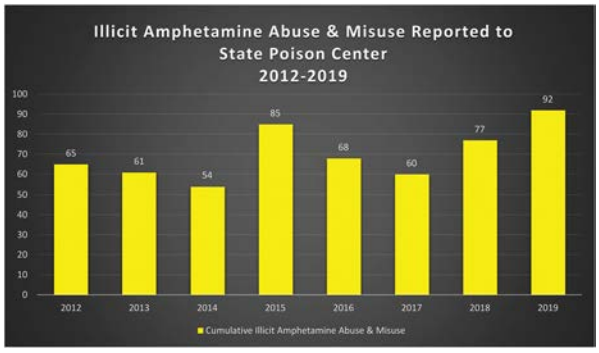

Figure 2(#297). Illicit amphetamine abuse and misuse reported to state poison center, 2012 to 2019.

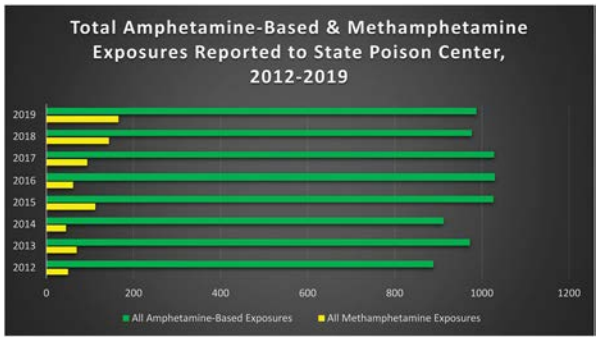

Figure 3(#297). Total amphetamine-based and methamphetamine exposures reported to state poison center, 2012 to 2019.

Methods: The State Automated Prescription System (APS) was queried for amphetamine-based and opioid (opioid agonists or partial agonists) medications prescribed in the state from 2012-2019. Total prescriptions and units dispensed were recorded. APS data was juxtaposed to ToxSentry® database queries for total exposures involving all amphetamine-based substances and abuse and misuse of illicit amphetamines reported to our poison center from 2012-2019. Illicit amphetamines queried included methamphetamine, hallucinogenic amphetamines, and synthetic phenylethylamines, analogs, and precursors.

Results: Total amphetamine-based prescriptions dispensed increased from 2.6 million in 2012 to 3.1 million in 2019 (19% increase), while opioid prescriptions decreased from 10.2 million to 7.3 million during this timeframe (32.4% decrease) (Figure 1). Dosage unit analysis paralleled this trend increasing from 115.5 million in 2012 to 135.8 million in 2019 (17.6% increase). Prominent increases in amphetamine prescriptions occurred from 2012 to 2016, however stabilized thereafter. Poison center data demonstrated increases in abuse and misuse of illicit amphetamines from 2017 to 2019 (Figure 2). An overall increase in total amphetamine-based exposures was also evident from 888 to 987 from 2012 to 2019 (Figure 3). Consistent increases in poison center reported methamphetamine exposures occurred from 2012-2019, representing a 3.2-fold increase (Figure 3).

Conclusion: Amphetamine-based prescriptions have increased coinciding with a decline in opioid prescriptions statewide between 2012 to 2019. Meanwhile, poison center data reveals total amphetamine-based exposures have increased with illicit amphetamine use and misuse climbing since 2017 despite stabilizing amphetamine prescription trends. Poison center data further supports an overall increase in illicit amphetamine exposures from 2012 to 2019.

While national and statewide efforts have been directed towards mitigating the opioid burden, similar initiatives may be warranted for amphetamine-based prescriptions. Legislative efforts to limit supplies of prescription opioids is a plausible contributing factor in diverting users to prescription or illicit amphetamine-based substances. Nonetheless, this rise indicates an evolving public health concern and potentially significant intersection between an established epidemic and an emerging threat.

Our state and state poison center have experienced a rise in amphetamine-based prescriptions and reported amphetamine exposures, respectively, coinciding with declining opioid prescriptions from 2012 to 2019. Amphetamine-based prescription trends and increases in illicit amphetamine use indicates a public health challenge warranting further scrutiny.

KEYWORDS Amphetamines, Opioids, Prescriptions

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298. Misery Loves Company: Rise of the "Goofball" - Methamphetamine with Opioid Co-Exposures and Outcome Severities at a State Poison Center Over Time

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[a]Michigan Poison Center, Wayne State University School of Medicine; [b]Wayne State University School of Medicine; [c]Michigan Department of Health and Human Services

Background: Methamphetamine use has increased across the United States, signaling an emerging public health concern. Combination use of methamphetamine and heroin, (a.k.a. 'goofball'), is rising. Increased availability, higher purity, and low-cost have all contributed to methamphetamine's rising popularity. Efforts to curb the opioid epidemic, including limiting supplies of prescription opioids, may have the unintended effect of increasing use of illicit opioids and other drugs of abuse including methamphetamine. 'Goofball' users report a desirable high and balance in drug effects despite placing users at increased risk. Our poison center has noted increases in reported methamphetamine exposures. Our objective was to describe the relationship between reported cases of methamphetamine with opioid co-exposures and outcome severities over time.

Methods: This is a retrospective review of methamphetamine exposures reported to a state poison center from 2012-2019. ToxSentry® database was queried for "methamphetamine" exposures. Case co-exposures and medical outcomes were recorded. Outcome severities were derived from American Association of

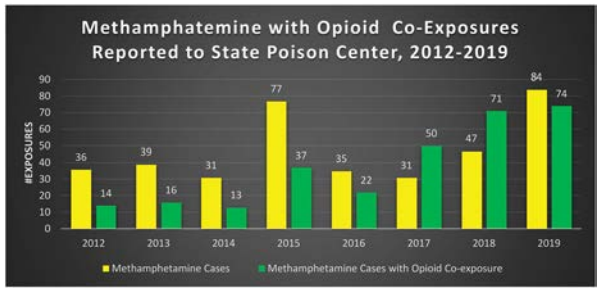

Figure 1(#298). Cases of Methamphetamine with Opioid Co-exposures Reported to State Poison Center, 2012 to 2019.

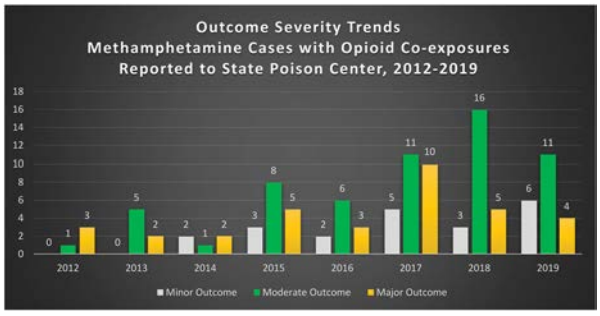

Figure 2(#298). Outcome Severity Trends in Poison Center Methamphetamine Cases with Opioid Co-Exposures, 2012 to 2019.

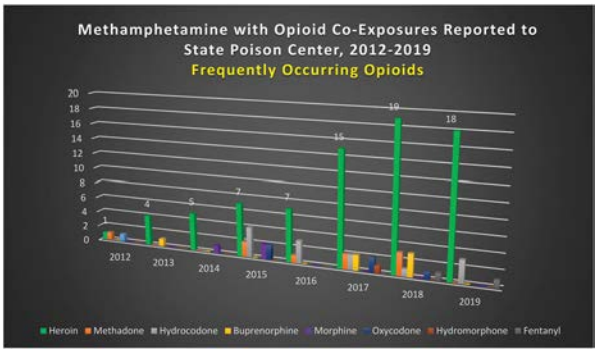

Figure 3(#298). Frequently Occurring Opioid Among Methamphetamine Cases with Opioid Co-Exposures Reported to State Poison Center, 2012 to 2019.

Poison Control Centers' National Poison Database System coding definitions.

Results: There were a total of 738 methamphetamine exposure cases with a notable increase from 50 in 2012 to 165 in 2019. Cumulative methamphetamine/opioid co-exposures totaled 40.2% (297 cases) of all methamphetamine exposures and methamphetamine/opioid co-exposures increased from 14 in 2012 to 74 in 2019. Co-exposures increased annually from 2015-2019 (Figure 1).

Outcome severities were recorded for 114 cases: moderate severity comprised the majority of documented outcomes from co-exposure cases, increasing from 1 in 2012 to 16 in 2018. Cases with major outcome severity increased from 3 in 2012 to its peak of 10 in 2017 (Figure 2).

The opioids most frequently involved in co-exposures were heroin, hydrocodone, and methadone. Heroin co-exposures were the most frequent: cumulative heroin co-exposure cases outnumbered all other opioids nearly 2 to 1 and cases generally increased over the study period (Figure 3).

Conclusion: Mixtures involving methamphetamine and opioids have become more prevalent, signaling a critical intersection between an established drug epidemic and emerging public health threat approaching epidemic status. The 'goofball' anecdotally produces a synergistic high, which users seek while producing balancing physiological effects. Methamphetamine and opioid co-exposure cases reported to our poison center increased from 2012 to 2019. Moderate severity outcomes increased progressively from 2016 to 2018. Although no conclusive trend in outcome severity was observed, deaths involving psychostimulants such as methamphetamine are increasing statewide. Discordance between reported clinical severity and mortality trends may be due to inherent poison center data limitations including reporting inaccuracies, incomplete coding, cases lost to follow-up, and lack of inclusion of coroner's/medical examiner cases. Heroin co-exposures ('goofballs') exceeded all other opioids and parallels national trends. This study supports the utility of real-time poison center toxicosurveillance data to help identify, track, and coordinate mitigative responses to emerging public health threats.

Not only is methamphetamine use surging statewide, concerning methamphetamine/opioid co-exposures are becoming more common, though there is no clear trend in outcome severity. Poison center toxicosurveillance provides a valuable element in detecting growing public health threats and guiding public health action.

KEYWORDS Methamphetamine, Opioids, Goofball

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299. A Meth Disturbance?: Topographical Trends in Methamphetamine Exposures Reported to a State Poison Center from 2012 to 2019

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Background: Historically, methamphetamine use has been highly prevalent in rural regions of the United States (US), with even higher preponderance in the western US. Methamphetamine has traditionally been of domestic origin; private makeshift labs confined to barns and trailers in sparsely populated locations. Due to increasing law enforcement focus on shutting down these labs, domestic methamphetamine manufacturing has been declining. Sourced high quality methamphetamine smuggled from Mexico is now the predominant source into the US drug black market; this explains the high use prevalence in the western US because of established drug trafficking routes. However, methamphetamine use is expanding across the country and its presence in rural midwestern states has been recognized by poison centers and state health departments.

Our state has demonstrated a marked rise in methamphetamine use, consistent with national trends and an increase in prevalence across the country. Classically in this state, cocaine predominated in urban areas while methamphetamine was more likely found in rural, less population dense regions. Anecdotal reports describe an increasingly urban presence of methamphetamine use. We aim to identify changes in topographical trends of methamphetamine use by evaluating our state poison center cases across state counties over time.

