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ABSTRACTS

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Platforms: 1–20; Posters: 21–316

1. Cyanide blood concentrations and clinical signs in patients after smoke inhalation in fire: Results of the European RISK Study

Thomas R. Zilker, Ernst M. Koch

RISK Study Group

Background: Hydrogen cyanide (HCN) intoxication may cause or contribute to many fatalities among fire victims. A rapid diagnostic method is missing which could tell if HCN poisoning is relevant. Thus the European RISK-study was carried out to relate blood cyanide concentrations in victims of smoke from fires with characteristic clinical symptoms.
Methods: The study was performed in hospitals and emergency departments in Belgium, France, Germany, Italy and Spain. The study centers received case report forms, and material needed for shipment of refrigerated (4°C) or frozen blood samples. The samples were sent to a reference laboratory for the determination of HCN. The following inclusion criteria were used: Closed-space fire, soot deposits, altered neurological status, blood sampling prior to antidote treatment. The study protocol did not demand any further invasive or therapeutic measures.
Results: 102 patients (f:39, m:63) were included. There were no blood samples available in 2 cases. One patient with an extremely high level of Cyanide (195.6 µmol/l) was statistically rated as outlier. In 25 patients the cyanide concentration in blood was below the detection limit of 1.2 µmol/l. The average of the cyanide levels above the detection limit ($n = 74$) was 13.9 ± 25 µmol/l (95% CI: 8.1–19.7). By comparing the mean blood cyanide concentrations there were significantly higher levels in patients with absent pulse, respiratory arrest, confusion, dyspnea, and convulsions. A correlation between GCS score and cyanide levels could be shown ($p < 0.01$). It could be found that cyanide poisoning could be expected if soot particles can be detected in multiple places. Confirmed correlation also existed between COHb and HCN levels ($p < 0.001$). 60% of the patients could escape from the fire of their own, 39% had to be rescued. A significant difference was calculated between these two groups for age ($p = 0.02$), cyanide levels (6.2 vs 24.1 µmol/l ($p < 0.001$), GCS ($p < 0.01$), COHb ($p < 0.001$) and soot deposit ($p < 0.001$). There was a significant difference between the cyanide levels of patients in Germany compared with patients from other countries (24.6 vs 7.6 µmol/l).
Conclusion: There are some characteristic clinical signs which may indicate a cyanide intoxication of patients who have been exposed to fires with smoke. There appears a particular danger of cyanide poisoning in patients who could not escape on their own. Those victims should be treated immediately with hydroxocobalamine as an antidote. Elevated COHb is also an indication for this treatment. The difference in the cyanide concentrations may be due to furnishing and equipments.
Keywords: Cyanide, Cyanide, Smokeinhalation

2. Nicotinic receptor antagonists protect the neuromuscular junction after acute parathion poisoning

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Background: Organophosphorus (OP) poisoning causes inhibition of acetylcholinesterase and an increase of acetylcholine throughout the cholinergic system and at the neuromuscular junction (NMJ). Current therapy targets only the muscarinic effects. Prolonged muscle weakness (termed the intermediate syndrome) after initial resuscitation causes significant morbidity, and is thought to be due to persistent nicotinic receptor (nAChR) activation.
Objectives: To determine the effect of nAChR antagonism with rocuronium or pancuronium on NMJ structure in a 24-hour critical care swine model of severe parathion poisoning.
Methods: Minipigs were intubated, ventilated, and instrumented with arterial and venous catheters. At time zero and every 4 hrs a muscle biopsy was taken and frozen in isopentane. Arterial blood to quantitate parathion, metabolites, and lactate was taken hourly. At $t = 0$ pigs were given 4x the rat IV LD50 of parathion. To mimic a clinical scenario, when mean arterial pressure (MAP) reached 55 mmHg, bolus doses of atropine, 2-PAM, and diazepam were given IV, followed by continuous infusion of atropine and intermittent doses of 2-PAM and diazepam. Norepinephrine was used to maintain a $MAP > 55$ mmHg. Animals were randomly assigned to receive either saline placebo ($n = 4$), rocuronium 2.5 mg/kg IM every hour ($n = 4$), or pancuronium 0.5 mg/kg IM every 2 hours ($n = 3$). Clinical NMJ function was determined every 30 minutes by acceleromyography. Muscle samples were stained with bungarotoxin to visualize nAChR. nAChR dispersal (a quantitative measure of functional nAChR) was performed blinded to treatment allocation. Animals were euthanized 24 hours after poisoning.
Results: All animals survived to 24 hours. There was no statistically significant difference in the amount of norepinephrine needed among the groups. There was no difference in area under the curve for lactate. Animals that received rocuronium or pancuronium had a statistically significant preservation of NMJ structure compared

to animals that did not receive rocuronium ($P < 0.05$ for rocuronium vs placebo; $P < 0.01$ for pancuronium vs placebo).
Conclusion: In this realistic minipig model of severe parathion poisoning, comprehensive medical treatment with atropine, norepinephrine, 2-PAM, and diazepam, combined with the nAChR antagonists rocuronium or pancuronium resulted in preservation of the NMJ. Further research examining the functional and clinical effects of such NMJ preservation in long-term animal models is underway.
Keywords: Pesticide, Organophosphate, Nicotinic

3. Medical toxicologist practice regarding drug-induced QTc prolongation in overdose patients: a survey in the United States of America, Europe, and Asia Pacific region

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Objective: To describe knowledge and practices of medical toxicologists in the USA, Europe, and Asia Pacific Region (APR) regarding management of drug induced QTc prolongation (QTcP) and torsades de pointes (TdP) in overdose.
Methods: A survey was developed based primarily on guidelines published by the American Heart Association (AHA), American College of Cardiology (ACC), and European Society of Cardiology (ESC). It was reviewed by our research committee and the American College of Medical Toxicology (ACMT). We contacted the ACMT, European Association of Poisons Centres and Clinical Toxicologists, and Asia Pacific Association of Medical Toxicology to electronically disseminate the survey to their members (physician toxicologists only) in the USA, Europe and APR.
Results: The survey was emailed to 616 medical toxicologists (physicians only) (449-USA; 98-Europe; 71-APR). The overall response rate was 37% (228/616) (35.9%USA; 30.6% Europe; 52.1% APR). Thirteen toxicologists from Europe and APR used the QT nomogram (8) or QT alone (5), and not the corrected QT (QTc) to determine risks of developing TdP. Thus, only 215, who used QTc, could proceed through the remainder of the survey. Most respondents (53.8%) did not calculate QTc manually and based decisions on the electrocardiogram machines automated measurement. For those who corrected the QT interval themselves, the most common formula used was still Bazett's (41.0%).

Using an overdose scenario of a male patient with a QTc of 560 ms, heart rate (HR) of 90 beats/minutes (bpm), 58.9% (122/207) would not recommend administering IV MgSO4. Interestingly, 45.4% (88/194) and 36.6% (71/194) believed IV MgSO4 could shorten QTc and prevent TdP, respectively, though existing evidence showed that MgSO4 could prevent TdP without shortening the QTc. In addition, almost 90% thought giving 1–2 boluses of IV MgSO4 was safe, even when serum Mg was not available. In regards to cardiac pacing, patients with QTcP and TdP, only 37.6% of the participated toxicologists answered in agreement with AHA/ACC/ESC recommendations. Surprisingly, 8.2% would pace when "QTc > 500 ms with HR < 60 bpm". On the other hand, 21.1% would not pace a patient at all regardless of TdP development.
Conclusions: This survey was conducted in a cohort of medical toxicologists in 31 countries from 4 continents. The results indicate that knowledge and management practice on QTcP and TdP vary widely and sometimes can be harmful. Evidence-based guidelines need to be developed and disseminated globally among medical toxicologists to manage these common conditions in overdose.
Keywords: QT prolongation, Torsade de Pointe, Overdose

4. Long-term outcomes following deliberate self poisoning: A 10-year longitudinal population-based Study

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Background: Suicide is a leading cause of death in North America and deliberate self-poisoning (DSP) is the leading method of attempted suicide. In contrast with more violent methods, DSP has a high survival rate, providing a unique opportunity for secondary prevention. We sought to explore recidivism and long-term mortality risk following an index DSP event in a population of 13 million people.
Methods: Using linked healthcare databases, we identified all patients presenting to hospital for DSP (ICD-10 codes T36–65, T96, T97) between 2002 and 2012 in Ontario, Canada. Volition was confirmed using external cause of injury codes. To limit the analysis to first instances of DSP, we excluded all subjects with any poisoning episode in the preceding 10 years. We obtained detailed demographic and clinical data from the index admission on study subjects, through the end of study or death, and compared relevant parameters with age- and gender-matched controls from the same population.
Results: We identified 68,071 patients who presented to hospital for a first DSP episode. Of these, 29,405 (43.2%) were admitted, including 18,546 (63%) to Intensive Care Units. Overall, 537 (0.8%) died during the index hospitalization. During study follow-up, 11,308 (16.7%) patients were hospitalized for repeat DSP, after a median interval of 274 days (IQR: 60 to 764 days). A further 3,591 (5.3%) were hospitalized for DSP two or more times after the initial episode. Following the index discharge, 4,571 (6.7%) patients died. The overall mortality rate of DSP patients during follow-up was more than four times higher than that of matched controls (1.15 vs. 0.26/ 100 person years, respectively; hazard ratio 5.5; $p < 0.001$). Among DSP patients, injuries including suicide accounted for half of all deaths, far more than in the controls (46.4% vs. 10.3%; $p < 0.001$). Death from injuries was even more common among patients with repeat vs. single DSP (63.6% vs. 42.5%; $p < 0.001$). Female sex, age 31–50 years, low income, depression, psychiatric care, ingestion of psychoactive drugs on index presentation and alcohol or drug dependence were all strongly associated with recidivism.
Conclusions: A first hospital presentation for DSP is a strong predictor of subsequent premature death from injury, including suicide. Both repeat self-poisoning and suicide may occur long after the initial event, therefore, short-term preventive interventions may not be sufficient. While almost all patients survive the initial poisoning, targeted and sustained secondary prevention efforts are vital for suicide prevention.
Keywords: Intentional self poisoning, poisoning recidivism, mortality

5. Acetaminophen-protein adducts during prolonged administration of 4 g/day of acetaminophen

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Background: Acetaminophen-protein adducts are a biomarker that can be used to document acetaminophen exposure and may indicate overdose. Serum concentrations have been described in patients with acetaminophen overdose and after large single ingestions, but concentrations during prolonged repeated administration have not been reported. The study describes serum adduct concentrations during prolonged acetaminophen administration.
Methods: Subjects: Healthy adult volunteers enrolled in a randomized placebo controlled trial monitoring serum aminotransferase activity. Intervention: 1g/acetaminophen 4 times daily for a minimum of 16 days. If a subject had persistent ALT elevation at day 16, the dosing was continued until the elevation resolved (or for a maximum of 40 days). Testing: Serum samples for adduct concentration were obtained at day 0 (Baseline) and every 3 days thereafter. In one subset we collected additional early samples on therapy (days 1, 2 and 3) and in a second subset we collected samples after the subjects completed acetaminophen dosing (on days 19, 22, 25). Serum acetaminophen-cysteine (APAP-CYS) concentrations were measured using LC GC/MS after sample dialysis and protein digestion with a quantitation limit of 0.01 µmol/L.
Results: 205 acetaminophen subjects were enrolled in the main study; 63 also provided samples on days 1, 2 and 3; 52 provided samples after completing the main study. The majority of subjects were pre-middle aged (median age 34 years) Caucasian (70%) females (72%). Reported compliance was high. APAP-CYS was detectable prior to acetaminophen dosing in 15 subjects (7.3%). Mean APAP-CYS concentrations gradually increased from days 1–10 and plateaued around 0.1 µmol /L while subjects continued dosing. The highest concentration was 1.05 µmol/L; 2 acetaminophen subjects never had measureable APAP-CYS concentrations despite reported compliance. APAP-CYS was detectable in 90% of samples after 5 doses of acetaminophen. APAP-CYS concentrations decreased after dosing was stopped from a mean (SD) of 0.10 (0.01) µmol/L on day 16 to 0.03 (.002) µmol/L on day 25; 79% of subjects had detectable APAP-CYS 9 days after stopping acetaminophen.
Conclusion: Acetaminophen protein adducts are detectable in the vast majority of subjects after taking 5 x 1g doses of acetaminophen. Concentrations plateau after approximately 10 days and decrease slowly once dosing is stopped but remain detectable for more than a week. This study is limited by the use of healthy subjects who self-reported administration and a single laboratory.
Keywords: Acetaminophen, Adducts, Clinical Trials

6. Pharmacogenetic determinants of acetaminophen toxicity in children

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Background: Acetaminophen (APAP) overdose causes significant hepatotoxicity and accounts for nearly 40% of acute liver failure cases. While clinicians use the Rumack nomogram to predict hepatotoxicity risk, unpredictable hepatotoxicity, including fatal events, occur in exposed patients; recent advances in pharmacogenomics may offer further insight into genetic risk factors for predicting outcomes.
Objective: To evaluate whether genes associated with the major APAP metabolism pathways enhance the clinical prediction of hepatotoxicity in the setting of pediatric APAP overdose.
Methods: This is a prospective cohort study of patients 10–22 years of age admitted with a potentially toxic APAP ingestion to a tertiary care pediatric hospital between 2004–2012. The following clinical characteristics were collected: time of ingestion, amount of ingestion (mg/kg) and co-ingestants. Demographic variables included: age, gender, ethnicity, medications, alcohol use, and history of liver disease. Laboratory tests included serum APAP concentration (mcg/ml), maximum aspartate (AST) and alanine (ALT) aminotransferases (IU/L), blood urea nitrogen (BUN, mg/dl), creatinine (mg/dl), bilirubin (mg/dl), prothrombin time (PT, seconds), and partial thromboplastin time (PTT, seconds). Genotyping was comprised of common polymorphisms in CYP2E1, UGT1A6 and SULT1A1 as well as SULT1A1 copy number variation. A multi-variate model was constructed with AST then PTT as outcomes, and sex, ethnicity, dose of APAP, time to presentation, co-ingestants and genotypes as predictors.
Results: Thirty six patients were enrolled with mean age 15.7 ± 1.5 years. Thirty two (89%)were female and 28 (78%) were Caucasian. Mean ingested dose was 355 mg/kg $\pm$ 393 and mean time to presentation 1057 minutes $\pm$ 1119. Thirteen patients (36%) developed elevated transaminases; 8/13 patients had AST levels $>$ 1000 IU/L and 4/13 patients had AST levels $>$ 10,000 IU/L. On multi-variate modeling, maximum AST decreased by 2551 IU/L for each allele of the UGT1A6 541A$>$G SNP ($p = 0.03$). No patient with AST $>$ 10,000 IU/L was homozygous for UGT1A6 541A$>$G SNP (rs2070959). A similar effect was seen in maximum PTT with a decrease of 2.8 seconds for each allele of the polymorphism ($p = 0.049$). None of the other polymorphisms were associated with maximum AST/PTT on multivariate modeling.
Conclusions: The nonsynonymous UGT1A6 541A$>$G SNP ($Thr^{181}Ala$) which enhances acetaminophen glucoronidation appears to offer protection against APAP toxicity in children. Screening for genetic variation may enhance understanding and clinical prediction of this common overdose.
Keywords: Acetaminophen (paracetamol), Pharmacogenetics, Pediatric

7. Pooled analysis of time to administration of glucarpidase for methotrexate toxicitiy versus mortality

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Background: High-dose methotrexate is used to treat acute lymphoblastic leukemia, osteosarcoma, non-Hodgkin lymphoma, and

other cancers. Methotrexate-associated renal impairment with delayed elimination is an oncologic emergency that occurs after 2 to 10% of treatment cycles in patients, exposing them to resulting toxicity and prolonged hospitalization. Glucarpidase rapidly hydrolyzes methotrexate into inactive metabolites and provides an alternate route of clearance in patients with delayed elimination and acute kidney injury.