Methods: Retrospective review of state poison center reported cases of methamphetamine use stratified by state counties from 2012 to 2019. ToxSentry® database was queried for "methamphetamine" exposures, with county information documented. Counties with less than eight cases over the study

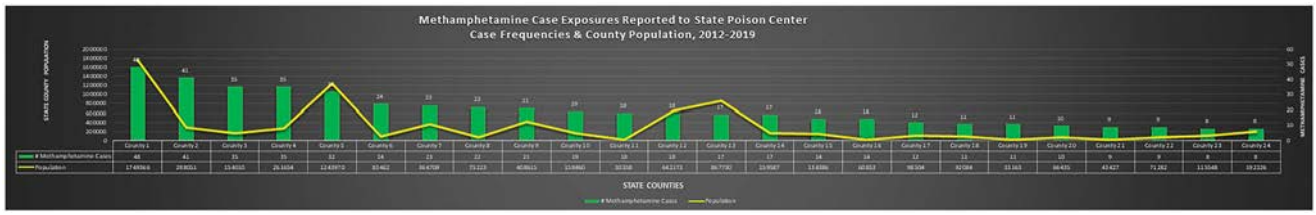
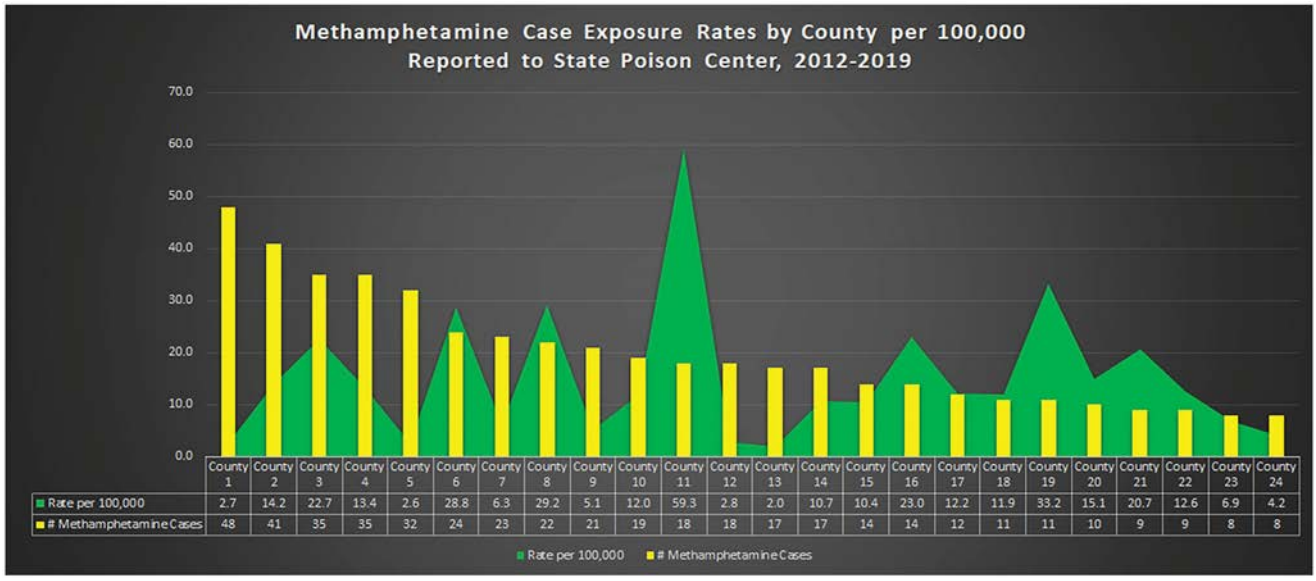


Figure 1(#299). Methamphetamine Cases Reported to State Poison Center by County, 2012 to 2019.



	County 1	County 2	County 3	County 4	County 5	County 6	County 7	County 8	County 9	County 10	County 11	County 12	County 13	County 14	County 15	County 16	County 17	County 18	County 19	County 20	County 21	County 22	County 23	County 24
Rate per 100,000	2.7	14.2	22.7	13.4	2.6	28.8	6.3	29.2	5.1	12.0	59.3	2.8	2.0	10.7	10.4	23.0	12.2	11.9	33.2	15.1	20.7	12.6	6.9	4.2
# Methamphetamine Cases	48	41	35	35	32	24	23	22	21	19	18	18	17	17	14	14	12	11	11	10	9	9	8	8

Figure 2(#299). State Poison Center Methamphetamine Case Exposure Rates per 100,000.

timeframe were excluded since this was equivalent to less than 1 case per year. Individual counties were evaluated based on population density and reported methamphetamine case frequencies. Case frequencies based on population density were stratified (> 1 million; 500,000 to 1 million; 100,000 to 500,000; 50,000 to 100,000; and <50,000 persons). Population density information was based on 2016 estimated census information with a total state population of 9,653,345 and population of the three largest counties (in descending order) being 1,749,366, 1,243,970, and 867,730.

Results: Methamphetamine exposures reported to our poison center from 2012 to 2019 totaled 738 cases. There were 632 total case exposures from 69 counties with identified and documented county information (106 unknown); 476 cases from 24 counties were evaluated based on study inclusion criteria (Figure 1). Nine counties reported more than 20 cases. Total case frequency was prevalent among urbanized counties, owing to increased population density. However, normalizing for population density revealed increased case exposures rates per 100,000 among more sparsely populated rural counties (Figure 2). Among the highest exposure rates (> 20 per 100,000), 42.9% were among rural communities with a population density <50,000. Furthermore, the highest case exposure rate (59.3 per 100,000) occurred in the most sparsely populated county.

Conclusion: Despite anecdotal reports of methamphetamine use increasing among more urban counties, case exposures reported to our poison center support high rates of use in rural communities from 2012 to 2019.

KEYWORDS Methamphetamine, Topography, Poison Center

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300. Hydroxychloroquine overdose: Correlating a serum level to clinical manifestation

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Background: Hydroxychloroquine (HCQ) is a 4-aminoquinoline derivative of chloroquine used to treat malaria and other autoimmune disorders. Unlike its precursor, documented HCQ overdose is rare with only 23 published cases in the English medical literature. HCQ overdose can present with rapid deterioration followed by ventricular dysrhythmias and cardiovascular collapse. Currently, the association between serum HCQ levels and clinical toxicity in overdoses is not well established. Through this case report, we aim to further characterize clinical manifestation of HCQ poisoning and evaluate the utility of obtaining HCQ level.

Case Report: A previously healthy 16-year-old girl presented to the emergency department with stupor and hypotension after an intentional overdose of an unknown amount of prednisone, ibuprofen, melatonin, and hydroxychloroquine (mother's medication). She was initially found to be lethargic, confused, and profoundly hypotensive with QRS widening on 12-lead ECG. Sodium bicarbonate, vasopressors, early intubation, and high dose diazepam were recommended. Cardiac conduction abnormality was evident on ECGs throughout clinical course without

Table 1(#300). Patient clinical course.

Time from ingestion – location	Presentation	Intervention
3 hours – emergency department	• GCS 11 • HR 87 bpm, BP 68/48 mmHg, RR 20 br/min, O_2 Sat 87%, Temp 35.4°C	• Intravenous (IV) fluid boluses • Intubation
5 hours – pediatric intensive care unit (PICU)	• BP 56/40 mmHg • ECG: HR 85 bpm, QTc 430 ms, QRS 106 ms; borderline intraventricular conduction delay, borderline T-wave abnormality • VBG: pH 7.37, PCO_2 38, CO_2 22 • K 3.6 mg/dL • **Serum [HCQ] 2.7 mg/dL** (High Performance Liquid Chromatography/Tandom Mass Spectrometry, 17-day turnaround time)	• Norepinephrine 15 mcg/min • Diazepam IV bolus 1 mg/kg (per ideal body weight) followed by infusion of 1mg/kg over 24 hours • Magnesium sulfate 2 g IV • 50 mEq sodium bicarbonate
12 hours – PICU	• ECG: HR 85 bpm, QTc 514 ms, QRS 114 ms; unspecified intraventricular conduction delay (Figure 1) • Mg 1.9 mg/dL • K 3.5 mg/dL	• Magnesium sulfate 2 g IV • Potassium chloride 30 mEq IV
22 hours – PICU	• BP 114/53 mmHg, MAP 68 mmHg • ECG: HR 91 bpm, QTc 474 ms, QRS 98 ms; sinus rhythm	• Norepinephrine 3 mcg/min
32 hours – PICU	• BP 129/64 mmHg, MAP 80 mmHg	• Norepinephrine discontinued • Extubated
48 hours – floor status	• GCS 15 • HR 78 bpm, BP 116/71 mmHg, RR 20 br/min, O_2 Sat 87% on 0.5 L/min	• Psychiatry consultation pending

ventricular dysrhythmias. Patient was extubated and weaned off vasopressor support after 32 hours from time of ingestion, then transferred to floor status after 48 hours. The patient subsequently presented several weeks later with a repeat intentional overdose of HCQ, but had a benign course requiring only observation (Table 1).

Case Discussion: The toxic serum HCQ level has yet to be established. Severe HCQ poisonings have been described with levels between 0.64 and 28.0 mg/L while levels between 0.5 to 2 mg/L are targeted for therapeutic indications. Toxicokinetic data described time to C_{max} of 3-12 hours and half-lives between 11.6 to 31 hours following overdoses. The decrease in drug concentration over time has been shown to correlate with clinical improvement. Here, we report a moderate to severe case of HCQ poisoning where the patient presented with neurological changes, cardiovascular collapse, and ECG abnormalities without marked hypokalemia or ventricular dysrhythmias. The treatment strategy for this patient was largely derived from that for chloroquine poisoning, which consisted of three principle factors that have been shown to impact mortality: early intubation, high dose diazepam, and pressor support. The patient had a relatively benign course with these aggressive interventions. Due to the 17-day turnaround time, the patient's serum HCQ level drawn at the time of initial presentation could only offer retrospective utility.

Conclusion: We present a case of HCQ poisoning that was successfully treated with supportive care and high dose diazepam. The patient had moderate to severe toxicity despite HCQ level minimally above the therapeutic range. The delay in obtaining the results of serum HCQ level at many institutions limits its utility in clinical practice. However, we contributed to the current pool of evidence in the effort to correlating specific HCQ level to clinical presentation. Additionally, given a recurrent potentially life-threatening overdose, this case emphasizes the importance of education on safe medication storage after adolescent intentional overdoses.

KEYWORDS hydroxychloroquine, high-dose diazepam, serum hydroxychloroquine level

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301. Clinical Characteristics in Cardiotoxic Agent Overdose Necessitating Venoarterial Extracorporeal Membrane Oxygenation: A case series

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Background: Venoarterial extracorporeal membrane oxygenation (VA- ECMO) is increasingly utilized to treat patients with drug-induced refractory cardiogenic shock. We present a case series to describe the clinical characteristics of acutely poisoned patients who received VA-ECMO support due to severe cardiotoxicity.

Methods: Cases were identified by reviewing medical toxicology consult log from January 1, 2015 to February 1, 2020. Patients were included if they ingested cardiotoxic agents (i.e. beta blockers, calcium channel blockers and membrane stabilizing agents), received VA-ECMO support for refractory cardiogenic shock (mean arterial pressure $<$65 mmHg or systolic blood pressure $<$90 mmHg) and evaluated by a medical toxicologist. Clinical data obtained include vital signs, laboratory results, and medical/antidotal therapies, and intensive care unit (ICU) and hospital length of stay (LOS). Acute Physiology and Chronic Health Evaluation (APACHE) IV score was computed using clinical data immediately before and 24-hours after VA-ECMO. A descriptive analysis was performed.

Case reports: Six patients (5 male, and median age of 36 years) were retrospectively identified and included in our case series.

Table 1(#301). Demographic and hemodynamic parameters of 6 cases with refractory drug-induced cardiogenic shock.

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Age (years)	54	36	24	12	55	36
Gender	Male	Male	Male	Male	Male	Female
Ingested agents	Verapamil Quetiapine Valproic acid Apixaban	Atenolol Amlodipine	Amlodipine Metoprolol Lisinopril Insulin glargine	Bupropion Lisdexamfetamine	Amlodipine	Loperamide
Cardiac arrest	No	No	No	Yes (Tdp)	No	Yes (VT)
Antidotal therapy	HIE (10) Glucagon (5) L-carnitine	HIE (10) Glucagon (10) Methylene blue (2) Lipid (1.5)	HIE (10) Glucagon (8)	HCO_3 (18) Lipid (1.5)	HIE (4) Glucagon (PRN)	HCO_3 (22.5) NAC
CRRT (hours)*	Yes (0)	Yes (+26)	No	No	No	Yes (-3)
MARS (hours)*	No	Yes (+7)	No	No	No	Yes (-3)
Pacemaker	No	No	No	No	No	Yes
Pre VA-ECMO						
BP (mmHg)	97/45	79/43	74/49	85/46	73/52	63/32
MAP (mmHg)	62	55	57	59	59	42
Vasopressor infusions	EPI (0.08) NE (1.9) VASO (0.03)	NE (0.6) DOBUT (7) VASO (0.03)	EPI (0.45) NE (2.5) VASO (0.03)	EPI (0.12) NE (0.2) ISO (0.8)	EPI (0.5) NE (0.6) VASO (0.04)	EPI (0.07) ISO (0.02)
APACHE IV score	82	47	69	42	62	77
24-hours post VA-ECMO						
BP (mmHg)	100/62	100/63	93/53	90/58	103/85	141/70
MAP (mmHg)	75	75	66	69	91	94
Vasopressor infusions	NE (0.85) VASO (0.03)	EPI (0.04) NE (0.46) VASO (0.03)	NE (0.96)	ISO (0.5)	EPI (0.23) NE (0.2)	–
APACHE IV score	30	34	39	19	34	22
Discharge status	Psych unit	Psych unit	Psych unit	Psych unit	Rehab	Home

*Represents CRRT or MARS initiation time (hours) before (-) or after (+) VA-ECMO cannulation.
HIE: high-dose insulin euglycemic therapy (units/kg/hr); HCO_3: sodium bicarbonate (mEq/hr); Lipid: Lipids emulsion 20% (mL/kg); EPI: epinephrine (mcg/kg/min); NE: norepinephrine (mcg/kg/min); VASO: vasopressin (units/min); DOBUT: dobutamine (mcg/kg/min); ISO: isoproterenol (mcg/kg/min); glucagon (mg/hr); methylene blue (mg/kg); NAC: n-acetylcysteine.
VA-ECMO: venoarterial-extracorporeal membrane oxygenation; Tdp: torsade de pointes; VT: ventricular tachycardia; BP: blood pressure; MAP: mean arterial pressure; CRRT: continuous renal replacement therapy; MARS: molecular adsorbent recirculation; APACHE: acute physiology and chronic health evaluation.

Table 2(#301). Pre and 24-hours post VA-ECMO cannulation laboratory findings of 6 patients.

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Pre-ECMO						
pH	7.09	7.34	7.26	7.57	6.82	7.5
Lactate (mmol/L)	18.0	2.8	5.8	13.6	17.0	5.7
Creatinine (mg/dL)	2.64	2.18	1.55	0.49	1.44	3.26
Total bilirubin (mg/dL)	0.4	0.6	0.3	0.1	0.1	1
AST/ALT (units/L)	38/35	30/38	44/34	27/24	31/30	8764/5553
24-hours post ECMO						
pH	7.43	7.42	7.34	7.47	7.37	7.42
Lactate (mmol/L)	4	1.3	1.6	0.6	3.9	1.3
Creatinine (mg/dL)	1.03	0.73	0.51	0.48	1.35	1.01
Total bilirubin (mg/dL)	0.6	0.2	0.2	0.5	0.9	5.5
AST/ALT (units/L)	133/29	309/84	43/41	59/54	191/55	4323/3056

ECMO: extracorporeal membrane oxygenation; AST: aspartate transaminase; ALT: alanine transaminase.
Note: Patients #5 and #6 developed AKI during ECMO course (max creatinine 2.72 and 4.83, respectively) but it resolved by the time of discharge (patient #5) and 9 days post discharge on outpatient follow-up (patient #6). Elevated AST/ALT of patient #6 resolved at the time of discharge.

Two patients with cardiotoxicity from membrane stabilizing agents (i.e. bupropion and loperamide) experienced non-perfusing dysrhythmias (ventricular tachycardia and torsade de pointes) requiring cardiac resuscitation. Prior to VA-ECMO initiation, the median systolic blood pressure was 74 mmHg (range: 63-97) with median mean arterial pressure of 57 mmHg (range: 42-62). Five patients required 3 or more vasoactive agents for hemodynamic support. (Table 1) 83% of patients (n = 5) had pre-ECMO lactate concentrations >5 mmol/L. (Table 2) All patients required mechanical ventilation. Two patients (loperamide and atenolol/amlodipine ingestions) received molecular adsorbent recirculation system. Three out of five patients who developed acute renal injury required continuous renal replacement therapy. Median APACHE IV score before VA-ECMO was 62 (range: 42-82) that decreased to 30 (range: 19-39) 24-hours after VA-ECMO initiation. (Table 1) The median duration of VA-ECMO was 3 days (range: 2-5 days) with median ICU LOS of 5 days (range: 4-23). Median hospital LOS was 12 days (range: 7-68). All patients survived to discharge. (Table 1) Patient #2 developed a paraspinal abscess, requiring multiple surgical interventions. No other adverse complication was noted from acute poisoning or VA-ECMO support.

Case Discussion: Six patients experienced significant drug-induced cardiotoxicity despite ingestion of different cardiotoxic agents. Their cardiogenic shock was refractory to standard medical therapy necessitating circulatory support with VA-ECMO. Currently, there is no standardized guideline to assist critical care providers and medical toxicologist when VA-ECMO should be considered for circulatory support in the setting of cardiotoxic agent overdose. Based upon our limited experience, we propose that VA-ECMO should be considered in patients with persistent

cardiogenic shock with following conditions: 1. Infusion of >2 vasopressors; 2. End-organ injury involving >2 organ systems; 3. Maximized/optimized antidotal therapy (e.g. high-dose insulin, bicarbonate infusion, lipid emulsion, etc.); and 4. Lactate >6 mmol/L. With appropriate selection of VA-ECMO candidate, VA-ECMO may decrease the risk of ischemic injury and fatality in critically ill poisoned patients.
Conclusions: VA-ECMO can provide hemodynamic stabilization after failure of standard pharmacologic therapy in drug-induced cardiogenic shock from acute poisoning.

KEYWORDS VA-ECMO, acute poisoning, cardiotoxicity

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302. Impact of Marijuana Legalization on Healthcare Utilization for Psychosis and Schizophrenia in Colorado

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Background: The public health impact of the availability of high potency marijuana products has yet to be fully understood. Of particular concern is the impact on mental and behavioral health. Available evidence has demonstrated an association with chronic marijuana use with an increase in acute psychosis and schizophrenia-type symptoms and is strengthened with exposure to higher doses of THC. Colorado is one of the first states to allow both medical (2000) and recreational (2014) marijuana, and has been on the forefront on the public health impact of legalization. The objective of this study was to evaluate the impact of marijuana legalization on psychosis and schizophrenia related healthcare encounters in Colorado (CO).
Methods: A retrospective search was performed from January 2010 through December 2018 using the Colorado Hospital Association (CHA) database. CHA uses the DATABANK Program to collect hospital data from over 100 hospitals and health systems throughout the state, representing multiple regions and patients. Data includes patients with variety of insurance (private, public) and uninsured. Hospital data includes inpatient, outpatient and emergency department healthcare encounters. Diagnosis ICD 9 and 10 codes for cannabis abuse/intoxication and psychosis and/or schizophrenia were obtained.
Results: Descriptive statistics including patient age and sex will be reported. Overall and annual counts for searched cannabis and vomiting codes will be analyzed. This includes counts by county, and emergency department and inpatient encounters. Comparative analysis of diagnosis rates by population and hospital visits before and after retail legalization will be performed, along with overall time trend analysis.
Conclusions: By using the CO APCD, this study will be able to report state trends of hospital encounters related associated with both cannabis and psychosis/schizophrenia. We will also be able to evaluate the impact at a county level, to comment on the mental health resources required in both low and high populated and resourced areas. This will provide insight on the impact of marijuana legalization on the vulnerable mental health population.

KEYWORDS Marijuana, Psychosis, Schizophrenia

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303. On the analytical characteristics of commercial acetaminophen assays in the United States between 1984 and 2019

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Introduction: Management of acetaminophen (APAP) toxicity is heavily reliant on the plasma or serum concentration. We sought to determine the analytical characteristics of past and current commercial APAP assays in the United States.
Methods: We systematically reviewed the analytical characteristics of APAP assays cleared by the Food and Drug Administration's (FDA) 510(k) premarket notification process by searching the Clinical Laboratory Improvement Amendments (CLIA) database. If no analytical data were available, we contacted the manufacturer directly and searched for peer reviewed reports. We excluded non-blood assays, qualitative assays, and assays for which precision data were not available. We collected the following data where available: test principle, precision near 10 mg/L, precision near 150 mg/L, limits of detection, and limits of quantitation. Accuracy and specificity were not routinely reported and outside the scope of this study.
Results: From 212 search results, we identified 19 different assays derived from 15 parent devices (Figure 1). All extracted analytical characteristics are shown in Table 1. Twelve were enzymatic while 7 were immunoassays. For all assays, absolute analytical precision decreased as analyte concentration increased (Figure 1). Near [APAP] = 10 mg/L, the most precise assays had a standard deviation (SD) of 0.2 mg/L or coefficient of variation (CV = SD/mean) of 1% and the least precise assays had a SD of

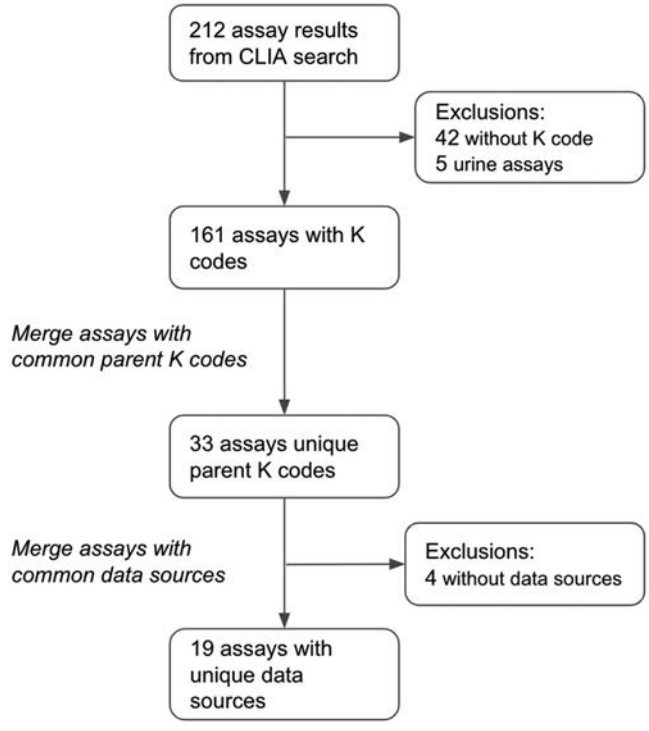

Figure 1(#303). Flow diagram of acetaminophen assays from CLIA database search to final inclusion and data analysis.