Widemann et al (2010) reported that administration of glucarpidase > 96 hours after the start of HDMTX infusion is associated with development of grade 4 and 5 toxicity in these patients. To assess the importance of earlier administration of glucarpidase, we analyzed overall mortality trends in a set of 476 patients from 4 compassionate-use clinical trials who were treated with glucarpidase up to 4 days after administration of methotrexate.

Methods: From November 1993 through June 2009, 492 patients experiencing renal toxicity and delayed elimination of methotrexate were treated with glucarpidase (50 Units/kg IV). All patients received IV hydration, urinary alkalinization, and leucovorin rescue. Data were pooled and analyzed for overall mortality using the time to death interval (in days) between start of MTX dose and the first glucarpidase dose as a covariate.

Results: A total of 476 patients were efficacy-evaluable. Higher percentages of patients who were treated later with glucarpidase (i.e., at longer intervals between the MTX dose and the glucarpidase dose) died (22.0% of patients treated >4 days after MTX died, and 10.9% of patients treated within 2 days after MTX died. The Cox regression model showed that mortality was statistically significantly higher for patients who received glucarpidase later ($p < 0.001$) with a hazard ratio corresponding to a 1 day delay in glucarpidase administration of 1.28.

Conclusion(s)/Discussion: This analysis of 476 patients suggests that earlier administration of glucarpidase after recognition of possible methotrexate toxicity results in lower overall mortality.

Keywords: Antidote, Medical toxicology, Death

8. Risk factors for respiratory failure after Eastern coral snake envenomation

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Background: Envenomation by the Eastern coral snake is rare but may be associated with severe complications including respiratory failure and death. With diminishing antivenom supplies, it is important to determine which patients are at risk for severe complications. The purpose of this study is to determine which factors are associated with respiratory failure after Eastern coral snake envenomation.

Methods: This was a retrospective cohort study utilizing cases from a state poison center network. Calls received from 1/1/1998 to 10/31/2010 with the AAPCC code of 0137104 (Coral Envenomations) were included. Cases were excluded for unrelated exposures or those not followed for 24 hours after exposure. We analyzed 20 predictors including gender, age, location of bite, specific symptoms, and use of antivenom to determine if there was an association with respiratory failure. We defined respiratory failure as need for intubation. Odds ratios analyzed variables for associations with this outcome.

Table. Results for abstract number 8.

	Odds Ratio (95%CI)
Male	1.72 (0.2–13.3)
Female	0.58 (0.08–4.54)
Age	
< 19 years old	0.62(0.13–2.91)
19–39 years old	2.1 (0.65–6.86)
> 40 years old	0.63 (0.17–2.42)
Decreased Level of Consciousness	42.3 (16.1–111.23)
Edema	10.1(1.82–55.6)
Redness	0.23 (0.03–1.64)
Location of Bite	
Upper Extremity	1.33 (0.16–10.86)
Head	14.5 (2.38–88.45)
Snake Pulled Off	1.65 (0.28–9.88)
Ptosis	63 (26.94–147.74)
Diplopia	83.1 (22.67–304.67)
Blurred Vision	4.06 (0.55–29.96)
Emesis	1.76 (0.38–8.27)
Dysphagia	162 (72.1–365.4)
Dysphonia	106.5 (40.5–280.1)
Paresthesias	2.1 (0.66–6.99)
Fasciculations	12.4 (1.96–78.37)
Weakness	14.0 (5.19–38.05)
Paralysis	61.7 (25.3–150.1)
Nausea	1.55 (0.33–7.31)
Respiratory Depression	247.3 (111.1–550.6)
Anaphylaxis	23.3 (8.56–63.42)
No sign/symptoms for 24 hours	3.65 (1.17–11.38)

Results: 387 cases met our inclusion criteria. There were 11 endotracheal intubations and 0 deaths. Males made up 85.5% of patients. Bites to the fingers and hands involved 49.3% and 25.6% of cases, respectively. 56.3% of patients experienced no systemic symptoms. The most common symptoms after exposure were pain (40.6%), paresthesia (28.4%), nausea (12.7%), and emesis (11.4%). Antivenom was administered to 252 patients. No cases developed respiratory failure when the snake did not hang on or if the skin was not broken. Table demonstrates which factors were most predictive of respiratory failure.

Conclusion: Factors most associated with respiratory failure include decreased level of consciousness, edema, bite on the head, bulbar symptoms, fasciculations, weakness, paralysis, and respiratory depression. These predictors may help clinicians in determining judicious use of antivenom.

Keywords: Snake bite, Antivenom, Coral Snake

9. Methylene blue in an experimental model of severe amlodipine poisoning

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Background: Calcium channel blocker poisonings account for a substantial number of reported deaths from cardiovascular drugs. While supportive care is the mainstay of treatment, experimental therapies such as high dose insulin-euglycemia and lipid emulsion are being studied in animal models and used in humans. In the most severe cases even aggressive care is inadequate and deaths occur. In both experimental models and clinical cases of vasodilatory shock, methylene blue (MB) improves hemodynamics. MB acts as both a nitric oxide scavenger and inhibits guanylate cyclase that is responsible for the production of cGMP. Excessive cGMP production is associated with refractory vasodilatory shock in sepsis and anaphylaxis. The goal of this study was to determine the effectiveness of MB in the treatment of amlodipine toxicity.
Methods: The study design used adult Sprague-Dawley rats where each rat was anesthetized, ventilated and instrumented with continuous blood pressure and heart rate monitoring. The minimal dose of amlodipine that produced death within 60 minutes was determined to be 17 mg/kg/hour. Rats were divided into 2 groups: Amlodipine followed by MB or amlodipine followed by normal saline (NS) with 15 rats in each group. Rats received MB at 2 mg/kg over 5 mins or an equivalent amount of NS in three intervals from the start of the protocol: Minute 5, 30, and 60. The animals were observed for a total of 2 hours after the start of the protocol. The primary outcome, survival, was analyzed using Kaplan Meier survival analysis with the log rank test. The secondary outcomes, heart rate and mean arterial pressure, were analyzed with analysis of variance.
Results: The median survival time for the NS group was 42 min (95% CI, 28.1–55.9) and the MB group was 109 min (95% CI, 93.9–124.1) ($p < 0.05$). Heart rate was significantly higher in the MB-treated group starting 25 min after the start of the amlodipine infusion (at 25 min (95% CI, 30–113) which was analyzed up until 60-minutes. MAP in mmHg was significantly higher in the MB-treated group starting 25 min after the amlodipine infusion (at 25 min (95% CI, 2–30) which was analyzed up until 60-minutes.
Conclusions: Methylene blue improved survival and hemodynamics in this model of intravenous amlodipine toxicity.
*This study is supported by the 2011 AACT Junior Investigator Grant.
Keywords: Antidote, Calcium channel blocker, Cardiac toxicity

10. Pharmacokinetics of N-acetylcysteine during renal replacement therapies (RRTs)

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Background: APAP induced fulminant hepatic failure (FHF) is associated with acute kidney injury, metabolic acidosis and fluid and electrolyte imbalances. Therefore RRTs are increasingly used in severe APAP poisoning. Although NAC is potentially extracted by RRTs, data are lacking to guide dosing of NAC during RRT. We report data from the first 6 patients in a multicenter pharmacokinetic study of the extracorporeal removal of NAC by RRTs.
Methods: Patients with FHF were enrolled if RRT was coincident with NAC. Simultaneous urine, plasma, dialysate and/or ultrafiltrate specimens were serially collected for total or free [NAC], and measured via HPLC. During RRTs plasma was collected from both access and return, to obtain average [NAC] (Cp). NAC kinetics were determined in up to 3 stages: the absence of RRT, during RRT, and upon discontinuation of NAC (to determine T ½). Standard pharmacokinetic calculations were applied.
Results: Six patients were enrolled over 12 months, average age 43 years, and 3 where men. Four of the six had APAP induced FHF. All patients received a continuous infusion of 6.25mg/kg/hr IV NAC. Patient 1 had kinetics determined while on CVVH, in the absence of RRT, and lastly during HD. Patients 2–5 had kinetics determined only while on CVVH. Patient 6 had kinetics determined while on CVVH, and during HD. Total [NAC] was measured in patients 1 and 2, while free NAC was measured in patients 3–6. Plasma [NAC] in the absence of RRT was consistent with standard literature and averaged 31.8 mg/L. CVVH kinetics demonstrated high intra and inter-individual variability; mean extraction ratio 0.08 (0.03–0.15) and 0.13 (0.02–0.44), for total and free NAC respectively. CVVH mean fractional clearance was 9% (3–14%) for total NAC, removing a mean of 33.2 mg (15.1–48.9 mg) total NAC/hr. CVVH mean fractional clearance of free NAC was 0.2% (0.0–0.6%), removing a mean of 1.21 mg (0.15–2.06 mg) free NAC/hr. HD clearance was substantial, with mean extraction ratio 0.26 (0.15–0.34) and 0.29 (0.03–0.56) for total and free NAC respectively. HD mean fractional clearance was 50% (5–85%) for total NAC, removing a mean of 233 mg (25–395 mg) total NAC/hr. HD mean fractional clearance was 5% (1–12%) for free NAC, removing a mean of 18 mg (5–43 mg) free NAC/hr.
Conclusions: The CVVH clearance of NAC is minimal and unlikely to require altered dosing. In contrast, HD extracted a significant amount of NAC and a substantial NAC dose adjustment may be indicated. These data are limited based on the number of patients per RRT type and changing clinical condition of the patients during the sampling process. Ongoing collection of both free and total [NAC] in each future patient will enable us to better define NAC dose adjustments during RRTs.
Keywords: N-acetylcysteine, Pharmacokinetics, Acetaminophen (paracetamol)

11. Botanic cardiac glycoside poisoning: epidemiology, laboratory diagnosis and treatment

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Background: Ingestion of botanic cardiac glycosides (BCGs) in oleander (*Nerium* and *Thevetia*), lily of the valley (*Convallaria*) and foxglove (*Digitalis*) yields human toxicity, but there is no current data describing the frequency and typical severity of these poisonings. Older digoxin assays have been used to diagnose *Digitalis* and *Nerium* toxicities and the empirical use of digoxin immune Fab has been rare and its feasibility has not been shown for many BCGs. Specifically, the ability to diagnose and treat*Convallaria* toxicity is not known. We aimed to (1) clarify the extent and severity of BCG ingestion in the United States, (2) determine the utility of common digoxin assays at measuring toxic serum levels *in vitro* and *in vivo*, and (3) determine whether Fab is a feasible antidote for *Convallaria* poisoning.

Methods: A retrospective review of all BCG exposures in the National Poison Data System (NPDS) from 2000 to 2010 was conducted to identify frequency, geographic distribution and severity of exposures. Toxins from each species were assayed in human serum using common digoxin assays. Convallatoxin exposed mice were used to determine *in vivo* assayability. Fab was tested as an antidote for convallatoxin *in vitro* using binding purification techniques.
Results: 14,620 calls about ingestions of BCGs were made between 2000 and 2010. These localized to each plant's endemic area:*Nerium* (61% of calls) to the southwest, *Convallaria* (13%) to the north and *Digitalis* (9%) to the northwest. Of these exposures, there was one death, 59 uses of Fab, and 459 admissions, half of which were to an ICU. Five commonly used digoxin assays measure each plant's toxin in ranges consistent with toxicity. Plant parts with highest detected toxin are leaves and seed pods, with *Nerium* and *Adenium* being the most reactive per plant weight. *In vivo* toxicity of convallatoxin is measurable to 5% of mouse LD50. Serum levels of toxic doses of convallatoxin are not bound *in vitro* by Fab. Unlike digoxin in serum, most convallatoxin is present as free toxin rather than protein bound.
Conclusions: (1) Few deaths or serious medical outcomes were documented in the NPDS between 2000 and 2010 from BCG ingestion, suggesting that poison control specialists may safely divert asymptomatic exposures from further health care contact. (2) Like other BCGs, *Convallaria* is detected with several digoxin assays. (3) Digoxin immune Fab does not provide an antidote to convallatoxin, so all but the most severely affected patients should be managed conservatively. Further study would identify if hemofiltration could reduce serum toxin loads of BCGs unresponsive to Fab.
Keywords: Plants, Cardiac glycoside, Laboratory

12. In vitro study of acetaminophen on prothrombin time in plasma samples from healthy subjects

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Background: N-Acetylcysteine (NAC) has been shown to elevate prothrombin time (PT) in a dose-dependent manner *in vitro*. Clinically, reports have shown PT elevations with NAC after acetaminophen (APAP) overdoses and with APAP overdoses alone without liver injury. The goal of this study is to determine the effect of APAP and APAP with NAC on the measurement of PT *in vitro*.
Methods: A single venous blood draw was obtained from 34 volunteer subjects using a vacutainer system in tubes with 0.129 M sodium citrate used as an anticoagulant. The plasma sample from each subject was divided into four 1 ml aliquots. Each subject acted as their own control. The three 1 mL aliquots had 10 microL of decreasing concentrations of APAP, Ofirmev (Cadence Pharmaceuticals, San Diego, CA), added. The serial concentrations of APAP (1, 0.5, and 0.25%) were created in order to maintain the same volume of drug added to each plasma sample. The control aliquot had 10 microL of 0.9% saline added. This made 3 plasma concentrations of APAP (100, 50, 25 mg/L) plus the control. All samples were gently mixed and incubated at 37oC for one hour. PT's were obtained on all samples.

The effects of APAP in combination with NAC were evaluated using plasma samples from an additional 10 subjects. The plasma sample from each subject was divided into two 1 ml aliquots. One aliquot had 5 microL 20% NAC plus 10 microL 1% APAP. Second aliquot had 5 microL 20% NAC plus 10 microL 0.9% saline. The remaining study was conducted as described above.

PT values were compared using ANOVA. The post-hoc analysis was performed using student t tests with a Bonferroni correction for multiple comparisons. All statistics were performed in Rv2.15.2. Approval was obtained from the Institutional Review Board at the University of Pittsburgh prior to study implementation.
Results: Table contains the mean and 95% confidence interval (CI) for the six groups. As previously described, NAC alone was associated with significant prolongation of mean PT times compared to all APAP alone groups ($p < 0.001$). APAP alone had no effect on mean PT times regardless of concentration ($p = 0.818$). NAC with APAP demonstrated longer PT times compared to all groups of APAP alone ($p < 0.001$); however, APAP in combination with NAC was not associated with a difference in mean PT times compared to NAC alone ($p = 0.903$).
Conclusion: APAP has no direct effect on PT alone or in combination with NAC in an *in vitro* model of healthy subjects.
Keywords: Acetaminophen (paracetamol), N-acetylcysteine, Coagulation

Table. Results for Abstract number 12.