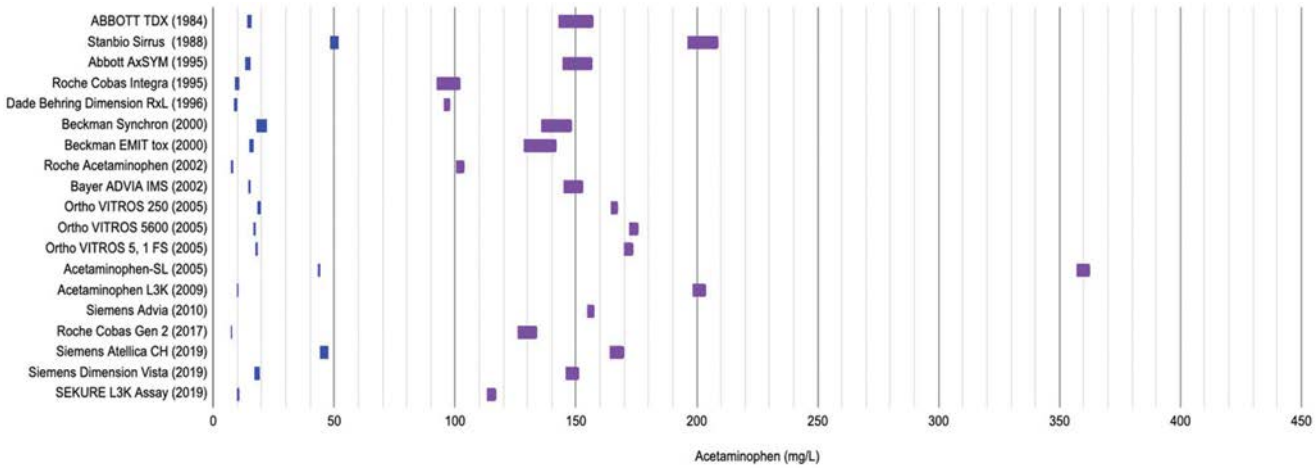

Figure 2(#303). Absolute analytical precision of commercial acetaminophen near concentrations used to determine treatment. Parenthetical years indicate the publication date of the data source or - when not available - the FDA decision date. Bars represent mean +/- 1 standard deviation.

Table 1(#303). Analytical characteristics of acetaminophen assays cleared by the FDA 510(k) pathway.

					Precision *near 10 mg/L*			Precision*near 150 mg/L*		
Assay	Test Principle	LoD (mg/L)	Lower LoQ (mg/L)	Upper LoQ (mg/L)	sample (mg/L)	SD (mg/L)	CV (%)	sample (mg/L)	SD (mg/L)	CV (%)
ABBOTT TDX (1984)	IMM	NA	NA	200	15	0.7	4.9	150	7.4	4.9
Stanbio Sirrus (1988)	ENZ	NA	10	300	50	1.8	3.6	202.7	6.4	3.1
Abbott AxSYM (1995)	IMM	1	NA	200	14.3	0.9	6.2	150.5	6.2	4.1
Roche Cobas Integra (1995)	ENZ	NA	NA	235	9.9	0.7	7.5	97.4	4.8	4.9
Dade Behring Dimension RxL (1996)	ENZ	NA	NA	NA	9.3	0.6	5.9	96.8	1.3	1.4
Beckman Synchron (2000)	IMM	0.1	10	300	20	2	10	142	6.2	4.4
Beckman EMIT tox (2000)	IMM	0.1	NA	200	15.8	0.7	4.4	135.3	6.8	5
Roche Acetaminophen (2002)	ENZ	NA	NA	NA	7.9	0.5	5.7	102.1	1.5	1.5
Bayer ADVIA IMS (2002)	IMM	NA	NA	200	15	0.4	2.6	149	3.9	2.6
Ortho VITROS 250 (2005)	ENZ	NA	10	200	19	0.5	2.6	166	1.5	0.9
Ortho VITROS 5600 (2005)	ENZ	NA	NA	200	17	0.3	1.8	174	2	1.1
Ortho VITROS 5, 1 FS (2005)	ENZ	NA	NA	200	18	0.4	2.2	172	1.9	1.1
Acetaminophen-SL (2005)	ENZ	NA	NA	380	43.6	0.4	1	359.7	2.8	0.8
Acetaminophen L3K (2009)	ENZ	NA	0.6	378	10.1	0.3	2.8	201	2.6	1.3
Siemens Advia (2010)	ENZ	NA	2	200	12.8	0.1	1.1	156.2	1.4	0.9
Roche Cobas Gen 2 (2017)	IMM	3	5	200	7.7	0.2	2.6	130	4	3.1
Siemens Atellica CH (2019)	ENZ	2	NA	200	46	1.7	3.7	167	3.1	1.9
Siemens Dimension Vista (2019)	ENZ	2	NA	300	18.2	1.1	6	148.5	2.7	1.8
SEKURE L3K Assay (2019)	ENZ	2.4	8	378	10.3	0.5	4.6	115	2	1.8

Parenthetical years in column one indicate the publication date of the data source or - when not available - the FDA decision date for that device.
IMM: immunoassay; ENZ: enzymatic; LoD: limit of detection; LoQ: limit of quantitation; SD: standard deviation; CV: coefficient of variation; NA: not available.

range of 1.8 mg/L or a CV of 10%. Near [APAP] = 150 mg/L, the most precise assay had a SD of 1.4 mg/L or CV of 0.9% and the least precise assays had a SD of 7.4 mg/L or a CV of 4.9%. Some manufacturers failed to validate assay precision at or near clinically-relevant [APAP]: two assays did not have precision data for [APAP] < 40 mg/L, eight assays did not have precision data for [APAP] > 150 mg/L. The limit of detection ranged from 0.1-2.4 mg/L. The lower limit of quantitation ranged from 0.6-10 mg/L. The upper limit of quantitation ranged from 200-380 mg/L, before dilution.

Conclusions: APAP assays uncovered by our search had good analytical precision with improvement over time. The failure of some manufacturers to validate precision near treatment thresholds is concerning. Newer APAP assays could quantify lower [APAP], raising the likelihood of overdiagnosis and subsequent overtreatment. The FDA CLIA database for 510(k) devices is limited by redundant entries and incomplete data but remains a freely accessible starting point for clinicians to learn about many toxicologic assays. These data are not a substitute for independent laboratory optimization and validation.

KEYWORDS Acetaminophen, Paracetamol, Analytical Toxicology

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304. Peer Pressure Explosive Consequences: A Case of Cyclonite (C-4) Ingestion

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Background: Cyclotrimethylenetrinitramine (cyclonite, RDX) is an active ingredient in C-4 plastic explosive used extensively by the United States (US) military. It is a white solid with a putty-like

consistency. Symptoms of ingestion as reported in limited case reports include nausea, vomiting, diarrhea, seizures, postictal coma, lethargy, dysrhythmia, and myoclonus. Previous literature has shown soldiers may intentionally ingest cyclonite for two reasons: to elicit intoxication with symptoms similar to ethanol ingestion, and to feign illness. We present a case of intentional C-4 ingestion in a military patient who suffered from gastrointestinal effects and seizure after a colleague dared him to eat a walnut-sized piece of the agent.

Case Report: A 20-year-old male US Army member was brought to the emergency department with nausea and headache. While training at a rifle range, a colleague dared him to eat a piece of C-4. Within half an hour he experienced a two-minute seizure with 60 minutes of post-ictal behavior. Physical exam revealed clonus. His vital signs were unremarkable throughout the encounter. Medications administered included lorazepam 1 mg IV, ketorolac 30 mg IV, and normal saline one liter bolus. Laboratory testing was remarkable for leukocytosis of 16.4 10○3/uL, elevated d-dimer 2003 ng/mL D-DU, and lactate of 2.41 mmol/L. A non-contrast head CT showed no evidence of acute hemorrhage, edema, or mass effect. Poison Control was called, and the toxicologist recommended benzodiazepines for seizures and 24-hour observation. He was admitted to the intensive care unit (ICU) for monitoring. On admission, Neurology was consulted and recommended administration of valproic acid 20 mg/kg and levetiracetam 40 mg/kg IV. He was also given two doses of polyethylene glycol oral solution for gastrointestinal decontamination. He remained in the ICU overnight and was discharged the following day without recurrence of symptoms. He remained symptom free four days later at follow-up examination.

Discussion: Multiple case reports describe C-4 ingestion resulting in symptoms ranging from acute gastrointestinal illness to severe neurological sequelae. Few case reports exist over the last decade and none occurred outside of military hospitals. Since 2018, one case of intentional C-4 ingestion has been reported–it occurred at a military base involving a young male. Young adults increasingly comprise military ranks, and this demographic may be more prone to risk-taking behavior. Physicians need to be aware of intentional explosive ingestion as a potential cause of GI symptoms or seizures when working on or near a military base.

Conclusion: Cyclonite exposure, whether occupational or intentional, increases seizure risk. Soldiers and physicians alike should be able to recognize C-4 poisoning. It is imperative to consider C-4 ingestion as a cause of seizure in young military members, as this group is most likely to have access to the toxicant and use it recreationally.

KEYWORDS cyclonite, explosive, military

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305. Tizanidine Overdose Successfully Treated with Naloxone

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Background: Tizanidine is a skeletal muscle relaxant in the class of imidazoline derivatives. It is structurally similar to clonidine, another imidazoline derivative, and it is often prescribed as an anti-spasmodic agent. Like clonidine, it is an alpha-2 adrenergic receptor agonist and exerts its clinical effects via presynaptic inhibition of motor neurons. There are multiple adverse effects reported even with therapeutic use of tizanidine, and centrally-mediated signs and symptoms such as drowsiness, hypotension, and bradycardia are common. These systemic effects may be pronounced in overdose and produce a sympatholytic toxidrome analogous to that observed in clonidine toxicity, which may resemble the opioid toxidrome. Clonidine is the most studied α2 adrenergic receptor agonist. It causes increases in the concentration of the endogenous opioid β-endorphin, resulting in decreased blood pressure. The opioid antagonist naloxone has been used in high doses to reverse systemic effects of clonidine toxicity, and it has likely been successful due to its ability to antagonize the effects of endogenous opioids.

Given the similarities in mechanisms of action, chemical structure, and toxicity profiles of clonidine and tizanidine, it is postulated that naloxone may also be effective in cases of tizanidine toxicity. We report a case of tizanidine toxicity successfully treated with high-dose naloxone.

Case Report: A 43-year-old female intentionally overdosed with an unknown amount of tizanidine. On arrival to the ED, the patient's GCS was 15 with slight hypertension and tachycardia. While being observed in the ED, she became lethargic with miotic pupils, hypotensive at 86/59 mmHg, and had inappropriately normal heart rate at 70 bpm. Urine drug screen was negative for opiates. In addition to atropine and 4.5 liters of crystalloid, she received total of 6.4 mg naloxone in separate boluses with hemodynamic improvement. A naloxone infusion was started in the ED but was discontinued at the request of the admitting intensivist. When the naloxone was discontinued, the patient quickly developed recurrent hypotension and bradycardia. The infusion was restarted and the patient's hemodynamics again improved. The patient was admitted to ICU and despite her improvement with naloxone, this was permanently discontinued and she was switched to dopamine. She subsequently made a full recovery.

Discussion: We present a patient who was successfully treated with high-dose naloxone after suffering toxicity due to sympatholytic central α2 agonist effects of tizanidine. There is no evidence that naloxone interacts with alpha-adrenergic receptors or that tizanidine interacts with opioid receptors; however, it is postulated that naloxone may be successful in treating sympatholytic toxicity due to its ability to antagonize the effects of endogenous opioids such as beta-endorphin. High-dose naloxone has been used with some success in toxicity due to clonidine, which has a similar mechanism of action. Naloxone likely reverses endogenous opioid effects of clonidine and structurally similar substances like tizanidine.

Conclusion: This case demonstrates that high-dose naloxone may improve the sympatholytic effects of tizanidine toxicity.

KEYWORDS tizanidine, naloxone, clonidine

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306. COVID-19 Associated Cases to US Poison Centers

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Objectives: On 23-Jan-2020, the National Poison Data System (NPDS) Rapid Coding Committee activated Novel Coronavirus (synonym - Micromedex Emergency Code #99) with Product code 7325206. The code was revised 11-Mar-2020 Emergent Code #99 updated to COVID-19 CONFIRMED and Emergent Code #100 was added for COVID-19 Not Confirmed. We desired to examine the time course and components of NPDS cases regarding COVID-19.

Methods: We examined all COVID-19 and Non-COVID-19 NPDS cases via the NPDS Special Projects Enterprise Report "COVID-19

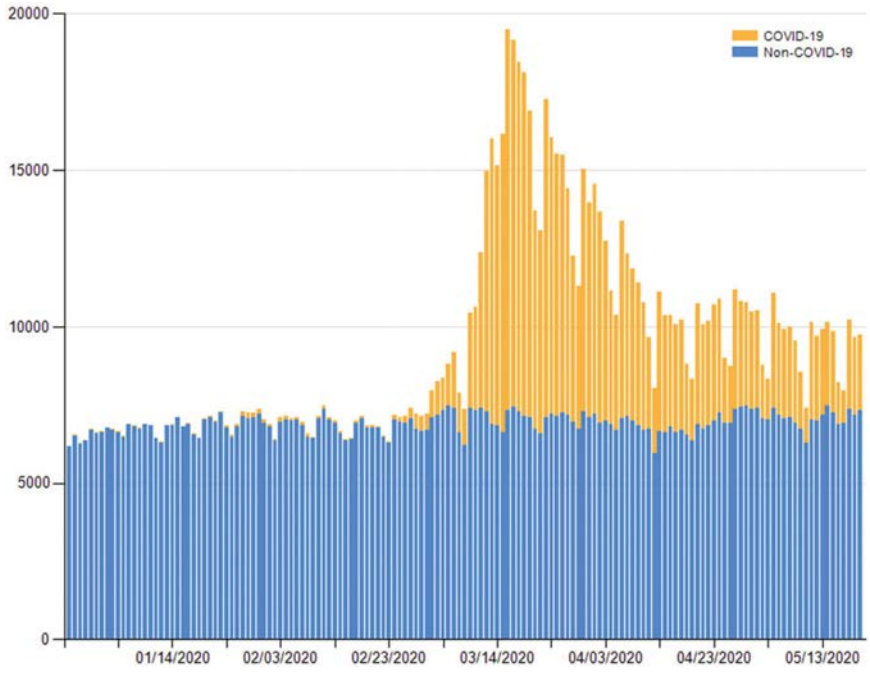

Figure 1(#306). All COVID and Non-COVID Cases by Day via the Special Project Enterprise Report "COVID-19 Case Count" for Closed Exposure & Info Case from 12/26/2019 through 5/20/2020.

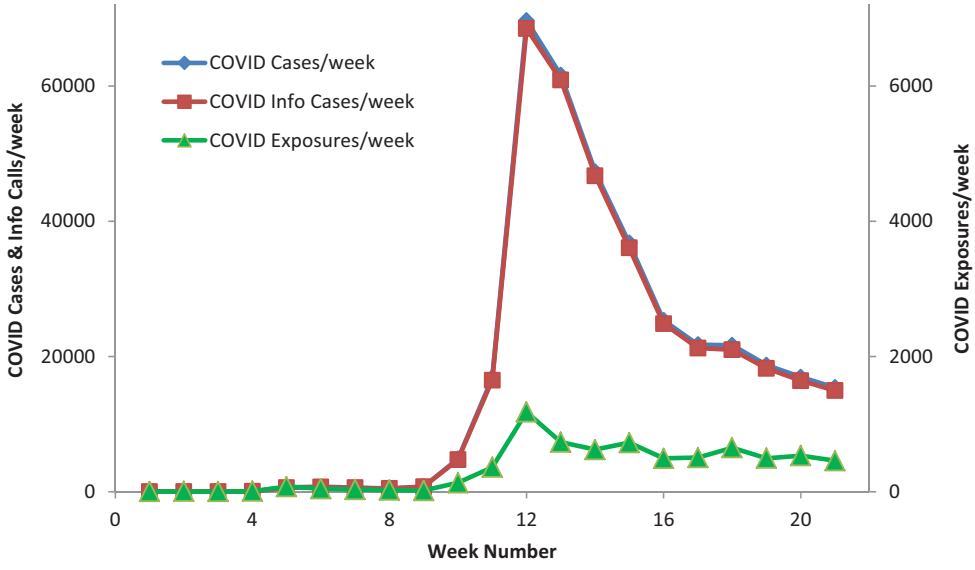

Figure 2(#306). COVID-19 Cases (Exposure + Information Cases) by week (12/26/2019 through 5/20/2020). The peak (68,494 cases) occurs on Week 12 (3/12/2020 – 3/18/2020).

Table 1(#306). Special Project Enterprise Report "COVID-19 Case Count" for Exposure & Information Cases for 1-Jan-2019 through 13-Apr-2020. Mean and maximum calls/day and sum for the 469 days.

Description	Mean (/day)	Mean (/week)	Maximum	Sum	% of Total
COVID -- TOTAL	2,449	17,144	12,142	360,026	100%
COVID, Exposures	48	337	232	7,068	1.96%
COVID, Information+	2,401	16,808	11,977	352,958	98.04%
Non-COVID - TOTAL	6,905	48,334	7,491	1,015,009	100%
Non-COVID, Exposures	5,953	41,671	6,487	875,092	86.22%
Non-COVID, Information+	952	6,663	1,454	139,917	13.78%

Case Count" for Open or Closed Exposure and Information cases 29-Dec-2019 through 20-May-2020 (Figure 1). We examined the contributions of Information and Exposure cases, doubling time of the initial increase in the cases, the half-time of the decrease in cases, and the day of the week contribution. Descriptive statistics and change over time via linear and logarithmic and multivariate regression were via SAS JMP (12.0.1).

Results: For the 147 days (29-Dec-2019 through 20-May-2020) poison centers (PCs) reported 360,026 COVID-19 Exposure and Information cases (COVID Cases), of which 99.69% were closed, and 7068 were COVID-19 Exposures. Most COVID Cases, 352,958 (98.04%), were Information cases (see Table 1). The maximum (peak) of 12,142 COVID Cases occurred on 16-Mar-2020, Week 12

(12-Mar-2020 –18-Mar-2020) (Figure 2). During the upswing (20-Feb-2020 through (16-Mar-2020) COVID Cases increased with a doubling time [95% CI] of 3.01 [2.76, 3.32] days. During the early decline (16-Mar-2020 through 20-Apr-2020), COVID Cases declined with a half-time of 16.5 [14.1, 20] days and during the later decline (20-Apr-2020 through 20-May-2020) with a half-time of 39.8 [22.2, 195] days. During the early decline, the day of the week effect was highly statistically significant (LogWorth =13,0, p< 0.00001) with Sunday < Saturday << Friday < Tuesday < Thursday < Wednesday < Monday.

Conclusions: NPDS case data is not thought of as cases in the traditional public health framework especially since PCs do not have the current capability of case verification (contact tracing). Appropriate resources could add this capacity to PCs – utilizing appropriate resources is realistic. System design such as enhancing cases verification should be developed to build on the near real-time infrastructure of PC data collection. The COVID-19 outbreak is an ongoing challenge requiring continual surveillance through a multidisciplinary approach. NPDS data findings reinforce the substantial utility of poison center signals. This pandemic should serve as a stimulus to public health agencies to collaborate with AAPCC and PCs, especially in the data collection phases.

KEYWORDS COVID-19, Information Cases, Exposure Cases

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307. Neurotoxicity with Resultant Respiratory Failure Secondary to South African Coral Snake Envenomation

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Background: Limited data exists on human toxicity after South African coral snake (Aspidelaps lubricus) envenomation. A previous case report demonstrated systemic toxicity and respiratory failure requiring intubation with resolution of paralysis after 12 hours. We present an additional case of systemic toxicity with respiratory failure after envenomation by the same snake.

Case Report: A 14-year-old male presented to a community hospital after being bit by a captive South African coral snake (reported by owner to be subspecies cowlesi). The snake was attempting to attack the family dog when the patient intervened and was envenomed. He developed immediate tongue swelling, dyspnea, diplopia, and dysarthria, for which he received famotidine, diphenhydramine, and methylprednisolone. He was intubated for respiratory failure and transferred for further care. On arrival, he was sedated but flaccid in the extremities with puncture wounds to his right index finger. Twelve hours after intubation, his paralysis resolved, and he was extubated to room air. The patient was discharged home the following day without persistent neurologic deficits. Local reaction was limited to mild edema and erythema.

His father was envenomed by the same snake a year prior and required intubation for respiratory failure; he had a similar clinical course.

Case Discussion: There are many species and subspecies of African snakes with little experience regarding human toxicity and treatment. There are reported to be two subspecies of Aspidelaps lubricus, which may produce variable effects after envenomation depending on venom composition. The venom from this snake species is reported to contain alpha-neurotoxins that competitively inhibit post-synaptic nicotinic acetylcholine receptors, resulting in muscle paralysis, bulbar paresis, and respiratory failure. However, another case report demonstrated no systemic toxicity after South African coral snake envenomation. Potential for neurotoxicity may depend on the venom composition, which can vary based on diet, or predatory circumstances surrounding the envenomation and the snake's propensity to deliver venom. This specific snake has caused neurotoxicity with resultant respiratory failure in two individuals.

Conclusion: This specific South African coral snake contains neurotoxic venom, and clinical effects of envenomation may vary between the two subspecies. Alternatively, differences in diet or predatory circumstances surrounding the envenomation may contribute to potential neurotoxicity.

KEYWORDS South African Coral Snake, Envenomation, Neurotoxicity

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308. Fatal Ingestion of Sodium Azide Treated with Plasma Exchange

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Background: Sodium azide ingestion is not common but often fatal. There are no known antidotes or recommended treatment modalities in sodium azide toxicity, and the question is raised of risk to healthcare providers in treating these patients. We aim to describe a case of sodium azide toxicity to add to the limited data available for this toxic ingestion.

Case Report: A 19-year-old-male presented to the emergency department two hours after a reported intentional ingestion of 40 mL 5% sodium azide solution. Initial vital signs were notable for tachycardia (160 bpm), hypertension (148/123 mmHg), and tachypnea (25 rpm). Intravenous hydration was initiated, and after 30 minutes, he required norepinephrine infusion for hypotension. He became progressively more tachypneic with worsening mental status. Initial laboratory studies were notable for the following: pHa 7.41, PaCO2 14 mmHg, HCO3a 9 mEq/L, methemoglobin 3.5%, anion gap 27 mMol/L, lactate 12.8 mMol/L. Central venous and arterial access were obtained, and the patient was intubated after pre-treatment with sodium bicarbonate for impending respiratory failure and encephalopathy. He was admitted to the ICU for further care. He was placed on a bicarbonate infusion and evaluated by nephrology. After a multidisciplinary discussion, a hemodialysis catheter was placed, and plasma exchange was performed.

Hemodynamics, metabolic derangements, and vasopressor requirements improved throughout the day. However, 15 hours after arrival, the patient acutely decompensated and required titration of multiple vasopressors for refractory hypotension. Bedside echocardiogram revealed biventricular failure.

Our extracorporeal membrane oxygenation (ECMO) team was consulted, but the patient was not considered a candidate after two episodes of PEA arrest with return of spontaneous circulation. He expired despite resuscitation.