	[APAP] (mg/L)	[NAC] (mg/L)	N	Mean (s)	95% CI
APAP Alone	0	0	34	13.0	12.8–13.2
	100	0	34	12.9	12.7–13.1
	50	0	34	12.9	12.7–13.2
	25	0	34	13.0	12.7–13.2
NAC +/− APAP	0	1000	10	15.2	14.3–16.0
	100	1000	10	15.2	14.4–16.0

13. Evaluation of an alternative intravenous N-acetylcysteine regimen in pediatric patients

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Background: Intravenous N-acetylcysteine (IV-NAC) is approved for acute and chronic acetaminophen (APAP) ingestions. It is conventionally administered as a three bag regimen over 21 hours, which increases the risk of compounding and administration errors. To minimize errors, an alternative IV-NAC dosing regimen consists of a loading dose of 150 mg/kg over 60 minutes followed by a maintenance infusion of 15 mg/kg/hr until the typical termination criteria are met. No studies have examined the efficacy and safety of an alternative IV-NAC regimen in pediatric patients.
Methods: A retrospective review of pharmacy dispensing records and diagnostic codes at a pediatric hospital identified all patients who received the alternative IV-NAC dosing regimen from March 1, 2008 to September 10, 2012 for APAP toxicity. Exclusion criteria included: use of NAC for non-APAP liver disease, presence of

chronic liver disease, and initiation of oral NAC or initiation of the standard 4 or 16 hour NAC infusion prior to facility transfer. Clinical and laboratory data were abstracted from the electronic medical record. Descriptive statistics were used to analyze the data.
Results: 59 (56 acute, 3 chronic) patients, mean age 14 ± 3.3 years (range 2 months-18 years) with APAP toxicity were identified. Risk of hepatic injury was assessed in acute ingestions using the Rumack Matthew Nomogram. 21 patients (37.5%) were classified as probable risk, 22 patients (39.3%) as possible risk, 7 (12.5%) patients as low risk, and 6 patients (10.7%) as unknown risk. Mean APAP level at IV-NAC initiation was 137mcg/ml. Mean duration of the IV-NAC infusion was 30 ± 17.7 hours (range 4.25 to 89 hours). At the time of IV-NAC discontinuation, 45 patients had normal alanine transaminase (ALT) levels while in 14 patients, ALT levels remained elevated (median 140 U/L) but were trending downward. Hepatotoxicity (AST or ALT > 1000 U/L) developed in 2 patients (3.4%) who presented for treatment more than 8 hours after acute APAP ingestion.

No patients developed encephalopathy. None experienced bleeding, received blood products or vitamin K. No patients were intubated, underwent hemodialysis, or were listed for a liver transplant. No patients died. Two patients (3.4%) developed minor anaphylactoid reactions during the loading dose infusion. They were treated with diphenhydramine and completed IV-NAC therapy without further complications. No known medication or administration errors occurred.
Conclusions: This alternative IV-NAC dosing regimen is effective and well tolerated among pediatric patients. In addition, it may result in fewer compounding and administration errors, leading to improved patient care and patient safety.
Keywords: N-acetylcysteine, Pediatric, Acetaminophen (paracetamol)

14. High-dose, variable-length, intravenous N-acetylcysteine (HINAC) therapy for acetaminophen poisoning

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Background: Despite decades of research and experience, the optimal regimen for administration of N-Acetylcysteine (NAC) for acetaminophen (APAP) overdose remains controversial and multiple dosing regimens exist. Since 1998, our toxicology group has utilized a high-dose, variable-length, intravenous (IV) N-acetylcysteine (HINAC) regimen of a loading dose of 140 mg/kg, followed by 70 mg/kg every 4 hours (hrs) for a minimum of 20 hrs. If hepatotoxicity (HT) was present, HINAC was continued until the transaminases begin to decline. Our objective was to describe our clinical experience with HINAC therapy for the treatment of APAP poisoned patients.
Method: Retrospective chart review of an institutionally approved HINAC protocol from 1998 to 2013 at 2 centers by the same toxicology group. Charts of patients with APAP poisoning who received HINAC were reviewed and excluded when doses deviated > 25% from protocol, inadequate data available or serum APAP below detectable limits. Patients were separated into 3 risk groups based on serum APAP, as extrapolated on the Matthew-Rumack Nomogram. HT was defined as an alanine aminotransferase or aspartate aminotransferase > 1000 U/L. Adverse reactions were recorded and the primary investigator reviewed charts for accuracy. Outcomes were compared to previously published 20-hr IV NAC regimens.
Results: 882 charts between January 1998 and March 2013 were reviewed. 475 patients were included and 407 excluded—the most common reasons being chronic APAP abuse (N = 148), HINAC initiation 24 hrs or more post-ingestion (N = 94), and HINAC dosing deviation (N = 80). 202 of the 475 (43%) were treated at > 10 hrs post-ingestion. Three groups were created based on risk for HT: possible (N = 130), probable (N = 139), and high-risk (N = 206). For the possible risk group, 4 patients (3%) developed HT. For the probable risk group, 6 patients (4%) developed HT. For the high-risk group, 50 patients (24%) developed HT. The incidence of HT in the combined probable and high-risk groups was 17%. Adverse reactions occurred in 3%.
Discussion: This study population of 475 patients was weighted towards the high-risk group and later treatment time, as compared to prior NAC outcome studies, yet the incidence of HT was lower. Study limitations include retrospective design, potential reviewer bias, multiple chart reviewers and some missing data.
Conclusions: 1) HINAC was as, or more effective in all risk groups as compared to other NAC regimens 2) Incidence of adverse reactions was similar to those reported in other NAC regimens 3) The HINAC regimen should be considered for treatment of probable and high-risk group patients treated later than 10 hrs post ingestion
Keywords: Acetaminophen (paracetamol), N-acetylcysteine, Hepatotoxicity

15. Evaluation of the initiation of urine drug screens intended for use in transfer patients

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Background: There has been significant debate on the proper role of urine drug screens (UDS) within clinical medicine. Immunochromatographic UDS (PROFILE®-V MEDTOX*Scan*® Test) were instituted at a major tertiary hospital emergency department (ED) for restricted use only to comply with new transfer requirements of surrounding psychiatry institutions. The objective of this study was to determine if signs of clinical intoxication were present in patients who had such UDS performed and whether UDS were performed in actual cases that were transferred.
Methods: After randomization, half of all medical records of patients who had a transfer UDS ordered from November 19, 2011 to December 31, 2012 were reviewed by one of three trained study investigators. As part of a quality assurance method for data extraction, a random sample of 100 patient charts was independently reviewed by all three investigators to review and resolve discrepancies and assure consistency in interpreting charting data. Demographics, history of drug abuse, physical exam, vital signs,

admission diagnoses, chief complaints, disposition, and laboratory results were recorded.

Results: Six hundred thirty nine charts were included in this study. Approximately half of the patients presented with suicidal ideation. Vital signs were abnormal in the following manner: systolic blood pressure greater than 180 mmHg (5.5%) or less than 90 mmHg (3.3%); tachycardia (58.7%); bradycardia (10.5%); febrile (1.3%); respiratory rate less than 12 (4.9%). Glascow Coma Score was less than 15 in 3.0%. Most common reasons identified for the UDS included "psychiatry workup (77%)" and "requested by psychiatry (15%)". Nearly half (47%) of patients were admitted to the institution's inpatient psychiatric facility, 21% were discharged, and 14% were admitted to a medical floor; only 18% were transferred to another psychiatric facility and in compliance with appropriate indication of the transfer UDS. More than one third (36%) of the UDS were positive for at least one substance. Marijuana was the most common substance (23%), followed by cocaine (7%) and opiates (7%). There was no evidence that the transfer UDS changed acute management decisions.

Discussion: Few (< 5%) patients demonstrated any clinical characteristics that were consistent with an acute intoxication. Less than 20% of patients who had a transfer UDS were actually transferred to an outside facility, demonstrating that 82% were not ordered as per protocol for transfers. This corresponds to over $152,000 of avoidable UDS cost to patients during the study period.

Keywords: Drug of abuse, Laboratory, Clinical Practice

16. Paradoxical drug reaction detection in FAERS

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Background: Paradoxical drug reactions occur when an outcome is opposite from that expected from a drug's known actions. They complicate clinical management and pharmacovigilance. The FDA Adverse Event Reporting System (FAERS) codes recognized paradoxical reactions as paradoxical bronchospasm, pain, drug reaction, embolism and pressor response. Immune reconstitution inflammatory syndrome (IRIS) may develop in patients on HAART with certain infections (*pneumocystis*, etc.). IRIS, associated with *better* virological response, may cause new or *worsening* clinical or radiological disease. An analogous paradoxical reaction occurs in immunocompetent patients with mycobacterial infections, despite effective therapy. Baclofen may produce paradoxical effects due to competing pre- and post-synaptic GABAB actions. Targeted FAERS searches with known paradoxical reactions may improve incidence detection.

Methods: The website 2004–2012(Q3) FAERS data were imported into Microsoft Access. We used a left join query on unique subject numbers to unify DIR – drug, indication and reaction (using Medical Dictionary for Regulatory Activities terms) – to build a FAERS events data model. We exported our model to Google API cloud storage service and forwarded quarterly models to Google Big Query to cull it for event definitions – drug names for FDA approved HIV and TB drugs, along with FAERS HIV disease and TB terms. We combined our results in Microsoft Excel, redacting duplicates, to produce distinct FAERS events involving HIV and TB drugs, indications and IRIS outcomes. A similar analysis assessed baclofen for muscle spasms, excluding nonspecified usages for MS and epilepsy.

Results: In the data period there were 4,285,093 unique subjects with 393,449,039 unique DIR reactions. 742 recognized paradoxical reactions were reported in 566 unique subjects: undescribed paradoxical drug reaction (457), bronchospasm (69), embolism (25), pressor response (11) and pain (3). 15 antitubercular drugs (see table) were associated with 278 distinct IRIS events in 109 distinct subjects, 71 of whom were on antiretrovirals. Isoniazid (30.2%), pyranzinamide (28.1%) and rifampicin (23.7%) were most commonly represented. 54 antiretrovirals were associated with 4118 distinct IRIS events in 1365 distinct subjects. Lamivudine (14%), efavirenz (8.4%) tenofovir/emtricitabine (7.0%) and zidovudine (6.6%) were the most common. 93 paradoxical baclofen reactions were reported in 87 unique subjects.

Conclusions: The FAERS database can be utilized to determine the burden of paradoxical drug events. However, targeted queries with know paradoxical reactions improve capture of these events and specific drugs associations.

Keywords: Adverse drug event, IRIS, Pharmacovigilance

17. Outcomes following high concentration peroxide ingestions

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Background: High concentration peroxide ingestions have been associated with embolic events. However, outcomes have not been formally studied.

Objectives: To define the incidence of embolic events & clinical outcomes & to identify predictors of outcomes in symptomatic peroxide ingestions of > 10% concentration.

Methods: NPDS was queried for ingestions from 2001–2011 coded as a peroxide with concentration > 10%, hyperbaric oxygen as a treatment, or an outcome code of moderate/major effects or death. Poison control center charts were then obtained from all 57 open & 3/6 closed US centers. The primary outcome of embolic events was defined as seizure, altered mental status, respiratory distress, hypoxia, hemodynamic instability, EKG changes, radiographic evidence of infarct or emboli, focal neurologic deficit, pulmonary embolism, or elevated troponin.

Results: After elimination of low concentration peroxide ingestions, 294 cases of symptomatic high concentration peroxide ingestions were available for analysis. 14% (CI 10–18%) of included calls demonstrated evidence of embolic events. 7% (CI 4–10%) of included calls died or had continued disability at the time the poison center chart was closed, with 5 deaths. A logistic regression model identified age > 44 years (OR 2.5: CI 1.1–5.9) & volume ingested in ml (OR 1.0: CI 1.0–1.0) as predictors of embolic events.

In the 41 cases where embolic events occurred, 49% (CI: 33–65%) died or exhibited continued disability. 63% were unintentional & 29% were intentional ingestions for therapeutic purposes. Median volume ingested was 30 ml (range 4–960 ml). Mean age was 54 years (range < 1–94). The median time to onset of embolic

symptoms was 1 hour (range 0–25 hours). 15 had a focal neurologic deficit. 8 had seizures. 35 had a decreased level of consciousness or altered mental status. 16 exhibited tachycardia. 10 were hypotensive. 7 had a peak troponin > 0.05 (range 0.17–22). 6 had an EKG abnormality including 1 STEMI, 3 conduction abnormalities, & 2 tachyarrhythmias. 12 reported dyspnea. 12 reported an Sp02 < 90% or need for supplemental oxygen. 11 had a respiratory rate>20. 16 exhibited respiratory distress. 35 vomited & 20 reported hematemesis. A logistic regression model identified presence of a focal neurologic deficit (OR 10.7: CI 1.8–62.3), age > 44 years (OR 6.44: CI 0.8–50.0), & troponin > 0 (OR 4.6: CI 0.7–29.7) as predictors of permanent disability or death amongst those with embolic events.

Conclusion: Symptomatic peroxide ingestions of > 10% concentration exhibit a high incidence of embolic events & a large proportion of those affected die or have ongoing disability. Symptoms of embolism began up to 25 hours post ingestion; thus, an extended observation period may be warranted.

Keywords: Peroxide, Caustic, National Poison Data System

18. Outcomes of severe cutaneous sdverse drug reactions: A population-Based Study

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Background: Adverse drug reactions are a leading cause of death, and over one fifth of all hospital admissions are drug-related. Stevens-Johnson Syndrome (SJS) and Toxic Epidermal Necrolysis (TEN) are relatively rare but potentially life-threatening drug reactions with prominent cutaneous features. Recurrence rates following an initial episode of SJS/TEN are unknown.We sought to explore recurrence rate as well as short and long-term outcomes in a longitudinal, population-based cohort of SJS/TEN patients.

Methods: We conducted a population-based cohort study using linked administrative databases to identify patients hospitalized for first SJS or TEN in Ontario, Canada between April 1, 2002 and March 31, 2011. Demographics, clinical data, mortality and recurrence were analyzed through end of follow-up (March 2012) or death. Healthcare utilization patterns in the year following discharge were determined. We contrasted the features of patients with a single vs. recurrent SJS/TEN episodes.

Results: We identified 708 individuals (127 children, 17.9%) with a first hospitalization for SJS/TEN. Eighty-four (12%) patients died during the index admission, representing 23% and 9% of TEN and SJS patients respectively. Among 624 patients discharged from hospital, another 43 (7%) died within 60 days. Of the remaining 581 patients, 42 patients (7.2%) had a recurrent SJS/TEN event and eight (1.4%) had multiple (≥ 2) recurrences during follow-up. Median time to first recurrence was 315 days from index admission. Patients who experienced SJS/TEN recurrence were more likely male and younger at index admission compared with patients who did not. Healthcare resource utilization (e.g., Intensive Care/Burn Unit admission, mechanical ventilation, hemodialysis, repeat specialist clinic visits) was high amongst SJS/TEN patients during admission as well as one year follow-up after discharge.