Discussion: This case provides two areas of discussion: exposure of prehospital and hospital personnel to potential toxic metabolites and insight into an unproven treatment modality. The patient called 911 two hours after his overdose; sodium azide is rapidly metabolized to hydrazoic acid, which then dissipates to all tissues. He did not have any episodes of emesis, and there was no evidence of dermal contamination. Thus, the overall risk of healthcare exposure was minimal, as the patient likely fully

expired the hydrazoic acid prior to arrival. Intentional sodium azide toxicity is almost uniformly fatal with no proven treatment options. As a mitochondrial poison, significant metabolic acidosis and multi-organ failure ensue. Despite initial stabilization after plasma exchange, the patient rapidly decompensated and died. It is unclear the exact benefit of plasma exchange, if any. Hemodialysis was unlikely to be beneficial in this patient for two reasons: sodium azide's rapid metabolism and distribution and the stabilization of his metabolic derangements. ECMO was considered, although there is no evidence this intervention would mitigate the toxic effect of this chemical, but the patient suffered from PEA arrest before full evaluation could be performed.
Conclusion: Sodium azide ingestion, if presenting late, poses low risk to healthcare providers. Supportive care remains the mainstay of treatment, and despite other advanced treatment modalities such as plasma exchange, these cases are most often uniformly fatal.

KEYWORDS Sodium Azide, Plasma exchange, Fatal intentional ingestion

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309. Development and Validation of a Case Definition for the Opioid-Associated Amnestic Syndrome

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Background: An opioid-associated amnestic syndrome (OAS) characterized by acute onset memory loss and bilateral hippocampal signal abnormalities on brain imaging in the setting of a history of opioid use, particularly fentanyl, has recently been elucidated. As of yet, there is no case definition to assist emergency physicians and toxicologists in diagnosing this syndrome.
Methods: A collaboration of physicians with backgrounds in emergency medicine, toxicology, radiology, and neurology who have cared for patients with OAS aimed to propose and apply diagnostic criteria for OAS to potential cases that have been published in the medical literature or presented at conferences. Cases were identified by direct discussion with public health authorities, PubMed search using the criteria "(amnesia or amnestic syndrome or hippocampal) and (fentanyl or opioids or cocaine or MDMA or overdose)", and PubMed search using the most frequent medical subject headings (MeSH) among available articles. Publications or presentations through November 2019 were considered. Included cases were defined by new-onset amnesia greater than 24 hours in duration and were considered: "confirmed" if toxicology testing was positive for an opioid and there was bilateral hippocampal injury on brain imaging (CT or MRI); "probable" if there was a known history of opioid use and bilateral hippocampal injury on brain imaging; "possible" if there was either positive opioid toxicology testing, known history of opioid use, or bilateral hippocampal injury on brain imaging. Cases of transient global amnesia (duration of amnesia less than 24 hours) or those attributable to an alternative etiology such as encephalitis were excluded. The percentages of cases that met confirmed, probable, and possible criteria were calculated.
Results: We identified 23 case reports or series accounting for 40 unique cases. Average age was 38 years old. 65% (26/40) were male, 22.5% (9/40) were female, and 12.5% (5/40) did not have a gender reported. All 40 subjects had findings of bilateral hippocampal injury on MRI imaging, which led to the publication of their cases in the literature. 33 subjects had analytical toxicology testing performed and reported; of those, 20 subjects had an opioid detected and fentanyl or a fentanyl analogue specifically in 9 subjects. Of the 20 subjects who did not have analytical testing or had no opioid detected, 10 had a history of opioid use disorder or reported opioid use prior to presenting for care. Therefore, in 75% (30/40) of subjects an opioid potentially contributed to their illness. In cases where there was no opioid reported or detected, the most common alternate exposures were cocaine (6) and cannabinoids (3). Based on our case definition of OAS, 50% (20/40) were confirmed, 25% (10/40) were probable and 25% (10/40) were possible cases.

Table 1(#309). Opioid-Associated Amnestic Syndrome (OAS) Case Characteristics.

Potential OAS cases identified	40
Confirmed OAS case percentage	50% (20/40 cases)
Confirmed OAS case %, unspecified opiate only	10% (4/40)
Confirmed OAS case %, unspecified opiate + other illicit substance(s)	17.5% (7/40)
Confirmed OAS case %, fentanyl (or analogue) only	10% (4/40)
Confirmed OAS case %, fentanyl (or analogue) + cocaine only	7.5% (3/40)
Confirmed OAS case %, fentanyl (or analogue) + polysubstance	5% (2/40)
Probable OAS case percentage	25% (10/40)
Possible OAS case percentage	25% (10/40)

Conclusion: We have validated a proposed formal case definition for OAS that can assist emergency physicians and toxicologists in evaluating patients with amnesia and a history of opioid or substance use.

KEYWORDS Opioid, Amnesia, Hippocampus

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310. "Unintentional" ingestion – regional poison center and toxicology service management of factitious disorder presenting as intimate partner violence and gunpoint-forced warfarin ingestion

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Background: In factitious disorder imposed on self (Munchausen's Syndrome), patients consciously feign illness in order to attain the attention and sympathy associated with being "sick." These patients use aliases and travel between hospitals to intentionally deceive providers and undergo extensive medical workups. When unrecognized, such practices increase morbidity and mortality and place financial and emotional strain on hospital systems. There are no known mechanisms to track patient aliases and care across multiple hospitals within a region, making the disorder notoriously difficult to identify. Additionally, there are few established guidelines for management of factitious disorder within the emergency department.
Case Report: A 49-year old woman with a reported history of prior pulmonary embolism on warfarin and gastric ulcers presented to the emergency department (ED) of an urban academic

hospital (Hospital A) with a chief complaint of abdominal pain. She reported that one day prior her ex-husband had forced her at gunpoint to drink nearly sixty blended tablets of warfarin, and that she had since had multiple episodes of hematemesis. The ED team contacted the regional poison center (RPC). There, the report from Hospital A was identified as very similar to a report about a woman of a different name and similar birthday who presented to a nearby hospital (Hospital B) days prior. While hospitalized at Hospital B the patient's INR increased despite being off of warfarin, elevating suspicion for surreptitious warfarin ingestion. She was also recognized by providers at Hospital B as having previously presented under different names, further indicating deceptive behavior. Following confrontation, the patient had left Hospital B against medical advice (AMA) one day before presenting to Hospital A. The RPC toxicologist shared this information with the patient's physicians at Hospital A, where she had been admitted with an INR of 5.0 for further monitoring and likely esophagogastroduodenoscopy (EGD). Ultimately, her team at Hospital A confronted her about the story and she again left AMA once decisional capacity was established. Through tracking similar cases, the RPC determined that within a two-month period, at least six hospitalizations including multiple procedures were linked to known aliases for the same patient.

Case Discussion: By recognizing patterns amongst ingestion cases, regional poison centers are uniquely positioned to illuminate an early diagnosis of factitious disorder. Such early recognition is critical both in minimizing self-induced and iatrogenic harm to patients and in guiding provider reaction to patient dishonesty. As we learned, patients with factitious disorder tend to abscond if confronted about their behavior. In response to this case, our toxicology service developed a living dossier stored on a secure server which tracks aliases and lab values across hospitals. With this tool, our service is able to share both objective collateral information and proposed management with the patient's care teams. Future management recommendations include avoiding direct confrontation, assuring constant patient observation, and avoiding risky or invasive diagnostic procedures.

Conclusions: Early discovery of factitious disorder via pattern recognition through centralized resources like the regional poison center may help to guide hospital practices and optimize patient care.

KEYWORDS Factitious disorder, Munchausen's, Warfarin

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311. Successful Use of Anavip for Treatment of an Agkistrodon Envenomation

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Introduction: Anavip is a lyophilized F(ab')2 immunoglobulin fragment derived from horses immunized with venom from Bothrops asper and Crotalus durissus. It was approved by the FDA in 2015 for treatment of North American rattlesnake envenomation but notably not approved for treatment of Agkistrodon spp. envenomation. Published data regarding the efficacy and safety of Anavip in treating Agkistrodon spp. envenomations is limited to in vitro studies and a small number of patients treated as part of a prospective, blinded, randomized, controlled clinical trial of Anavip. We present a case of a patient successfully treated with Anavip after confirmed Agkistrodon contortrix contortrix envenomation.

Case Details: We present the case of a man in his late 70's with coronary artery disease, diabetes, and a history of two previous snake envenomations (both treated with Antivenin (Crotalidae) Polyvalent, Wyeth, equine derived whole IgG antivenom) who was bitten on his non-dominant fifth finger by a captive Agkistrodon contortrix contortrix. He rapidly developed severe pain and swelling in the finger and was taken to a local emergency department arriving 3 hours after the time of envenomation. The patient complained of diaphoresis, pain, nausea, and vomiting. Exam at that time was notable for 2 puncture wounds to the dorsum of the finger and erythematous swelling circumferentially around the finger progressing to the ulnar styloid process. His extremity was elevated and initial coagulation studies were drawn which subsequently returned normal. The only snake antivenom available at this facility was Anavip; the patient received a 10 vial loading dose shortly after arrival without any adverse reaction. He also received morphine, hydromorphone, ondansetron, intravenous fluids, and a tetanus booster before being transferred to a nearby academic tertiary referral hospital. He arrived at the receiving facility 5 hours after envenomation. His pain had improved and his erythematous swelling had not progressed past the boundaries marked at the initial healthcare facility. His troponin was noted to be elevated and he was diagnosed with a non-ST elevation myocardial infarction which was treated with medical management. Over the next 36 hours, his platelets demonstrated a slow downward trend to a nadir of 132 for which he received an additional 4 vials of Anavip. The remainder of his hospital course was unremarkable. By 2 weeks post-envenomation, his symptoms had largely resolved and by his 3 month follow-up his hand was completely back to normal.

Discussion: We present a case of Agkistrodon contortrix contortrix envenomation successfully treated with the off-label use of Anavip antivenom. There was no progression of swelling or pain following the initial loading dose of 10 vials of Anavip. He received an additional 4 vials for developing thrombocytopenia. Published data and clinical experience outside of the United States suggests Anavip should be efficacious in the treatment of Agkistrodon spp envenomation.

Conclusion: This case provides an additional published datapoint suggesting Anavip shows promise as an efficacious and safe treatment for envenomation by Agkistrodon spp.

KEYWORDS Antivenom, Agkistrodon, Anavip

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312. Management of severe childhood lead poisoning: usefulness of monitoring zinc protoporphyrin (ZPP) during chelation therapy

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Background: It is unclear which biomarkers besides venous blood lead level (BLL) are clinically useful in assessing progress in severe childhood lead poisoning (SCLP), defined as BLL >45 μg/dL (CDC reference value is <5 ug/dL). While BLL reflects recent exposure history, it may not characterize completely the duration

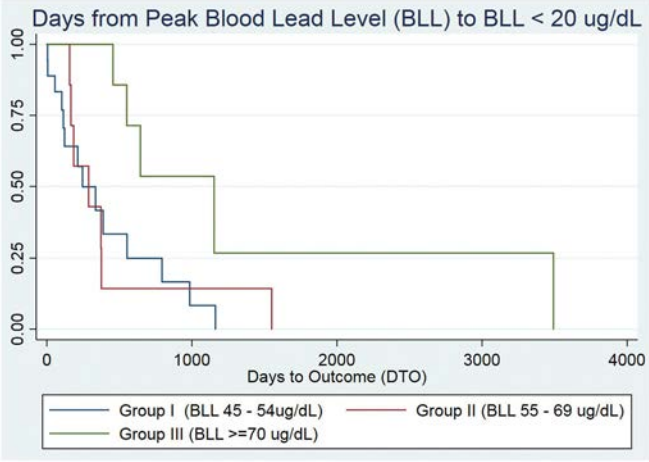

Figure (#312).

of exposure. Another biomarker, zinc protoporphyrin (ZPP; a measure of lead's effect on hemoglobin synthesis or, alternatively, the lack of iron in a deficiency state) can assess high intensity, longer-term lead exposure and its toxic cellular effects. The usefulness of ZPP in monitoring progress in SCLP has not been fully described.