Conclusions: SJS and TEN carry an exceedingly high short-term mortality and recurrence risks. In light of the high recurrence risk, physicians should carefully weigh the risk of prescribed drugs to patients who suffered SJS/TEN, especially medications commonly associated with development of these conditions.

Keywords: Adverse drug event, Stevens Johnson syndrome, Toxic Epidermal Necrolysis

19. Urine uranium concentrations and renal function in residents of the United States

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Background: Environmental exposure to soluble uranium salts in drinking water may affect renal function. Alterations in urine glucose, alkaline phosphatase, beta2-microglobulin, fractional excretion of calcium and phosphate, and microalbuminuria have previously been reported. The National Health and Nutrition Examination Survey (NHANES) is a multi-stage probability sample of residents of the United States. We analyzed NHANES to determine if urine uranium concentrations (UUC) were associated with alterations in renal function or clinical renal disease.

Methods: NHANES respondents who had UUC, serum creatinine (sCr), and urine albumin/creatinine ratio (ACR) performed and who had no reported history of diabetes mellitus were included. UUCs were normalized to urinary creatinine. Respondents with and without detectable UUC were compared using Welch's t-test for ACR and sCr and using Fisher's exact test for a reported history of renal disease. Regression analysis was performed to assess for an association between UUC and ACR, sCr, or a reported history of renal disease. All analyses were performed using SPSS version 20 (IBM, Somers, NY, USA).

Results: Of the 2,561 NHANES respondents who underwent testing for UUC, 2,374 (92.7%) had detectable UUC (Table). Respondents with and without detectable UUC did not differ significantly from each other in age or gender. ACR was significantly greater in respondents with detectable UUC as compared to respondents without detectable UUC. However, there was no significant difference between the groups with respect to sCr or a reported history of renal disease. Regression analysis showed a statistically significant positive association between UUC and a reported history of renal disease ($p = 0.02$), but did not show a statistically significant association between UUC and ACR or sCr.

Conclusions: Detectable UUC is present in a significant majority of this sample of residents of the United States and is associated

Table. Comparison of Respondents With and Without Detectable UUC.

	No Detectable UUC	Detectable UUC	
Number	187 (7.3%)	2,374 (92.7%)	
Age	38.0 [34.7, 41.2]	36.0 [35.1, 36.9]	$p = 0.248$
Gender	47% M/53% F	50% M/50% F	
sCr (μmol/L)	73.4 [70.7, 76.0]	76.0 [74.3, 77.8]	$p = 0.10$
ACR (mg/g)	10.0 [8.3, 11.7]	23.4 [18.5, 28.3]	$p < 0.001$
History of renal disease	0.76%	2.1%	$p = 0.512$
Average UUC normalized to urine creatinine (μg/g)		0.017 [0.010, 0.024]	

95% confidence intervals given in brackets.

with increased microalbuminuria. Although logistic regression analysis demonstrated an association between UUC and a reported history of renal disease, sCr concentrations were not significantly different between respondents with and without detectable UUC.
Keywords: Environmental, Heavy metals, Renal toxicity

20. Don't drink the water: poison center and public health collaborate to manage a salmonella Event

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Background: Regional Poison Center (PC) evolution requires ongoing public health liaison to provide call center infrastructure services not readily available to local and state health departments (SHD). A PC staffed dedicated public health emergency line is an obvious fit. From 18 March – 7 April 2008 (21 days), a Salmonella contaminated drinking water outbreak paralyzed a rural community with a population of 8900 and limited public health resources. We collaborated with both local and SHDs to help manage this event.
Methods: Within 3 hours of notification and before the initial press conference, we activated a dedicated public health line. Messages and 14 frequently asked questions (FAQs) were written and entered into the PC's help line delivery software. Staffing followed our emergency surge model and all staff were trained on event details. Health messaging and FAQs evolved during the event reaching a total of 73. Emergency requests for bottled water delivery to elderly and home bound callers were sent in near real-time to the local and SHDs. To assist the local Public Health Nursing Department, after hours and weekend requests for medical support were transferred to PC specialists for medical management. PC managers participated in daily conference calls with the SHD and city officials. Daily customized reports (call volume by time of day, top 5 FAQs, and call origination zip code) for State and Local public health officials were sent daily. Call trend analysis was prepared daily and were used to modify the hours of operation.
Results: Staff received 2897 event related calls; 50% spoke with a Poison Information Provider or Specialist in Poison Information with the others listening to recorded messages. 442 illnesses were reported. Peak call volume was 486 calls in one 24-hour period; 90 calls in 1 hour. The outbreak resulted in 122 cases of laboratory confirmed cases and 1 death. The health department estimated that up to 1300 people may have been ill.
Conclusions: SHDs partnering with PCs to leverage existing PC call center infrastructure is a cost effective strategy for public health event management. Early PC involvement demonstrates the benefits of these working relationships. Collaboration with health departments is an emerging and vital role for PCs.
Keywords: Public health, Poison center, Environmental

21. Evaluating oral fluid as a screening tool for lead poisoning

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Background: Many parents prefer not to have their children's blood drawn to be tested for lead. The use of other less invasive methods for screening environmental lead exposure may increase the screening rate for childhood lead poisoning. Oral fluid refers to the liquid normally present in the region of the oral cavity anterior to the teeth and gum line. While oral fluid usually contains some saliva, the small amount of saliva is mixed with gingival crevicular fluid and other secretions from the musosal surfaces of the cheek and gums. Thus, oral fluid is more similar to an ultrafiltrate of the plasma than common saliva. Sialochemistry for environmental heavy metals may be useful for screening exposure to lead, but has not been evaluated in an actual clinical setting for this purpose.
Objective: To evaluate the correlation of oral fluid and venous blood lead in a clinical setting.
Methods: Oral fluid samples were collected on 500 children aged 6 months to 5 years in a primary care clinic. Children due to have blood lead levels drawn at their well child check visit were eligible. Oral fluid samples from 50 children were gathered twice to provide internal controls, but were counted once. Blood was obtained by venipuncture. Data analysis used Pearson correlations, scatter plots and linear regression. The mean absolute difference between the sample groups was determined to test the hypothesis that group means are equal ($\alpha = 0.05$).
Results: 500 patients agreed to enroll in this study. 474 patients had both venous blood and oral fluid samples available for analysis; 25 patients did not have blood available and 1 oral fluid sample was unacceptable. 455 patients had both oral fluid and venous blood lead levels < 4 µg/dL, and 19 had both oral fluid and venous blood lead levels ≥ 4 µg/dL. All oral fluid levels < 4 µg/dL correlated with a venous blood level < 4 µg/dL, $p < 0.05$. Internal controls suggested no variations, $p > 0.05$.
Conclusions: Oral fluid appears to be a reliable medium to use when screening children for lead exposure at levels < 4µg/dL. Oral fluid lead levels ≥ 4 µg/dL should be confirmed by a venous blood sample. The convenience of lead screening by measurement of oral fluid should improve our screening success by reducing parental refusal and eliminating inability to obtain an adequate blood sample.
Keywords: Lead, Pediatric, Laboratory

22. The vasoactive properties of the novel psychoactive substance methoxetamine

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Background: Methoxetamine is an arylcyclohexylamine derivative of ketamine. Analytically confirmed reports of acute methoxetamine toxicity demonstrate that in addition to ketamine-like toxicity, methoxetamine is associated with cerebellar toxicity and acute stimulant effects including tachycardia and hypertension. The mechanisms of the hypertension seen in acute methoxetamine toxicity are not understood. The aim of this study was to investigate the vasoactive properties of methoxetamine at concentrations published in case reports of analytically confirmed acute methoxetamine toxicity (up to 0.2 mg/L).

Methods: Two pulmonary arteries of male Wistar rats were prepared and suspended in a standard tissue bath set-up containing Krebs buffer solution at pH 7.4 that was continuously oxygenated with 95% oxygen/5% carbon dioxide at 37°C. The arteries were pre-contracted with high potassium (45mM) to determine the maximal contractile response. Following washout, a prostaglandin PGH2 analogue U46619 or norepinephrine were added to induce partial contraction approximately 30–50% of maximum. Methoxetamine was then added to achieve concentrations of 0.1 mg/L, 0.2 mg/L and 0.3 mg/L in the organ bath. The contractile response after each dose was then observed.
Results: Contractions of the two arteries were achieved with 10 nanoM of U46619 and 100 microM of norepinephrine respectively. In the artery pre-contracted with U46619, contraction was achieved to 0.47 milli-Newtons (mN). Methoxetamine at concentrations of 0.1 mg/L, 0.2 mg/L and 0.3 mg/L in the tissue bath induced a relaxation response in a dose-dependent fashion of 0.411 mN (cumulative relaxation of 12.5%), 0.395 mN (15.9%) and 0.385 mN (18.1%) respectively. The artery pre-contracted with norepinephrine produced a contraction of 1.568mN. Methoxetamine at concentrations of 0.1 mg/L, 0.2 mg/L and 0.3 mg/L in the tissue bath induced a small contractile response of 1.570 mN (cumulative contraction of 0.14%), 1.596 mN (1.8%) and 1.667 mN (6.3%) respectively.
Discussion: This study suggests that methoxetamine possesses both vasodilating and vasoconstricting properties, depending on the drug used to pre-contract the artery suggesting that there may be more than one mechanism by which methoxetamine produces its vasoactive effects. Further experiments using this and other similar in vitro models may help identify the mechanism by which methoxetamine causes its cardiovascular effects.
Keywords: Bath salt, Substance abuse, Drug of abuse

23. Leucovorin pharmacokinetics in patients receiving high dose methotrexate, with or without glucarpidase

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Objectives: Glucarpidase is a recombinant form of carboxypeptidase G2 and hydrolyzes methotrexate (MTX) into inactive metabolites and provides alternate clearance in pts with delayed elimination and acute kidney injury. It is administered with IV hydration, urinary alkalinization, and leucovorin (LV). The primary objective was to investigate whether glucarpidase reduces exposure to LV and its active metabolite (5MeTHF) to below the level achieved in pts who have not received glucarpidase, by assessing the PK of the active L-isomer of LV (6S-LV) following administration of high-dose methotrexate (HDMTX) and LV.
Methods: Open-label, multicenter PK study in pts treated with HDMTX (≥ 1 g/m^2) and LV (either ≥ 15 mg or ≥ 10 mg/m2) with subsequent glucarpidase where indicated for renal impairment (Arm A) or without glucarpidase (Arm B). Plasma samples for LV and 5MeTHF were taken pre-LV and at 5, 30, 60, 120, and 180 min after LV to calculate the area under the concentration curve of 6S-LV over 0–3 hours (AUC_{0-3}) following the LV dose.
Results: 17 pts (8 Arm A, 9 Arm B) were analyzed.

The median pre-glucarpidase methotrexate (MTX) plasma concentration was higher for Arm A 7.5 µmol/L) than B (1.1 µmol/L). Similarly, median LV doses were 89.88 mg/m^2 (Arm A) and 13.51 mg/m^2 (Arm B).

Mean 6S-LV AUC_{0-3} values (µmol*h/L) for Arm A were 8.70 ± 5.56, compared with 1.31 ± 0.78 for Arm B, consistent with Arm A receiving a higher LV dose than Arm B. Mean 6S-5MeTHF AUC_{0-3} values (µmol*h/L) were similar in arms A and B (0.68 and 0.73). When normalized for LV doses, mean 6S-LV AUC_{0-3} values (µmol*h/L) were similar between arms: 10.02 ± 4.83 in Arm A versus 9.79 ± 5.18 for Arm B.
Conclusion(s): Glucarpidase does not reduce exposure to 6S-LV and 5-MeTHF to below the level achieved in patients with normal renal function who did not receive glucarpidase. Adequate LV exposure is achieved if LV dosing is based on pre-glucarpidase plasma MTX concentration for at least 48 hours after glucarpidase administration.
Keywords: Renal toxicity, Antineoplastic, Antidote

24. What your patients aren't reporting-comparing urine drug screen data to patient self-reported medication history

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Background: There is currently no standardized method for ascertaining accurate patient medication histories. While a combination of methods including patient self-report, medication lists, and pharmacy records are frequently used, these may not be comprehensive or indicative of actual medication use. The objective of this study is to determine the rate of under-reporting for common medications when patients are evaluated with a structured medication history assessment.
Methods: Patients were recruited from an urgent care clinic at a large urban safety-net hospital. Patients were asked to verbally recall their medication use over the past 14 days using a comprehensive, incremental medication history assessment tool. Urine samples were collected on the same day as the interview and analyzed for commonly used prescription and over-the-counter medications using LC/MS assays. Patients were classified into 2 groups: patients with at least 1 non-reported drug detected in their urine and all other patients.
Results: 100 patients completed the study. 151 positive drug screens were detected among 63 patients for 20 medications. Among these, 28 (44.4%) patients did not report the use of at least 1 drug detected in their urine. Among patients with non-reported drugs, 11 (39.3%) did not report the use of a scheduled drug. 38 (25.2%) of the

Variable	Value	Non-Reporters n = 28	All Others n = 72	p value
Gender	Female	17 (60.7%)	40 (55.6%)	0.6399
	Male	11 (39.3%)	32 (44.4%)	
Age (years)	Mean (SD)	38.8 (14.02)	36.0 (11.67)	0.3058
Ethnicity	Hispanic	12 (42.9%)	29 (40.3%)	0.8138
	Non-Hispanic	16 (57.1%)	43 (59.7%)	

151 positives detected were not reported, indicating some patients have more than 1 non-reported medication. There was no difference in gender, age or ethnicity between groups.
Conclusion: Even when utilizing a comprehensive systematic approach to collecting patient self-reported medication use some medications remain under reported. As the medication history spanned the prior 14 days, it is unlikely that the urine results reflect use outside of the history window. Reasons for failure to report include misidentification of the medication, lack of recall, and deliberate concealment. While concealment is expected for drugs with abuse potential such as opiates, several medications with no abuse potential were also under reported. This suggests patients are either misidentifying medications or cannot reliably recall medications. Most importantly, our findings suggest that patients often have medications in their system that are not detected by obtaining a detailed oral history. This may have significant implications for identifying and preventing adverse drug effects.
Keywords: Urine drug screen, Medication history, Emergency medicine