Aim: We sought to determine whether ZPP correlates with changes in BLL over time in children with SCLP and can be used to assess DTO ("days to outcome' defined as duration from peak BLL to BLL <20 μg/dL).

Methods: Medical records of children <21 years old admitted to the hospital from 2005-2017 with BLL >45 μg/dL were reviewed including demographics, BLL (initial, peak, and serial levels during monitoring), ZPP (normal <70), hospital length of stay (LOS), chelation courses, and DTO. Patients were clustered into 3 groups based on BLL: Group I (45–54 μg/dL), Group II (55–69 μg/dL), and Group III (>70 μg/dL). DTO was contrasted between groups using multivariate models and compared to time to ZPP normalization.

Results: Thirty-six children (53% female) met entry criteria. Mean age was 3.5 yrs (range: 1 yr–15 yrs). Of these, 33% were white and 67% were black or "other," and 69% of families had public insurance. Mean peak BLL was 65 μg/dL (range: 45–216 μg/dL). Mean peak ZPP was 439 (range: 34–2279). Peak ZPP correlated with peak BLL ($r = 0.50$; $p < 0.002$). Children received between 1–23 courses of chelation. Mean LOS and number of chelation cycles was 6 days [range: 0–11] and 4.5 cycles [range: 1–13] for Group I, 9 days [range: 6–16] and 5.3 cycles [range: 2–17] for Group II, and 17 days [range: 8–41] and 11.3 cycles [range: 2–23] for Group III. In multivariate models, mean DTO was less for Group I (302 days) than Group II (442 days; $p < 0.002$) or Group III (1259 days; $p < 0.03$) and correlated well with ZPP normalization (349 vs. 436 vs. 556 days; $r = 0.71$; $p < 0.002$).

Discussion: In this study, peak and trends in BLL correlated with ZPP. Group assignment by peak BLL predicted both hospital LOS and total number of chelation cycles. Mean DTO was less in this study (389 days for 18 children with BLL 45-54 μg/dL) than in previous studies of children with BLL 25–29 μg/dL (730 days in one study) and children with BLL >45 μg/dL (825 days in another study), although in both of those studies the end-point was 10 μg/dL. ZPP is useful to monitor the progress in SCLP and can predict re-exposure events and the duration of therapy and monitoring needed to reach BLL <20 μg/dL.

KEYWORDS lead, plumbism, zinc-chelated protoporphyrin

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313. Trends in Intentional Substance Abuse by Adolescents Aged 11-18 Reported to US Poison Centers from 2013-2018

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Background: Intentional substance abuse by adolescents is common, can have serious consequences, and includes a wide variety of substances such as prescription medications (Rx), over-the-counter medications (OTC), illicit drugs, and non-drug substances. Previous literature published in 2013 focused on Rx and OTC intentional abuse exposures reported to US Poison Control Centers (PCCs). This study describes the trends in demographics, substance(s), and medical outcomes of intentional substance abuse exposures by adolescents aged 11-18 years reported to US Poison Control Centers (PCCs) from 2013-2018.

Methods: A retrospective review of intentional substance abuse exposures by adolescents aged 11-18 years old reported to PCCs from 2013-2018 was performed. Exposures were excluded if the following medical outcomes were coded: a) confirmed non-exposure and b) unrelated effect- the exposure was probably not responsible for the effects. This study was reviewed by our institutional review board and deemed non-human subject research. Statistics were descriptive in nature and performed by Microsoft Excel and SPSS.

Results: A total of 64,131 exposures were identified after exclusion criteria was applied. The average number of substances involved in an exposure was 1.3 (SD 0.7). The median patient age was 16 years (IQR 15-17 years), and the mean patient age was 15.8 years (SD 1.6 years). The sample was 36.4% female.

Pharmaceutical and illicit drugs were the most common substances abused by adolescents during the study period and included benzodiazepines (n = 5,594, 8.7%), ethanol (beverages) (n = 5,163, 8.0%), dextromethorphan preparations (not otherwise classified) (n = 4,725, 7.4%), marijuana: dried plant (n = 4,346, 6.8%), and synthetic cannabinoids, analogs and precursors (n = 3,735, 5.9%).

The number of exposures that included a non-drug substance was 5,217 (8.1%). The most common non-drug substances were freon and other propellants (n = 793, 1.2%), hand sanitizers: ethanol based (n = 436, 0.7%), plants: hallucinogenic (n = 368, 0.6%), gasolines (n = 303, 0.5%), mouthwashes: ethanol containing (n = 217, 0.3%), and other chemicals (n = 247, 0.4%). Non-drug substances were involved in 20.0% or more of exposures in patients 11 and 12 years old (28.0%, 20.0% respectively) compared to less than 10.0% in patients 14 years and older.

The most common medical outcomes, accounting for 74.6% of all exposures, were moderate effect (n = 21,109; 32.9%), minor effect (n = 20,164; 31.4%), and unable to follow, judged as a potentially toxic exposure (n = 6,592; 10.3%). The most common outcome for ages 11-15 years old was minor effect (range 28.1-33.8%). The most common outcome for ages 16-18 years old was moderate effect (range 34.3-36.5%).

Overall 141 fatalities (direct and indirect) were reported. The most common single substance exposures resulting in death were fentanyl (prescription) (n = 14, 0.02%), hallucinogenic amphetamines (n = 9, 0.01%), miscellaneous unknown drugs (n = 6, 0.009%), ethanol (beverages) (n = 5, 0.008%), and heroin (n = 5, 0.008%).

Conclusion: The most common substances involved in adolescent intentional abuse exposures reported to US PCCs included benzodiazepines, dextromethorphan preparations (not otherwise classified), and ethanol (beverages). As patient age increased,

exposures to non-drug substances decreased and exposures to pharmaceuticals increased. Additionally, as patient age increased, medical outcomes increased in severity.

KEYWORDS adolescent, substance abuse, poison control centers

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314. Implication of Nicotine's Postmortem Redistribution Post Fatal E-liquid Ingestion

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Background: Postmortem redistribution is an alteration of drug concentrations that occurs after death. Many substances may undergo redistribution, including nicotine. We present a child fatality following an e-liquid ingestion and dermal exposure in which the postmortem redistribution phenomenon may have played a role in the reported autopsy level.
Case Report: A 17-month-old male was rushed to the ED after the child was found unresponsive and cyanotic, with e-liquid around his mouth and covering his hands. EMS arrived at the scene and determined he was in asystole; CPR was performed in route to the hospital. Once in the ED, multiple doses of epinephrine were administered. The time and amount ingested were unknown, but the child had a nearly empty bottle of e-liquid lying next to him. The bottle contained 18 mg/mL of nicotine and was 16.5 mL in volume. The toxicology report showed that the child had nicotine and caffeine blood levels of 0.3 mg/L and 0.222 mg/L, respectively. The source was whole blood via the subclavian artery approximately 14 hours after the pronounced time of death. There were no other confounding findings on autopsy.
Case Discussion: Postmortem redistribution is not an exact science. Central to peripheral blood concentrations have been used to predict the occurrence of PMR. Substances with higher C/P ratios have been correlated with undergoing PMR. Multiple mechanisms have been postulated which involve passive diffusion, cell lyses, acidification, and putrefaction. Other factors may also contribute to the extent of PMR such as the physiochemical properties of a substance, temperature, body position, route of exposure and when the samples were collected. However, there is no distinct relationship between these factors and PMR. Samples obtained from various tissues in one case report of a liquid nicotine overdose showed that the heart, kidneys, and lungs may be sites of redistribution as these had higher nicotine concentrations than the peripheral blood postmortem. Several other cases of nicotine overdoses have correlated that the cardiac concentrations have been about 3 times greater than that of femoral concentrations. Although the patient in our case had clinical effects potentially related to a nicotine overdose, the peripheral blood concentration was low, and questions were raised concerning the cause of death. Transdermal absorption has been found to be possible with e-liquids, thus it is plausible to assume that there was at least some dermal absorption from the child's hands before his death that should have elevated the blood concentration. Unfortunately, central concentrations were not obtained, but PMR helps to explain the discrepancy between the nicotine level and the proposed cause of death.
Conclusion: Blood concentrations of drugs that have been collected after death may be misleading as they may not represent the concentration of drug in the system at the time of death. When correlating a substance to the cause of death and interpreting toxicology reports, it is pertinent to be aware of the substances that may undergo postmortem redistribution, its properties, and the site of collected samples.

KEYWORDS liquid nicotine, postmortem redistribution, child fatality

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315. Role of Respiratory Symptoms in Assessing Risk for Serious Injury Among Young Children Who Accidentally Ingest Liquid Laundry Detergent Packs

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Background: US Poison Centers (PCs) are routinely consulted in response to unintentional ingestions involving Single Use Liquid Laundry Detergent Packs (LLDP). Although published case series have shown that most young children do not experience serious injury, a significant proportion of patients (>40%) are managed in a healthcare facility (HCF). Data from an ongoing prospective study involving 12 regional PCs (serving ~24% of the U.S. population) indicate that the rate of moderate/major medical outcome has been stable across the product category since 2016 (mean 1.2%). We seek to further investigate the role of respiratory symptoms in assessing risk for serious injury during this timeframe among young children treated in an HCF.
Methods: LLDP ingestion cases involving young children (aged <6 years) who were evaluated in a healthcare facility (HCF) from 2016-2019 were extracted from the study database. The case narrative was reviewed to verify the accuracy and inclusivity of standard coded fields (clinical effects, therapies, medical outcome, management site) as well as information relevant to the patient's clinical course (diagnostic procedures, duration/severity of clinical effects, etc.). Multi-route exposures were assigned a 'primary route' based on the patient's clinical presentation and exposure history. Coding discrepancies involving a moderate or major medical outcome were reconciled with the contributing PC.
Results: During the period of analysis (2016-2019), PC study sites reported 8,018 accidental childhood ingestions (age <6 years), of which 31% (N = 2,463) were managed in a healthcare facility (HCF). The majority of HCF patients (73.3%) did not consult the PC prior to arrival and most (95.9%) experienced no more than minor clinical effects. Overall, 23.8% (N = 587) of patients experienced respiratory symptoms; however, this proportion was higher (37.9%) for patients who were referred by the PC (n = 657). The most commonly respiratory symptoms included cough/choke (n = 478, 19.4%), other (n = 97, 3.9%), and bronchospasm (n = 57, 2.3%).
Among HCF patients followed to a known medical outcome (N = 2199, 89.3%), the proportion who experienced a Moderate (n = 89) or Major (n = 2) outcome was significantly higher among patients with respiratory symptoms (14.1%) vs those without respiratory symptoms (0.9%). Among the 15 patients with Moderate outcomes and no respiratory symptoms, roughly half (n = 8) were escalated due to concern for persistent vomiting and dehydration and 9 patients were scheduled for endoscopy in response to physical exam findings (throat irritation, excessive drooling, discolored emesis). Endoscopy findings were described as 'normal' in 5 patients and the remaining were noted to involve 'minor irritation' (n = 3) or a 'minor burn' (n = 1). One (1) patient was described as 'listless', however recovered within 8 hours of receiving IV fluids and food.

Conclusion: Young children who lacked respiratory symptoms after ingesting an LLDP product were unlikely to experience serious injury. Given the relative high proportion of children who are managed in an HCF, additional efforts to ensure the regional poison center is consulted by the caregiver prior to seeking emergency medical assistance are needed.