25. External validation of the prognostic utility of lactate for drug overdose fatality

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Background: With nearly 100 deaths/day day since 2007, the US is currently experiencing its worst drug overdose epidemic of all time. While diverse metabolic mechanisms may lead to hyperlactatemia in acute poisoning, all imply severe metabolic or hemodynamic insult. We previously demonstrated an association between hyperlactatemia and risk for inpatient mortality in poisoned patients. In this study we externally validate the prognostic utility of serum lactate for in-hospital fatality in ED patients with acute drug overdose.
Methods: This was an observational, prospective, cohort study over a 4-year period at 2 urban university teaching hospitals. Subjects were consecutive adult (>18y) ED drug overdose patients with serum lactate obtained in the ED; we excluded children and those missing lactate or outcome information. Data (demographics, history, vitals, chemistries) were obtained from electronic medical records using a standard data abstraction instrument. The initial lactate, drawn at the bedside in the ED, was used for analysis including receiver operating characteristics (ROC) to determine the optimal cutpoint (maximized sum of sensitivity and specificity). The study outcome was inpatient fatality. Sample size was determined a priori, assuming 20% prevalence of the predictor and mean lactate of 2 mmol/L we estimated the need to enroll 668 patients in order to have 90% power to detect a 4-fold difference in mortality risk.
Results: In 718 patients analyzed, 46% were female, mean age was 41.8 years, and similar drug exposure profiles existed between survivors (98.1%) and fatalities (1.9%). Mean lactate (mmol/L) was 7.96 ± 5.9 for fatalities and 2.2 ± 2.2 for survivors (t-test $p < 0.001$). The ROC area under the curve (c statistic) for prediction of fatality was 0.85 (CI 0.73–0.97). The optimal lactate cutpoints were 4.0 (OR 16.0, CI 5.2–49.2, 64.3% sensitivity, 90.5% specificity) and 6.0 (OR 41.9, CI 13.2–132.9, 64.3% sensitivity, 95.9% specificity). Lactate under 2.0 had 99.5% negative predictive value (CI 98.3–99.9).
Conclusions: In this large external validation study, the initial serum lactate drawn in the ED had excellent prognostic utility for inpatient drug overdose fatality. Clinicians should consider using lactate for disposition decision-making in patients with consequential drug overdose.
Keywords: Overdose, Acidosis, Laboratory

26. Ammonia concentrations peak later than valproic acid levels

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Background: Valproic acid (VPA) has been widely reported to cause symptomatic hyperammonemia, a well recognized neurotoxin. The objective of this study is to determine the time course in which ammonia (NH3) levels rise and peak in VPA overdose.
Methods: A single poison center database serving approximately a population of three million was queried for all cases with "valproic acid" listed as an exposure from April 2007 to February 2013. Cases were restricted to toxicological consults requested from a sole tertiary university hospital and were considered for inclusion regardless of other exposures listed. All cases that had at least three laboratory values for VPA and NH3 each were included in the study. Both the VPA and NH3 levels were compared with each other to determine if there was a temporal association between the two concentration peaks, and to determine if a peak VPA level was associated with a peak NH3 level.
Results: Forty-one cases met the search criteria and six cases met the inclusion criteria. All six cases demonstrated delayed maximum NH3 levels following peak VPA levels. The included cases were all acute overdoses; one patient required intubation for altered mental status. On average the NH3 level peaked 8.6 hours (range 2.1 hours to 17.8 hours) following the VPA peak. The maximum VPA level could not predict the maximum ammonia level; there was no significant correlation between peak VPA and peak ammonia levels (coefficient of correlation of 0.54 and p-value of 0.21).
Discussion: Our results demonstrate that peak NH3 levels lag behind peak VPA. In normal conditions, VPA's main metabolic pathway is through β-oxidation; however with long term therapy or overdose, a greater degree of ω-oxidation occurs. It is the metabolites of ω-oxidation that are theorized to decrease carnitine levels. Carnitine depletion prevents oxidation of fatty acids into acetyl-coenzyme A, a substrate that is ultimately required for the initiation of the urea cycle. Consequently, in overdose, as VPA transitions from beta to omega oxidation, peak NH3 levels would be expected to lag behind VPA as seen in our study.
Conclusion: In a small retrospective descriptive study, NH3 concentrations peaked later than VPA levels. In patients with persistent encephalopathy following VPA overdose, practitioners may consider trending NH3 levels even after the VPA concentration is diminishing.
Keywords: Anticonvulsant, Neurotoxicity, Ingestion

27. Evaluation of Log P value as a predictor of seizures associated with poisoning and drug overdose

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Background: The logarithm of the 1-octanol-water partition coefficient (log *P)* of chemicals, which is a measure of hydrophobicity (or lipophilicity), is widely used in numerous Quantitative Structure-Activity Relationship models for predicting the pharmaceutical properties of chemicals. Because most drugs cross the blood-brain barrier (BBB) by passive diffusion, lipophilicity is an important determinant of brain penetration. The objective of this study is to evaluate the role of Log *P* values of causes in chemical-induced seizure.
Methods: We conducted a review of the causes of seizures occurred in association with poisoning or drug intoxication using annual reports of Japanese Poison Information Center (2003–2008) and MEDLINE (1950–2007). The Log *P* values for drugs highly associated with seizure were collected from the literature (Hazardous Substances Data Bank, Interview Forms, etc.) and also were calculated from ACD/Log P software (ACD/Labs, Canada). Other Log P values were experimentally determined by the shake flask method (OECD guideline).
Results: 120 causes of seizures related to poisoning or drug intoxication were evaluated (pharmaceuticals 90, pesticide 13, natural poisons 5). In this survey, we collected the Log *P* values of 87 causes(range between -5.4 and 5.19). Seventy of these 88 causes were lipophilic (Log $P > 0$). The leading causes of seizures such as tricyclic antidepressants (1.38–5.19), organophosphates (-0.85–4.31), camphor (2.38) and strychnine (1.93), showed almost highly lipophilic. We also calculated the BBB permeability rates that related to Log *P* and molecular weight. It was shown that the shift speed in the brain suddenly rose when Log *P* exceeded 1.
Conclusions: When Log *P* of the causative agent of the poisoning is bigger than 1, the risk that seizure happen seems to increase. To evaluate drugs for CNS toxicity, it is important to understand this factors that affect drug delivery to the site of action.
Keywords: Seizure, Log P, BBB permeability rate

28. Toxicokinetics and toxicodynamics of massive human rivaroxaban overdose

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Background: Rivaroxaban (RXA) is a novel oral selective potent direct factor Xa (FXa) inhibitor, approved for prevention of stroke in atrial fibrillation, and prevention and treatment of venous thromboembolism. There is little information on patterns of toxicity and toxicokinetics of this substance in human overdose. In dose finding studies with plasma concentrations ranging between 0.5–500 μg/L, pharmacokinetic and pharmacodynamic parameters were largely dose-dependent. Plasma concentrations reach a maximum 2–4 h after ingestion, the terminal elimination half-life is 5–9 h.
Case report: A 63-y/o Caucasian male with a history of coronary heart disease with chronic atrial fibrillation, idiopathic thrombocytopenia, and chronic vertigo with subsequent falls was brought to the ED 2.5 h after ingestion of 1960 mg RXA (98 tbl.), 90 mg diazepam, 1 g quetiapine, and 50 mg zolpidem with suicidal intent. At admission he was fully conscious, temperature 35.9°C (96.6°F), blood pressure 120/90 mmHg, heart rate 90 bpm. The ECG showed atrial fibrillation. Laboratory analysis 2.8 h post ingestion revealed thrombocytopenia 127 G/L, INR 5.4, PTT 64 s (normal 25–37), FX activity 0.14 (0.77–1.3). Rotational thromboelastometry showed a prolonged clotting time (CT): Extem CT 288 s (38–70), Intem CT 367 s (100–240) and Fibtem CT 297 s (43–69). RXA quantification with modified chromogenic anti-FXa assay indicated a high RXA plasma level (2010 μg/L), which was later confirmed by an HPLC-MS/MS assay (2207 μg/L). The patient was treated with oral activated charcoal 1 g/kg (3 h after ingestion), and 2000 IU prothrombin complex concentrate (PCC) (4.5 h after ingestion). 7 h after ingestion hematologic parameters improved (INR 3.2, FX activity 0.41), and RXA plasma concentration was 1106 μg/L. Without further treatment, values 23 h post ingestion were: INR 1.4, FX activity 0.95, and RXA 158 μg/L. No bleeding occurred.
Case discussion: This massive RXA overdose led to very high RXA plasma concentrations, which have never been reported before, although bioavailability exhibits saturation kinetics. Tmax was not delayed as compared to therapeutic doses, and elimination half-life was not prolonged. Inhibition of FX activity showed the ceiling effect described already at lower doses, thus limiting the risk of bleeding.
Conclusions: An oral overdose of RXA may lead to plasma RXA concentrations > 2000 μg/L, but not to a more pronounced FXa inhibition than at plasma concentrations around 500 μg/L. The risk of bleeding is probably limited and more dependent on other factors than RXA plasma concentrations. Although there seems to be no need for PCC in RXA overdoses without bleeding, we recommend to evaluate each case on an individual basis.
Keywords: Rivaroxaban, Factor Xa inhibitor, Prothrombin complex concentrate

29. Analysis of the response to treatment with hyperbaric oxygen in a rat model with myocardial toxicity induced by amitriptyline

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The cyclic antidepressants are a group of drugs widely distributed that are involved in most psychoactive poisonings. These drugs act through inhibition of presynaptic serotonin and adrenaline uptake, also show antagonism of muscarinic cholinergic receptors and blockade of the fast sodium channel, slowing the phase 0 of

the action potential. Nowadays the sodium bicarbonate (SB) represents one of the most important components on the treatment of the patient with cyclic antidepressants poisoning. However this treatment requires the installation of a central venous catheter as well as a close monitoring of serum pH and potassium. On the other hand, the hyperbaric oxygen therapy (HBO) has shown to be effective on the regulation of the vascular tone and the heart rate as well as many other hemodynamic parameters through the improvement of the oxygen delivery, the reduction of the oxydative stress and other mechanisms that are not well elucidated. Our objective is to analyze the effect of the hyperbaric oxygen on the QRS interval (QRS) and the heart rate (HR) on a model of rat with amitriptyline poisoning.

In this work a total of 42 wistar rats were included to integrate the following groups: Group 1: Control group; Group 2: Amitriptyline poisoning; Group 3: Amitriptyline poisoning treated with SB and Group 4: Amitriptyline poisoning treated with HBO. An electrocardiogram (EKG) was performed to every group at time 0, 60, 180 and 540 minutes corresponding to its basal state, poisoned and after treating in 1 and 2 doses respectively. The HR (b/min) and the QRS (mseg) was obtained from the EKG to get the following results: With an only dose of amitriptyline 50 mg/kg IP we observed a mean HR at 180 minutes on 383.8 for the group 1; 269.1 for the group 2; 353 for the group 3 and 318.3 for the group 4. At 540 minutes (after 2 doses of treatment) we obtained a mean HR on 270 for the group 2; 385 for the group 3 and 385 for the group 4. With respect to QRS at 180 minutes we observed a mean of 32.4 for the group 1; 42.6 for the group 2; 37.5 for the group 3 and 38.3 for the group 4. Finally, at 540 minutes we get a mean QRS on 41.6 for the group 2; 34.1 for the group 3 and 31.6 for the group 4.

Based on the previous we conclude that amitriptyline poisoning treated with hyperbaric oxygen therapy after the second session shows an improvement of the heart rate and QRS interval length and therefore the results are comparable to those obtained with bicarbonate sodium than is currently the treatment of choice. Present study suggests that the HBO therapy can be used safely and beneficial in the treatment of amitriptyline poisoning.

Keywords: Hyperbaric oxygen therapy, Amitriptyline poisoning, Antidepressant, Cardiac toxicity, Electrocardiogram

30 "Orbeez": The magic absorbing bead – risk of pediatric bowel obstruction?

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Background: In December 2012, the US Consumer Product Safety Commission (CPSC) recalled the water-absorbing toy "WaterBalz" after reports of small intestine obstruction following ingestion by children. "Orbeez," another water-absorbing bead, remains available and is marketed as a children's toy. We sought to determine the extent to which "Orbeez" enlarge in various liquid media and potential risk for bowel obstruction.

Methods: Three "Orbeez" beads (red [R], yellow [Y], green [G]) were each added to 7 fl oz of the following liquid media. A: room temperature water. B: whole milk. C: simulated gastric fluid (Ricca Chemical Company: 0.2% (w/v) NaCl in 0.7% (v/v) HCL). D: GoLytely (Braintree Laboratories: PEG 3350 and Electrolytes), and E: vodka (80 proof). Diameter prior to addition to media and at 1 h, 2 h, 4 h, 6 h, 12 h and 24 h were measured using a caliper to the nearest 0.1 mm.

Table. Results for abstract number 30.

Time (h)	Diameter (mm)				
	Milk R/Y/G	Water R/Y/G	Gastric Fluid R/Y/G	GoLytely R/Y/G	Vodka R/Y/G
0	2.3/2.3/2.3	2.0/2.3/1.8	2.4/2.1/2.3	2.1/2.3/2.3	2.3/2.0/2.1
1	4.5/4.9/4.2	6.7/6.6/7.1	3.5/3.5/3.5	4.7/4.7/5.1	3.5/3.5/3.5
2	5.7/5.7/--	8.1/8.1/8.1	3.7/3.5/3.5	5.2/5.4/5.8	3.9/3.9/3.9
4	6.8/6.9/7.1	9.4/9.3/9.6	3.2/3.5/3.5	6.3/6.0/6.1	6.9/6.5/7.2
6	7.3/7.3/7.1	9.4/9.4/9.5	3.2/3.5/3.3	6.3/6.1/6.1	8.9/8.7/8.7
12	6.7/6.7/6.6	7.5/7.0/7.5	2.9/3.1/3.0	6.4/6.4/6.2	1.02/1.0/1.03
24	6.5/6.5/6.5	5.8/5.5/5.9	3.0/2.8/3.0	6.4/6.5/6.3	1.11/1.13/1.15

Results: Growth in each of the media was observed. Growth in simulated gastric fluid was minimal while the beads were observed to be the largest after 24 h in vodka. Clumping of the three beads was not observed to occur in any media. See Table.

Conclusions: "Orbeez" beads enlarge to a different extent in different liquid media. Growth in simulated gastric fluid was minimal. It does not appear that "Orbeez" swell to sizes that would be concerning for obstruction. While clumping was not observed with three beads, it is unknown whether clumping occurs with an ingestion of a larger number of "Orbeez".

Keywords: Pediatric, Ingestion, Toys

31. Markedly prolonged elevation of serum creatinine following Blue Thunder nitromethane-containing fuel ingestion

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Background: Nitromethane with or without methanol is found in fuels used by radio-controlled (R/C) model cars. Previous case reports of exposures to these fuels show that nitromethane can cause a spurious elevation of the serum creatinine (CR). This elevation is due to the interference of nitromethane with Jaffe colorimetric method used to determine the serum CR concentration by the majority of the diagnostic laboratories in the US. The duration of this effect is poorly described. We report a case of a patient with a spuriously elevated CR for greater than 36 hours.

Case report: 19 year-old male without a significant past medical history unintentionally drank approximately one mouthful of "Blue Thunder R/C Car Fuel" that had been stored in a juice bottle. The patient presented to a local emergency department about one hour after ingestion. At the time of presentation, the patient was asymptomatic. His vital signs and physical examination were normal except for a BP of 157/67. Initial laboratory results revealed

	CR over time					
Hours post-ingestion	3	4	10	20	36	60
Serum creatinine (mg/dL)	4.9	4.7	4.4	4	2.9	1

a CR of 4.9 mg/dL. The remainder of the patient's BMP, CBC, LFTs, and UA were within normal range. The Regional Poison Center was consulted and recommended observation only. Serum ethanol, methanol, and ethylene glycol levels were sent. The patient was admitted to the general medical floor and treated with IV fluids and empiric fomepizole.

The remainder of the patient's diagnostic testing including serum ethanol, methanol, ethylene glycol, CPK, methemoglobin, urine electrolytes, and renal ultrasound were within normal range. The patient was discharged on hospital day #3.

Case discussion: Nitromethane is contained in many fuels used by radio-controlled (R/C) model cars. Exposure to nitromethane is known to cause spurious elevations of the serum CR. In this case, the elevation was markedly prolonged for more than 36 hours after exposure. While this interaction is well known, the duration of effect has not been well described. A prolonged elevation in serum creatinine may prompt practitioners to order unnecessary tests as was done in our case.

Conclusions: We report a rare case of factitious elevation of creatinine secondary to nitromethane ingestion. In this case we document the time interval to normalization, which has not been previously described. The kinetics of elimination and interference with the Jaffe colorimetric method require further study.

Keywords: Renal toxicity, Nitromethane, Laboratory

32. Should we GoLytely in recommending whole bowel irrigation?

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Background: According to a published position statement, whole bowel irrigation (WBI) should be considered in patients with potentially toxic ingestions of sustained-release or enteric-coated drugs, oral iron overdose, retained lead in stomach or small bowel, and after ingestion of packets of illegal drugs. Proper dosing regimens include 1–2 L per hour of polyethylene glycol (PEG) (500mL per hour in pediatric patients) via nasogastric (NG) tube until clear rectal effluent or resolution of radiographic abnormality. The aim of our study is to determine how often WBI is recommended, for what substances, and how often it is performed correctly as reported to a single regional poison center (RPC).

Methods: Utilizing Crystal Reports (Version 11.0) we retrospectively queried cases (1/1/2009 and 12/31/2010) where WBI was performed by clinicians who consulted our RPC (annual call volume 90,000). Analysis included patient demographics, substance, PEG administration specifics, and whether standard endpoints of WBI were reached. Descriptive statistics were used to report the data.

Results: During the study period, WBI was performed in 89 patients. The mean age was 29 years (range: 17 months to 63 years; 66% male). Substances and frequencies were: cocaine body stuffers (34), heroin body stuffers (19), lead (9), lithium (7), iron (5), unknown (4), cocaine plus heroin body stuffers (3), buproprion XL (2), batteries (2), opioid patch (2), and methamphetamine plus heroin body stuffer (1). Procedural administration of PEG and endpoints obtained were as follows; 1) NG utilized in 10/89 (11%), 2) PEG flow rate of 1–2L/hour in 4/89 (4%), and 3) clear rectal effluent and/or normal radiograph for radio-opacities in 16/89 (18%). Patients met all 3 criteria in 2/89 (2%) of cases. None of the patients administered WBI died.

Conclusions: Although these data are limited by the retrospective nature of this study, some points are clear. WBI irrigation is rarely administered correctly and no patient died from drug toxicity despite improper decontamination. A similar, previous study performed by our RPC (2001–2007) similarly indicated poor adherence to guidelines for WBI (21% met all criteria). More recently, our data reveal a significant decline in an ability to administer WBI per standard recommendations (2%). Further research is needed to determine if there is a select patient population that will benefit from such a complicated and challenging form of gut decontamination.

Keywords: Decontamination, Poison center, Ingestion

33. Strategies for managing antidote shortages

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Background: Drug shortages in the U.S. are a growing problem. Reduced availability of 224 drugs were reported from January 1996 to June 2002. This number increased to 267 in 2011 alone. Drugs at risk for shortages include sterile injectables, single-source agents, and generic drugs. In 2012, ACMT and AACT drafted a position statement to the FDA that encourages recognition of antidotes as emergency, life-supporting medications and notification of impending shortages. Toxicologists and poison control centers (PCC) have previously addressed appropriate stocking of antidotes by hospitals. Neither of these approaches focuses on alternatives in the management of overdose patients when an antidote is unavailable.

Objective: To identify current antidote shortages and assess alternatives addressed in the medical literature for patient management when the antidote is unavailable.

Methods: We conducted a search of the American Society of Health-System Pharmacists (ASHP) and FDA websites for antidote drug shortages. Literature searches were conducted in PubMed, EMBASE, and Google Scholar for 20 common antidotes limited to the MeSH subheadings supply/distribution and again as the drug name and "drug shortages". Studies investigating inadequate antidote stocking not related to drug shortages were excluded. Additional searches on management of drug shortages were performed.

Results: The ASHP and FDA webpages identified reduced availability of 15 antidotes including methylene blue, sodium bicarbonate, acetylcysteine and others. Secondary literature searches identified 9 articles addressing reduced availability of specific antidotes associated with a drug shortage; 2 addressed leucovorin shortage in cancer chemotherapy, 2 addressed sterile ethanol intravenous solution, 1 addressed intravenous phytonadione, 3 addressed snake antivenin (1990s) and 1 addressed digoxin specific binding Fab fragments (Sri Lanka). Thirteen studies on managing drug shortages (not antidotes) were identified. Recommended strategies for coping with drug shortages include staying abreast of drug shortages through ASHP and FDA, preparing alternative treatment plans for unavailable drugs and proper stewardship of drug use. As the medical community has not adequately addressed these strategies as related to antidote shortages, we developed a table with common antidotes, potential risk of shortage, indications for best use, and possible alternative treatment options during shortages.

Conclusion: Hospital pharmacists across the U.S. focus on developing plans for drug shortages. Toxicologists and PCC should be acutely aware of antidote shortages and take the lead in developing strategies for shortages of these important toxicology drugs.
Keywords: Antidote, FDA, Poison center

34. Clinical Experience with uridine triacetate for 5-FU overexposure

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Background: 5-fluorouracil (5-FU) is broadly used to treat solid tumors. It is typically administered by IV infusion, at or near its maximum tolerated dose, over several days. The use of infusion pumps increases the possibility of life-threatening or lethal toxicity due to errors in pump programming, infusion reservoir errors and dosage miscalculations. Partial or total dihydropyrimidine dehydrogenase (DPD) deficiency, which predisposes patients (up to 3% of the population) to impaired 5-FU elimination, can also result in serious or lethal toxicity,

Uridine triacetate is an orally bioavailable direct biochemical antagonist of 5-FU toxicity that has been used successfully to treat patients in emergency overdose situations as well as patients with known or suspected overexposure to 5-FU due to DPD deficiency or other causes.

Approximately 100 patients at excess risk of 5-FU toxicity due to 5-FU overdose, accidental Xeloda (capecitabine) ingestion, or possible DPD deficiency (rapid onset of severe toxicities) have been treated with uridine triacetate using a common treatment regimen and protocol. More than 80 of these cases have occurred since 2009.
Methods: Uridine triacetate was provided under emergency IND provisions or an expanded access protocol when requested by qualified clinical sites following 5-FU overexposures, most due to infusion pump errors. Patients received uridine triacetate (10g q6h for 20 doses) as soon as possible after recognition of the overdose or possible clearance defect. Clinical outcomes, including safety and resumption of chemotherapy, were monitored.
Results: To date 98 patients overexposed to 5-FU have been treated with uridine triacetate. 96 of these 98 patients recovered fully. Reductions in or absence of GI, hematologic, and other toxicities associated with 5-FU poisoning were observed. Mild or no adverse events were attributed to uridine triacetate.
Conclusion(s)/Discussion: Uridine triacetate appears to be a safe and effective life-saving antidote for 5-FU overexposure in emergency situations.
Keywords: Antidote, Medical toxicology, Overdose

35. Descriptive analysis of patients receiving digoxin immune fab therapy: Demographics, concentrations, recommendations

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Background: Digoxin (DIG) is the most commonly prescribed cardiac glycoside in the United States. The administration of DIG immune Fab (DIF) is considered commonplace in the treatment of DIG toxicity. However, there have been few studies describing DIG post-DIF concentrations (C_p). As a result, an 8-year retrospective review was initiated with the aim of assessing DIG C_p after the administration of DIF.
Methods: Utilizing Crystal Reports (version 11.0), all DIF coded cases were retrospectively queried from a regional poison center (RPC). Data collected included reported amount and time of DIG ingested; initial heart rate and blood pressure, electrocardiogram (ECG) changes, gastrointestinal symptoms; pre- and post-DIF DIG C_p; serial potassium (K) C_p; time of DIG and K C_p; and mortality. Of 194 DIF coded cases from 11/2004 to 10/2012, 112 patients with DIG toxicity receiving DIF were included. Eighty-two cases were excluded due to wrong coding, DIF recommended but not administered, or poor documentation.
Results: Of the 112 cases, 79 (70.5%) were female, and 33 (29.5%) were male with a mean age of 69.5 years (range 0–96, SD 23.1). Eighty-three (74.1%) of the cases were chronic, 17 (15.2%) were acute on chronic, and 12 (10.7%) were acute with only 16 (14.3%) being reported as intentional. No one presented in cardiac arrest and only 56 (50%) had ECG changes. The mean initial DIG C_p was 5.7 ng/mL (range 2–26, SD 4.1) and the initial mean serum K was 5.3 mEq/L (range 3–9, SD 1.2). There were 7 (6.3%) patients with a mean DIG $C_p \leq 2.5$ ng/mL, with a mean K of 5.8 mEq/L (range 3.9–8.6, SD 2) compared to 11 (9.8%) cases in which the DIG C_p was ≥ 10 ng/mL with a mean K of 5 mEq/L (range 3.7–7.2, SD 1.2). Review of RPC recommendations found that in 24 (21.4%) cases, health professionals were encouraged to obtain further DIG C_p, 14 (12.5%) were told to hold all further DIG C_p, and 12 (10.7%) were told to obtain only free DIG C_p after the administration of DIF. In the 38 cases encouraged to obtain post-DIF C_p (free and total), 21 (55.3%) obtained C_p. A total of 8 patients had both pre- and post-DIF serum DIG C_p, and of these, only 1 (9.7%) showed an increase in serum DIG C_p post-DIF compared to 7 (87.5%) that showed a decrease.
Conclusions: The majority of cases in which DIF was administered were unintentional, chronic DIG ingestions, and mean K did not correlate with the degree of presenting DIG C_p. In addition, inconsistent recommendations from the RPC regarding the obtainment of C_p after DIF were noted. Serum DIG C_p were more likely to be decreased after the administration of DIF rather than increased as commonly reported. Based on these current findings, further elucidation of DIF influence on DIG C_p is warranted.
Keywords: Cardiac glycoside, Antidote, Overdose

36. Surfactant administration as treatment for respiratory failure following hydrocarbon aspiration

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Background: Hydrocarbon aspiration (HA) is well described as a cause of potentially fatal childhood poisoning. HA-induced acute

respiratory distressed syndrome (ARDS) necessitates supportive cares, mechanical ventilation and may require rescue therapy with extracorporeal membrane oxygenation (ECMO). Published use of exogenous surfactant (ES) in this context is scant. Combined use of ES and ECMO has not been reported. We present a case of HA-induced ARDS successfully treated with ECMO and ES; response is documented with clinical, radiographic, and ECMO flow data.

Case: A previously healthy 18-month-old boy presented to the Emergency Department via private car after witnessed aspiration of an oil-based cosmetic. Initial vital signs included respiratory rate 33, pulse 165 beats per minute, blood pressure 124/65 mmHg, and oxygen saturation 83% with bag valve mask ventilation. Physical exam showed a Glasgow Coma Scale score of 9, vomit in nares and oropharynx, tachypnea, grunting, and respiratory retractions. The patient was intubated and venous blood gas showed pH 6.98, pCO2 103 mmHg, pO2 25 mmHg, bicarbonate 24 mmol/L, and lactate 17 mmol/L. Chest x-ray showed bilateral pulmonary opacities. Venovenous ECMO was initiated due to continued hypoxemia despite advanced ventilator support. Sixty hours post-ingestion, 2 mL/kg of beractant (Survanta®) surfactant was injected into bilateral lower lobes during bronchoscopy. After 24 hours, ECMO support needs decreased marginally and chest radiography improved, so another dose was administered. ECMO flow rate subsequently decreased from 88 to 61.1 ml/kg/min, sweep gas from 2.2 to 0.7 L/min, and fraction of inspired oxygen (FiO2) from 1.0 to 0.40 over the next 30 hours, indicating a marked improvement in pulmonary vascular resistance. ECMO support was discontinued on day 8 after a mediastinal hemorrhage. He was extubated on day 14 and had a complete recovery without neurologic sequalae.

Case discussion: Hydrocarbons are organic compounds ubiquitous to products for cleaning, heating, and cooking. HA may lead to ARDS and death despite mechanical ventilation and ECMO. Proposed mechanisms of lung injury include disruption of the pulmonary surfactant layer and direct toxicity to lung tissue. ES's are approved for use in neonatal respiratory distress syndrome and are routinely stocked in Level I or II neonatal intensive care units. ES administration may be a useful adjuvant in cases of HA-induced ARDS.

Conclusion: HA-induced ARDS is potentially fatal despite advances in treatment. This case of HA-induced ARDS treated successfully with ECMO and ES is the first to add ECMO flow data to support the overall response to therapy with ES.

Keywords: Hydrocarbon, Pediatric, Antidote

37. Haloperidol successfully treats cannabinoid hyperemesis syndrome

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Background: Cannabinoid hyperemesis syndrome(CHS) is typically unresponsive to conventional pharmacologic antiemetics and patients often require hospital admission. We report 4 cases of CHS in patients habituated to cannabis and without psychiatric problems that improved significantly after ED treatment with haloperidol.

Case Series: *Case 1*: 34 yo male with recurrent CHS arrived to the ED with vomiting for 4 days. He has been admitted to our hospital 7 times and had multiple unremarkable diagnostic tests and several specialty consults. Only hot showers and abstinence help his symptoms; promethazine(PRO) and ondansetron(OND) have not worked. Initial ED treatment with OND 4 mg IV and IV fluids(IVF) did not improve his vomiting. He was given haloperidol 5mg IV, within 1 hour his symptoms resolved and was discharged home from the ED. *Case 2*: 28 yo male with recurrent CHS and multiple ED visits and non-diagnostic workups came to the ED for admission: he insisted no medical treatment ever improved his symptoms, including OND, metoclopramide(MET), or chlorpromazine(CHL). Initial ED treatment included haloperidol 5 mg IV, diphenhydramine 25 mg IV and IVF. Within 1 hour he improved, had no more vomiting, and was discharged from our ED 6 hours later. *Case 3*: 48 yo male arrived to the ED with vomiting for 2 days. He had multiple unremarkable workups over the past year for cyclical vomiting, but no one gave him the diagnosis of CHS despite his chronic cannabis use. He also reported no medications ever helped him (MET, PRO, OND, CHL). Initial ED treatment with OND 4 mg IV and IVF was unsuccessful. He was then given haloperidol 5 mg IV, within 1 hour his vomiting resolved and was discharged home within 8 hours. *Case 4*: 22 yo male with recurrent CHS arrived for treatment of vomiting and admission because MET and OND never work. Initial ED treatment with OND 4 mg IV and IVF were unsuccessful. He was then given haloperidol 5 mg IV, within 2 hours his vomiting resolved, and he was discharged home 6 hours later.