KEYWORDS Liquid Laundry Detergent Packs, Pediatric Exposures, Respiratory Effects

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316. Develop a High-Resolution Mass Spectrometry Method for Fentanyl Analog Screening

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Background: The overdose of illicitly manufactured synthetic opioids, including fentanyl and analogs, has escalated significantly in the US in recent years. In clinical practice, synthetic fentanyl analogs could be undetectable by either immunoassay or LC-MS/MS methods with a limited library. In some cases, symptoms were consistent with an opioid overdose and resolved with naloxone treatment without any drug culprits identified with routine testing. To address these issues, the Centers for Disease Control and Prevention developed Traceable Opioid Material Kits to support laboratory detection of current and emerging opioids.
Objectives: The objective of this project was to use the CDC fentanyl analog screening (FAS) kit to develop a high-resolution mass spectral (HRMS) FAS library and validate our routine comprehensive drug-testing method for limit of detection (LOD) and matrix effects (ME) in urine and serum for the 150 synthetic fentanyl analogs/opioids. The resulting library and validated method were further evaluated for their capability to identify synthetic opioids in routine clinical.
Methods: The FAS kit (Cayman Chemical) includes 150 synthetic fentanyl analogs /opioids. Chromatographic separation was performed using a Kinetex C18-column with a 10-minute gradient from 2%-100% organic; and data was collected on a SCIEX TripleTOF®5600 operating in positive-ion mode using a TOF-MS survey scan with IDA-triggered collection of product ion spectra. Urine samples were prepared by a 1:5 dilution in mobile phase, and serum samples were prepared by protein precipitation with acetonitrile. LOD was evaluated by duplicated injections of compound standards at different concentrations in drug-free urine and serum samples. LOD was defined as the lowest concentration for a compound identified with a combined score >70% and signal-to-noise ratio >20:1, in duplicate injections. ME were determined by spiking drug standards into drug-free urine (10 ng/mL) or pooled drug-free serum (2.5 ng/mL) of six healthy subjects in triplicates, and comparing to those spiked into water.
Results: A mass spectrum was acquired and added to our in-house HRMS library for all analytes in the FAS kit. The LODs ranged from 0.5-10 ng/mL (median, 2.5 ng/mL) in urine and 0.25-2.5 ng/mL (median, 0.5 ng/mL) in serum. ME was significant for a select few analytes which is to be expected given the simple sample preparation techniques used (dilution or protein precipitation). They ranged from -79%–86% (median, -37%) for urine and -80%–400% (median, 0%) for serum. We used this method to examine drug products, past clinical toxicology cases, and urine samples that screened positive by a fentanyl immunoassay in the emergency department. Our preliminary study has identified >10 fentanyl analogs from drug samples and clinical cases. Further analysis of the acquired spectrum revealed characteristic fragmentation patterns based on their structure that can be used for structure elucidation and compound identification by laboratories that do not have access to the FAS kit.
Discussion: We developed and validated an LC-HRMS method for FAS. The method can now be used to retrospectively and prospectively analyze cases of suspected fentanyl exposure, which will aid in furthering our understanding of the ongoing opioid epidemic.

KEYWORDS Fentanyl analogs, high-resolution Mass spectrumetry, Synthetic opioid crisis

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317. Emergency Provider Practices and Attitudes Around Naloxone-Prescribing in an Academic Emergency Department

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Background: Opioid-related mortality has risen nationally from 8,050 overdose deaths in 1999 (2.9 per 100,000) to 42,249 (13.3 per 100,000) in 2016. Naloxone reverses opioid overdose with little adverse effect yet is not universally prescribed, even to those with opioid use disorders. Emergency Department health care providers (physicians and advanced practice providers) are in a unique position to identify and treat opioid-related injury. We hypothesized that ED providers have varying naloxone-prescribing behaviors, and barriers to naloxone-prescribing are multifactorial.
Methods: A survey was designed to assess attitudes and experiences of ED providers regarding naloxone prescribing practices. The survey was emailed to providers at one urban academic emergency department. Descriptive statistics were performed.
Results: Survey response rate was 29% (36 of 124). Respondents were 69% (n = 25) males and 31% (n = 11) female which included 27 attending physicians, 7 residents, and 2 physician assistants. Ninety-four percent of respondents expressed openness to prescribing naloxone from the ED, but only 58% indicated that they have done so before. Six percent of providers believed that when given increased access to naloxone, people who abuse opioids will increase their opioid use, and 6% of providers expressed concern about laypersons' abilities to properly administer naloxone. Time constraints in the ED were cited by 39% of providers as a barrier to discussing proper naloxone use with patients, and 25% indicated that they did not feel that they could properly educate patients on naloxone use.
Conclusions: In a survey study of ED providers at an urban academic ED, the majority of providers are open to prescribing naloxone, yet almost half have not done so. Barriers to naloxone-prescribing to ED providers include concerns about increased risky opioid-use behavior in patients, lack of providers' own knowledge, and logistical barriers such as lack of time. More information is needed to gauge the impact of individual barriers to prescribing naloxone, but these findings may inform opportunity for provider education as well as designing pathways to increase naloxone-prescribing in EDs.

KEYWORDS naloxone, emergency medicine, prescribing

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318. Physician Attitudes on Buprenorphine Induction in the Emergency Department: Results from a Multistate Survey

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Objectives: Emergency Departments are rapidly becoming an important location for initiation of buprenorphine (EDBUP) for the treatment of opioid use disorder (OUD). Even so, there still exists a substantial treatment gap as only a minority of emergency departments have implemented EDBUP programs. Federal and state agencies have attempted to reduce this gap with increased access to buprenorphine; however, it's unclear if such interventions address specific physician attitudes to EDBUP and perceived barriers. Previous investigations of emergency medicine physicians exclusively sampled from urban, academic-affiliated physicians. We administered a multistate survey to an institutionally and geographically diverse collection of emergency medicine physicians to the characterize perceived attitudes and barriers to EDBUP implementation across a variety of practice settings.

Methods: This cross-sectional survey study used an online survey instrument to convenience sample emergency medicine physicians. The survey instrument was generated by our research team and drew from our professional experiences implementing and managing EDBUP programs. We also adapted questions from previously described surveys of ED provider attitudes towards other health interventions (e.g. naloxone distribution and HIV testing programs). Questions addressed providers attitudes towards the role of EM physicians in addressing the opioid crisis, support for specific harm reduction strategies (naloxone, non-opioid symptom treatment, MAT), and comfort with EDBUP. The survey also addressed possible operational and knowledge-based barriers to implementation of EDBUP. Demographic questions and questions about practice setting were also included. A survey question addressed whether the respondent had a close relationship with someone affected by substance use disorder. The survey instrument was piloted by physicians in our department outside our research group and reviewed by an expert in survey design. In order to sample from various practice environments, participants were identified from (1) statewide ACEP chapters from CO, MS, OR, WI and (2) Facebook groups exclusive to emergency medicine physicians. The survey explored physicians' attitudes of EDBUP adoption and the perceived barriers to doing so.

Results: 162 emergency medicine physicians completed the survey. Overall, 76% of respondents agreed that emergency medicine physicians should offer EDBUP. When stratified by practice setting and X-waiver status; 96% of X-waivered physicians, 34%

Table 1(#318). Respondent Demographics.

	ACEP Chapters	Facebook Group	Total
Sex			
Male	43/50 (86%)	44/96 (46%)	87/146 (60%)
Female	7/50 (14%)	51/96 (53%)	58/146 (40%
Non-binary	0 (0%)	1/96 (1%)	1/146 (.1%)
Age Median (IQR)	46 (37-61) years	38 (36-43) years	41 (36-47) years
Rural Practice	3/50 (6%)	8/98 (8%)	11/148 (7%)
Academic	9/49 (18%)	31/98 (32%)	40/147 (27%)
Critical access	7/50 (14%)	12/98 (12%)	19/148 (13%)
Years out of training			
0-4	10/50 (20%)	29/97 (30%)	39/147 (27%)
5-10	10/50 (20%)	43/97 (44%)	53/147 (36%)
>10	30/50 (60%)	25/97 (26%)	55/147 (37%)
Have an X waiver	10/52 (19%)	39/108 (36%)	49/160 (31%)
Buprenorphine at your hospital	9/52 (17%)	40/108 (38%)	49/160 (31%)
Personally affected by substance use disorder	29/50 (48%)	50/98 (51%)	79/148 (53%)

Table 2(#318). Attitudes.

	Overall	X waiver		Rural		Academic		Critical Access		EDBUP program	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
EM providers **should offer buprenorphine** to help control the symptoms of opioid withdrawal and craving	119/156 76%	49/49 100%	70/107 70%	7/11 64%	108/137 79%	38/40 95%	76/107 71%	13/19 68%	102/129 79%	47/49 96%	67/100 67%
EM providers **should offer non-opioid medications** to help control symptoms of opioid withdrawal and craving	151/155 97%	47/49 96%	104/106 98%	10/11 91%	133/136 98%	39/40 98%	103/106 97%	19/19 10%	124/128 97%	48/49 98%	96/99 97%
EM providers **should talk to patients about concerning opioid use**	156/156 100%	49/49 100%	107/107 100%	11/11 100%	137/137 100%	40/40 100%	106/106 100%	19/19 100%	129/129 100%	49/49 100%	100/100 100%
EM providers **should reduce prescribing of opioid medications**	145/156 93%	46/49 94%	99/107 93%	10/11 91%	128/137 94%	40/40 100%	97/107 91%	18/19 95%	120/129 93%	47/49 96%	92/100 92%
EM providers **should prescribe home naloxone**	136/155 88%	47/49 96%	89/106 84%	10/11 91%	119/136 88%	40/40 100%	88/106 83%	17/19 89%	112/128 88%	47/49 96%	82/99 83%
EM providers should **identify patients with opioid use disorder (OUD)**	151/156 97%	49/49 100%	102/107 95%	11/11 100%	132/137 96%	40/40 100%	102/107 95%	17/19 89%	126/129 97%	49/49 100%	95/10 95%
I am comfortable **using buprenorphine to treat acute opioid withdrawal in the ED**	89/156 57%	46/49 94%	43/107 40%	6/11 55%	82/137 60%	31/40 78%	56/107 52%	9/19 47%	79/129 61%	43/49 88%	46/100 46%
I am **comfortable initiating buprenorphine** for patients who are continuing it after discharge for the purpose of entering treatment	83/156 53%	47/49 96%	36/107 34%	6/11 55%	76/137 56%	29/40 73%	52/107 49%	9/19 47%	73/129 57%	41/49 84%	42/100 42%

Table 318. Barriers.

	Overall		
Barrier	No barrier	Moderate barrier	Significant barrier
There is **no reimbursement for me**	132/153 86%	15/163 10%	6/153 4%
I don't have **access to providers for follow up** in my area	36/155 23%	56/155 36%	63/155 41%
There's **no financial incentive for my department**	123/154 80%	21/154 14%	10/155 6%
It takes **too much of my time**	76/154 49%	64/154 42%	14/154 9%
I **don't have social work resources** for screening and follow up	50/154 32%	59/154 38%	45/154 29%
I **don't have training**	65/154 42%	49/154 32%	40/154 26%
I **don't have buprenorphine in my ED**	85/155 55%	23/155 15%	47/155 30%

of non-X-waivered physicians, 73% of academic physicians, and 49% of non-academic physicians felt comfortable initiating EDBUP. Lack of access to outpatient MOUD referral was the most frequently cited barrier to EDBUP across all practice settings. Individual as well as department financial incentive was the least cited barrier to EDBUP.

Conclusions: This is the first characterization of attitudes and barriers toward EDBUP implementation within various practice environments. An institutionally and geographically diverse group of emergency medicine physicians endorsed substantial support for EDBUP. Similarly, emergency medicine physicians practicing in different clinical environments endorsed similar barriers to EDBUP implementation. Future initiatives should focus on supporting workflow and increasing options for patient follow up, as well as continuing to support provider training.

KEYWORDS Buprenorphine, Emergency Department, Opiate Substitution Treatment

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