Discussion: All 4 patients arrived convinced hospital admission was needed for their cyclical vomiting, but all improved with haloperidol and were discharged. All had no psychiatric problems. The mechanism for CHS remains uncertain, but dysregulation at CB1 is likely. Haloperidol has antiemetic effects via D2 agonism in the chemoreceptor trigger zone, but recent animal data also show complex interactions between dopamine and CB1 signaling, another potential mechanism for haloperidol success in CHS patients.

Conclusion: Other than hot showers, CHS often resists conventional anti-emetics and results in costly admissions. Our success with haloperidol in these 4 patients warrants further investigation of haloperidol as an ED treatment for CHS.

Keywords: Cannabinoid hyperemesis syndrome, Antidote, Haloperidol

38. Forgoing the Folate – Fair or Folly?

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Introduction: A recent outbreak of methanol poisoning in Libya highlights morbidity following methanol poisoning. While hemodialysis (HD) and alcohol dehydrogenase (ADH) inhibition are the cornerstone of therapy, folic acid (FA) may be considered adjunctive treatment with the goal of converting formate into carbon dioxide and water. The aim of this study is to review our regional poison center's (RPC) recommendation of folate therapy in suspected methanol poisonings.

Methods: Utilizing Crystal Reports (Version 11.0), all methanol exposures reported to our RPC (2002 – 2012) were retrospectively queried. Patients with reported methanol ingestions were included in order to define frequency of folate recommendation, other

therapy rendered, degree of illness, and ultimate outcome. A trend for folate recommendation is also reported. Patients were excluded if methanol exposure was deemed insignificant by history.
Results: One hundred and two methanol ingestions met inclusion criteria (average age 28 years; 68% male). FA was recommended in 34 patients (33%). Of those who received ADH inhibition or HD, FA was recommended in 41% and 68%, respectively. 57% of patients who developed major effects were recommended FA. In contrast, of those who did not receive ADH inhibition or HD, FA was recommended 9% and18% of the time, respectively. 26% of patients who did not have major effects were recommended FA.

Overall, 85% of FA recommendations occurred between 2002–2006 (48% of all patients during this time span). The average pH was 7.22, 47 (78%) received ADH inhibition, 21 (35%) HD, and 8 (13%) had major effects. Comparatively, FA was only recommended 5 times (12%) between 2007–2012. During these latter years, the average pH was 7.22, 34 (81%) received ADH inhibition, 10 (24%) HD and 6 (14%) had major effects.
Conclusion: One-third of all methanol exposures meeting inclusion criteria were recommended FA as adjunctive therapy. Interestingly, patients who received ADH inhibition or HD were more likely to be recommended FA. Additionally, a greater number of FA recommendations occurred in higher frequency in those patients with major effects. A sharp decline in FA recommendation occurred between cases presenting in 2002–2006 and 2007–2012 (48% and 12% respectively) despite similar pH, rates of ADH inhibition, HD and major effects.

Despite animal studies suggesting FA is efficacious in methanol poisoning, a prospective study would be required to demonstrate this in humans. However, in light of its safety margin and lack of expense, FA may be more appropriately entertained after large outbreaks without resources such as ADH inhibition or HD and more so in those patients referred to a RPC that are unlikely to receive conventional therapy.
Keywords: Methanol, Antidote, Folic Acid

39. Sodium acetate substitution for sodium bicarbonate in pediatric poisoning: A case series

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Background: Sodium bicarbonate is used to treat poisoning from sodium channel blocking drugs or from salicylate, but it may not be available due to supply shortages in the U.S. Sodium acetate has been suggested as a substitute, but clinical experience with this alternative is limited – especially with children. We describe the use of sodium acetate in the treatment of 4 poisoned children aged 2 to 16 years.
Case Reports: A sodium acetate infusion given to a 35-month-old girl with QRS interval prolongation and decreased perfusion after an exploratory overdose of flecainide led to a peak blood pH of 7.48, serum sodium of 142 mmol/l, and serum carbon dioxide of 32 mmol/L. Additionally, a 12-year-old girl with tachycardia, a wide QRS interval, and hypotension after ingestion of nortriptyline; and a 16-year-old girl with QRS widening after a suicide attempt with bupropion; also were treated with sodium acetate and clinicians achieved what they felt to be acceptable endpoints of sodium supplementation and rise in blood pH. Sodium acetate was also used to achieve and maintain a blood pH $>$ 7.45 and a urine pH $>$ 7 in the treatment of a 15-year-old girl with metabolic acidosis and tachycardia due to salicylate poisoning. All 4 patients fully recovered. No adverse events were attributed to sodium acetate in any case.
Case discussion: Sodium acetate may be metabolized to sodium bicarbonate in a meq-for-meq for ratio, but conversion takes time and may be affected by age, muscle mass, alterations in tissue perfusion, and other metabolic factors. All four children treated with sodium acetate in this case series achieved objective measures of blood alkalinization, recovered from their poisoning syndromes, and seemed to tolerate the therapy acceptably. It is not known if hypoxemia or further impaired tissue perfusion might have interfered with biotransformation of acetate, or if higher doses of sodium acetate might have led to an equilibrium state which might promote acidosis from acetate accumulation. Caution is also advised in extrapolating this information to young infants who may have significant differences in body composition and metabolic processes compared to older children and adults.Unfortunately, sodium acetate has also been subject to recent supply shortages in the U.S.
Conclusions: Drug shortages can force clinicians to consider use of alternative therapies. These four cases provide information that can be utilized to inform future clinical decision making regarding the potential use of sodium acetate in treating children with cardiac toxicity from sodium channel blocking xenobiotics, or in treating pediatric salicylate poisoning. This series may also be useful in research hypothesis generation.
Keywords: Sodium Acetate, Antidote, Cardiac toxicity

40. What the Muktuk? Whale Blubber as a Cathartic Agent

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Background: Whale blubber is a thick layer of vascularized adipose tissue found underneath the skin of marine mammals where it used for insulation and buoyancy. It contains a rich network of collagen fibers and lipid-rich tissue. Whale blubber, referred by the Inuit as Muktuk, is an important staple of their diet due to its high-caloric content and source of vitamin D, E, selenium and anti-oxidants.
Case report: A set of 2 year old female twins with no medical problems shared a bottle of their mother's prenatal vitamins 15 minutes prior to calling the Alaska Poison Control Center. The mother was certain that the bottle was missing 50 tablets, with each tablet containing 27 mg of iron. Given concerns for a potentially toxic dose, the children were transferred to closest emergency department for further management and evaluation of serum levels. Upon arrival to the closest emergency department four hours later, the children were asymptomatic with normal vital signs and tolerating oral intake. Immediately available laboratory studies were only remarkable for anemia and mild elevations of alkaline phosphatase and bilirubin. Flat plates were performed in both children, but no radio-opaque tablets were identified. During their entire emergency department visit, both children were fed the local delicacy whale blubber as instructed by local aides to enhance bowel activity. Six hours after their ingestion,

the children remained asymptomatic, and one of the children had a witnessed bowel movement in the emergency department that contained seven tablets.

Case discussion: There is no published data on blubber being used as a cathartic agent. This case describes how Muktuk enhanced elimination of pills since it resulted in rapid passage of fragments within 6 hours of ingestion. The mechanism behind its cathartic action is unknown. It can be theorized that with its high lipid content, it may behave similarly to vegetable oil cathartics. These oils when ingested are hydrolyzed by pancreatic enzymes into irritating fatty acids, which lead to rapid evacuation of fecal material.

Conclusions: This is the first report of whale blubber acting as a cathartic agent when administered post iron pill ingestion.

41. Multiple dose activated charcoal fails to reduce elimination half-life in a severe phenobarbital toxicity

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Background: Phenobarbital is a sedative hypnotic known to have a long elimination half-life (t1/2). Treatment modalities to enhance its elimination include multiple dose activated charcoal (MDAC), urinary alkalinization (UA), and hemodialysis (HD). No clear guidelines exist as to when each of these modalities should be initiated.

Case report: A 47 year-old woman with bipolar disorder presented after a reported ingestion of sixty of her own phenobarbital 60mg tablets. There were no other reported ingestions. Home medications also included carbamazepine, alprazolam, and quetiapine. Upon arrival to the ED, she was unresponsive and intubated for airway protection. Initial BP: 94/66 mmHg with HR: 82/min. Initial phenobarbital level was 112 mg/L, subsequently rising to 157 mg/L a few hours later. Remarkable labs: Creatinine 1.0; K + 2.8; ETOH:0; carbamazepine 3.5 mcg/mL; and urine drug screen: + benzodiazepines. A total of eight doses of charcoal were confirmed to have been given during her hospitalization: Day 1: 50 g × 2, 25g × 3 and Day 3: 25g × 3. She did not undergo UA or HD. Patient remained comatose and without sedation for the first four days. Serial phenobarbital levels demonstrated a slow decline (Figure 1). On Day 5, patient began to regain consciousness as her level decreased to 68.1 mg/L. Extubation was attempted on Day 6, but she required re-intubation secondary to stridor and respiratory distress. Due to vocal cord and esophageal swelling visualized during bronchoscopy, tracheostomy was performed on Day 10 with discharge to a rehabilitation facility on Day 14.

Case discussion: The t½ of phenobarbital ranges from 80–120 hours in overdose. Studies have demonstrated that this can be reduced to between 36–38 hours with MDAC. HD has also been shown to be effective, leading to a reduction in serum phenobarbital concentrations. Our patient had high levels with a t1/2 of 83.8 hours overalller during her admission, which led to a prolonged and complicated hospital course. The t1/2 while receiving MDAC was 91.4 hours - well outside of the range published for patients receiving MDAC. It was unexpected that the t1/2 during the period of MDAC administration was longer than while the patient was not receiving MDAC (t1/2 = 80.5 hours). Any unidentified co-ingestions or other factors contributing to this phenomenon could not be established.

Conclusion: This case report highlights the need to consider alternative enhanced elimination techniques (UA, HD) when the initial method does not effectively decrease the t½ in a clinically meaningful manner. Potential risks of each modality, individual patient factors, and attempts to shorten hospital stays remain challenges in optimizing elimination.

Keywords: Enhanced elimination, Activated charcoal, phenobarbital

42. Grandparent involvement in exploratory pediatric poisonings: A hospital-based study

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Background: Exploratory pediatric poisonings (EPPs) in young children remain common, and considerable educational efforts are directed at parents regarding poisoning risk reduction. Grandparents (GPs) also provide child care, and prior studies have noted the potential for GP's medications, supervision or homes to be risk factors for EPPs, though most such studies have been poison control center (PCC)–based and have not examined these 3 factors individually. Thus, the aims of this study were to characterize EPPs with GP involvement resulting in emergency department (ED) evaluation and/or hospitalization, and to compare outcomes between such cases and those without GP involvement.

Methods: In this retrospective cohort study, electronic medical records of a children's hospital and its regional PCC were searched to identify patients < 6 years old who were evaluated between January 1,2006 and December 31,2008 for acute EPPs in the ED and/or were hospitalized. Patients were included if they were < 6 years of age, and had a diagnosis code of acute poisoning. Patients were excluded if they had food or medication allergic reactions, food poisoning, environmental exposures or concern for malicious poisoning. Patients were characterized with descriptive statistics. Predictor variables included GP involvement (GP's medication, GP's home, or GP as caregiver), and the primary outcome variable was severity of illness classified as asymptomatic, symptomatic but stable, or critical (adapted from the American Association of PCCs classification system of none, mild + moderate or severe outcomes, respectively). Associations between GP involvement and clinical outcome were sought using a linear test of trends.

Results: 890 children were included in the study. They were 57.2% male; mean age 27.4 months (SD 14.0 months); 63.9% black, 23.3% white, 2.6% Hispanic; and had insurance status of private 25.6%, Medicaid/CHIP 69.8%, self 4.4%. GP involvement was noted as follows: GPs home in 5.3%, GP caregiver in 8.5% and GPs medications in 11.8%, with any GP involvement in 16.9% of cases. GP home cases were more often symptomatic (36.2% vs 27.5%) or critical (8.5% vs 2.9 %) than non-GP home cases (p = 0.01). There was no association between GP caregiving or medications with clinical outcomes.

Conclusions: In this study, GP involvement was noted in 17% of EPPs resulting in hospital care, and GP homes were a particular risk factor for clinical severity. Limits of this study in estimating risk of GP involvement for EPP include its retrospective nature and our inability to quantify, or control for, children's "exposure" to their GPs.
Keywords: Pediatric, Epidemiology, Grandparents

43. A novel agent for agitated delirium: a case series of ketamine utilization in the emergency department (ED)

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Background: Ketamine is used in procedural sedation and general anesthesia. Ketamine is a noncompetitive N-methyl-D-aspartic acid (NMDA) antagonist, making it an effective dissociative analgesic agent. We present a novel case series describing the use of ketamine to treat agitated delirium in pediatrics.
Cases: 1: A 16 year-old (yo) male with oppositional defiant disorder exhibited suicidal intent and posed physical danger to staff. He received 2 mg/kg (200 mg) of IM ketamine, providing adequate sedation in 5 minutes. After 20 minutes he was given 2 mg lorazepam IM and 2.5 mg haloperidol IM to maintain sedation. This chemical restraint plan allowed proper ED evaluation with controlled transfer to psychiatry.
2: An 18yo female with schizophrenia exhibited paranoid and erratic behavior. She was physically abusive toward staff and received 1.5 mg/kg (100 mg) IM ketamine. Adequate sedation was achieved within 10 minutes. In the ED 3 separate doses of 1 mg lorazepam IV were given to sustain sedation and maintain control.
3: A 15yo male presented after reported ingestion of 4 tabs of "acid" and was tachycardic and aggressive toward staff. Over 8 hours a total of 24 mg lorazepam, 80 mg diazepam, and 8 mg midazolam were inadequate to quell the agitation. The patient received 1 mg/kg (50 mg) ketamine IV. Adequate sedation was achieved within 10 minutes.
4: A 16yo male presented with erratic behavior. He was tachycardic, agitated and aggressive toward staff. He received 2.5 mg lorazepam IV but continued his violent behavior. He then received 2.5 mg/kg (200 mg) ketamine IM and was adequately sedated in 6 minutes. In 45 minutes, he awoke and was given 2.5 mg lorazepam IV. The patient later admitted to ingesting "bath salts". A urine sample confirmed ingestion of methylenedioxypyrovalerone (MDPV).
Discussion: Agitated delirium is a serious condition that places patients and providers at risk. Patients can develop rhabdomyolysis, metabolic derangements or injuries. Chemical sedation should be considered early in the management of undifferentiated agitated delirium, as there is associated increased mortality. Gamma-aminobutyric acid agonists are effective sedating agents for delirium, but may lead to respiratory depression. Ketamine preserves airway reflexes, has rapid onset to peak effect and is titratable. There is limited data on the safety of ketamine for sedating patients in a hyperadrenergic state. However, in this novel case series describing successful sedation of agitated delirium with ketamine no adverse events were seen.
Conclusions: Ketamine may be an alternative agent to manage agitated delirium.
Keywords: Delirium, Sedation, Ketamine

44. Protracted seizures after vilazodone pediatric overdose

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Background: Selective serotonin reuptake inhibitor (SSRI) overdoses in children are not typically associated with severe toxicity or seizures. Common effects include: nausea, emesis, tachycardia, altered mental status, and concern for serotonin syndrome. SSRI toxicity is often managed with observation and supportive care only. Vilazodone hydrochloride is a new dual action antidepressant that was approved for major depressive disorder in 2011. Vilazodone has both SSRI and 5-HT_{1A} receptor agonist properties.
Case: A 3-year-old, 18 kg, male presented to the emergency department (ED) with a generalized tonic-clonic seizure within 2 hrs of ingestion of seven 40 mg tablets of his mother's vilazodone HCl (15.5 mg/kg.) En route he received 3 mg lorazepam intramuscularly (IM) but continued to have seizure activity on arrival to the ED requiring 2 mg lorazepam intravenously (IV). Initial vital signs were: HR 126 bpm, RR 30, temp 97.6F, BP 113/94 mmHg, and O2 saturation 100% on NRB. Electrocardiogram showed sinus rhythm with a QTc of 452. Laboratory values were pertinent for: glucose 125; bicarbonate of 19mmol/L; anion gap of 16; and a negative urine drug screen. In the PICU, 8 hours post ingestion, he continued to have twitching movements of his extremities and lip smacking. He was given two 1 mg lorazepam IV boluses without improvement, followed by two 7.5 mg/kg IV boluses (207 mg) phenobarbital leading to resolution of his seizure-like activity. A vilazodone level was 360 ng/ml at 24 hours post admission. He had no further seizure activity but developed aspiration pneumonia. On hospital day 3 he was discharged to home without further complication.
Discussion: Vilazodone is a new dual action antidepressant. Seizures were not reported as an adverse event in any clinical trials, though these have excluded patients with known seizure disorders. However, a 52-week canine study demonstrated seizures and seizure related deaths at doses of 40 mg/kg/day. One previous case report of pediatric ingestion of vilazodone showed generalized tonic-clonic seizures that were also resistant to benzodiazepines. It is possible that the 5-HT_{1A} receptor agonism or combination with the SSRI mechanism of action may predispose pediatric patients to seizures at toxic levels. Further research is needed to characterize the incidence and mechanism of benzodiazepine-resistant seizures observed in vilazodone toxicity.
Conclusions: Pediatric overdose of vilazodone HCl may lead to prolonged and benzodiazepine resistant seizures.
Keywords: Seizure, Pediatric, Overdose

45. Cardiopulmonary arrest and death in a patient with iatrogenic amantadine toxicity

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Background: Amantadine is an antiviral and anti-Parkinson agent. Toxicity consists of antimuscarinic, sympathomimetic and cardiotoxic effects, typically at concentrations greater than 1000 ng/mL. The clinical effects after repeated supratherapeutic exposures from medical error have not been reviewed. We report a case of iatrogenic amantadine toxicity with subsequent cardiopulmonary arrest and death.
Case report: A 55 year old male with a history of frontal lobe syndrome was admitted to hospital for an exacerbation of his Parkinson's disease. Medications on admission included amantadine, levodopa/carbidopa, entacapone and quetiapine. His amantadine dose was 100 mg three times a day. Twenty-seven days post-admission the dose and frequency of amantadine was incorrectly increased to 200 mg seven times a day because of confusion with his entacapone dosing. The patient noted and questioned these changes but was continued on this regimen. On day 32 post-admission the patient was noted to be tremulous, pacing and paranoid. The amantadine dosing error was recognized and amantadine was discontinued. Twelve hours later the patient developed hallucinations, became more agitated and suffered a pulseless electrical activity arrest of approximately ten minutes duration from which he was resuscitated. On transfer to ICU his neuropsychiatric medications were held. Amantadine concentrations 2 and 5 hours after the arrest were 5352 ng/mL and 4613 ng/mL, respectively. On day 2 following ICU admission he developed rhabdomyolysis (with a peak CK of 88,180 U/L) and non-oliguric acute kidney injury. Marked worsening of the patient's baseline muscular rigidity developed in both upper and lower extremities on day 3 following ICU admission. Due to the possibility of neuroleptic malignant syndrome (NMS), high dose benzodiazepines, and dantrolene were administered and his levodopa/carbidopa regimen was restarted. Neuroimaging of the brain (CT and MRI) demonstrated advanced signs of hypoxic-ischemic injury. The patient never regained consciousness and died 77 days post-admission secondary to complications of hypoxic-ischemic encephalopathy.
Case discussion: This case illustrates the full scope of amantadine toxicity including antimuscarinic symptoms, cardiac toxicity and possible development of NMS with abrupt discontinuance. Unique to this case are the clinical deterioration stemming from a medication error and markedly elevated amantadine concentrations coinciding with the early post-arrest period.
Conclusion: We present a case of amantadine toxicity from an in-hospital medication administration error with subsequent cardiopulmonary arrest and death.
Keywords: Amantadine, Chronic overdose, Neuroleptic malignant syndrome

46. A Donepezil Overdose: Trending levels and symptoms

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Background: Donepezil (DPZ) is a reversible, central anticholinesterase inhibitor used in the treatment of mild to moderate dementia and more recently in the treatment of mild cognitive impairment. Case reports of overdose describe symptomatic bradycardia, complete AV block, respiratory insufficiency, and syncope. We report an unintentional DPZ overdose with serum levels in a patient who developed symptomatic bradycardia, was treated with atropine and recovered over the course of three days.
Case report: A 53-year-old otherwise healthy man with a history of memory loss was placed on DPZ by his primary doctor six months prior to presenting for an acute accidental overdose of up to twenty 10 mg DPZ tablets, a dose 20–40 times the usual daily dose. The patient reported ingesting the pills when he mistook the bottle for his multivitamins. He presented to the Emergency Department (ED) via EMS thirty to sixty minutes after the ingestion. He was confused, somnolent and diaphoretic with a heart rate (HR) in the 30s-50s. An ECG demonstrated sinus bradycardia. The patient was given 1 mg intravenous atropine with minimal response. He was admitted to the medical intensive care unit for monitoring and supportive care. Serum levels of DPZ were trended, with the initial level drawn in the ED showing 100 ng/ml and final level drawn at 60 hours showing 37 ng/ml. His confusion, diaphoresis and somnolence resolved over the first 16 hours and the bradycardia persisted for 52 hours. Despite his bradycardia he remained normotensive throughout his hospital stay. He was discharged on the third hospital day, asymptomatic with a HR of 64.
Case discussion: Donepezil is a likely medication for overdose given the patient population for whom it is prescribed. Patients with memory loss may unintentionally take additional doses of their medications. Since most patients with memory loss are elderly, they are more likely to have co-morbid conditions such as underlying cardiac disease and conduction system abnormalities that would put them at higher risk of a poor outcome in the case of a DPZ overdose.
Conclusion: We present a case of symptomatic DPZ overdose with trending of DPZ levels over 60 hours. This patient had marked cardiovascular symptoms, but did well following one dose of atropine and subsequent supportive care. This case highlights the time course of DPZ toxicity and correlates symptoms with serum levels.
Keywords: Overdose, Anticholinergic, Arrhythmia

47. Severe hypercalcemia secondary to chronic excessive vitamin D administration in a neonate

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Background: The American Academy of Pediatrics recommends vitamin D (vit D) supplementation of 400 international units (IU) per day during the first year of life. We report a case of inadvertent vit D overdose resulting from confusion about the supplement concentration.
Case report: A full term, exclusively breastfed infant was recommended to be given 1ml of vit D-3 400 IU/ml daily. Unable to find the product at her local pharmacy, mom bought "Seeking Health Optimal Vitamin D" drops online, unaware that it contained 2,000 IU of vit D-3 per *drop*. Child was given 1ml (20 drops) of the product daily (40,000 IU/day) for 30 days before mom realized the mistake and contacted the pediatrician. The baby, now 41 days old, had been constipated (no bowel movements for 10 days) and was less active and feeding less than usual for about 1 to 2 weeks.

In the ED, patient was sleepy but arouseable. Physical examination was benign except for slightly decreased tone throughout. Weight was 5 kg (33 percentile). Admission vital signs were BP 102/62, HR 140, RR 24, T 37.6, 99% O2 saturation. Laboratory results were significant for K 3.1 mEq/L, BUN 15 mg/dL, SCr 0.6 mg/dL (normal for < 5yo = 0.2–0.5), calcium (Ca) 20.2 mg/dL, phosphate 4.8 mg/dL, magnesium 1.6mg/dL. Ionized Ca (drawn the next day) was 2.23 mmol/L (normal 1.12–1.32mmol/L). Serum level of 25-hydroxy D3 was 720ng/ml (25-hydroxy D2 < 4). Parathyroid hormone was < 3 pg/ml. Ultrasound of kidneys showed echogenic foci throughout bilateral kidneys consistent with nephrocalcinosis. Various ECG abnormalities were reported, including short QT intervals (ranging from 225 to 291 msec), right deviation of the QRS axis, and right bundle branch block. No J waves were seen. Patient was admitted to the ICU and treated with aggressive IV fluid hydration, calcitonin, pamidronate, and methylprednisolone. Serum Ca level normalized on hospital day 5, with resolution of hypertension and ECG abnormalities, and the patient was discharged home the next day.

Case discussion: Clinically significant intoxication from vit D is exceedingly rare, particularly from an acute overdose. However, chronic overdose can result in serious toxicity, including hypercalcemia, cardiac arrhythmias, and renal dysfunction. This infant was inadvertently given 100 times the recommended daily dose of vit D-3 for one month, resulting in severe hypercalcemia, ECG abnormalities, hypertension and renal parenchymal calcification.

Conclusion: The availability of various concentrations of liquid vit D preparations can lead to confusion about proper dosing. Health care providers must be extremely careful when recommending liquid preparations of medications in order to avoid inadvertent overdoses.

Keywords: Vitamin D, Hypercalcemia, Chronic overdose

48. Prolonged Hypertension from a 1,000 fold clonidine compounding error

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Background: Clonidine is a central alpha2 adrenergic agonist used for hypertension and attention deficit hyperactivity disorder (ADHD). Although clonidine overdose usually causes hypotension, early transient hypertension is sometimes noted. We report prolonged hypertension that resulted from of a 1,000 fold clonidine compounding error.

Case report: A 7 year-old boy with a past medical history of ADHD and pervasive developmental disorder was brought to the emergency department after being found unresponsive and apneic by his mother. The patient was administered his morning dose of clonidine (2.5 mL of a 0.1 mg/5mL clonidine suspension) thirty minutes prior to being found unresponsive. In the emergency department, he was lethargic with pinpoint pupils. His initial vital signs were: BP, 136/90 mmHg; Pulse, 110/min; RR, 5/min; Temp, afebrile. He was intubated using etomidate and succinylcholine and transferred to the pediatric intensive care unit where his vital signs were: BP, 140/115 mmHg and a pulse, 65/min. Naloxone had not been given prior to intubation. The patient remained hypertensive for eight hours after which his blood pressure dropped to 90/40 mmHg. He required intubation for five days due to secondary infection, and was discharged home nine days after the ingestion, without sequelae.

The pharmacist was contacted on suspicion of a compounding error. The patient's usual suspension required 4.5 mg of clonidine in solution; however, upon review of his records, the pharmacist had unintentionally used 4.5 grams of clonidine instead.

Case discussion: Clonidine is a centrally acting alpha2-adrenergic receptor agonist, which in overdose leads to transient hypertension due to peripheral alpha2-adrenergic effects. This is typically followed by hypotension. In this massive overdose, it is likely that the peripheral alpha2 adrenergic effects predominated over the central effects, leading to the prolonged hypertension. Clonidine is increasingly prescribed in children, predominantly for behavioral conditions. As many patients are unable to swallow pills, pharmacists are compounding these formulations.

Conclusion: In this case, a compounding error, where 4.5 grams was inadvertently added instead of 4.5 milligrams, led to a 1,000-fold overdose. A systems approach to checking compounded medications before dispensing should be instituted. The error was reported to the institute for safe medication practice.

Keywords: Pediatric, Clonidine, Overdose

49. Serotonin syndrome in a five year old child

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Background: Serotonin syndrome occurs very infrequently in young children. We describe a five year old boy who presented with severe serotonin syndrome requiring large doses of benzodiazepines to control his symptoms.

Case report: Two five year-old twins presented to the emergency department one hour after ingesting an unknown quantity of their older sister's 25 mg sertraline tablets. The bottle, which was just refilled and contained 20 pills, was empty. Twin A admitted ingesting one pill, indicating Twin B consumed the rest. Twin B was initially noted to be acting more active than usual; presenting vital signs were: a blood pressure of 102/52 mm Hg, heart rate of 100/min, respirations of 24/min, and temperature of 36.8 degrees Celsius. Twin A vomited twice at home, however, upon arrival to the ED, was symptom free with normal vital signs. Approximately two hours after arrival, Twin B achieved his baseline mental status, and had normal vital signs without intervention. At that time, Twin A's vital signs were: blood pressure, 119/98 mmHg, pulse, 160/min, respirations 24/min, and a temperature of 38.1 degrees Celsius. Diaphoresis, 7 mm reactive pupils, psychomotor agitation, visual hallucinations, and uncontrollable leg movements were present. Gastrointestinal and genitourinary examinations were unremarkable. He was administered 1 mg of intravenous lorazepam, followed by 1.5 mg 30 minutes later. He required further boluses of intravenous lorazepam (2 mg) for symptom control, for a total of 13.5 mg

over 12 hours. The patient remained awake and agitated throughout. Twin A's electrolytes, renal and hepatic panels, anion gap, and creatine phosphokinase were within normal limits. He was admitted to the pediatric intensive care unit for 4 days and was discharged home back to baseline. A serum sertraline concentration drawn 48 hours after ingestion was 41 ng/mL (reference laboratory peak plasma concentration for a 50 mg ingestion, 9.5 ng/mL).

Conclusion: This child's sertraline ingestion, confirmed with biological testing, and signs and symptoms are consistent with serotonin syndrome. This supports the hypothesis that children may develop serotonin syndrome following a one-time ingestion of sertraline. Furthermore, the serum sertraline concentration is inconsistent with the reported ingestion, highlighting the importance of confirmatory testing.

Keywords: Selective serotonin reuptake inhibitors, Serotonin syndrome, Pediatric

50. Retrospective review of loperamide ingestion reported to NPDS: 2000–2011

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Background: Loperamide is an OTC phenyl-piperidine derivative indicated for the control of acute, chronic and travelers' diarrheal symptoms. The drug is a meperidine analog which has a chemical structure similar to diphenoxylate and haloperidol. Loperamide maintains the anti-diarrheal effects of its structurally related compounds but, due to its low bioavailability and poor penetration through the blood brain barrier, it has minimal effects on the brain μ-opioid receptor. It is generally considered to have no clinically significant analgesic properties and a very low potential for abuse. There is limited published data on the toxicity of loperamide. In an effort to more clearly elucidate the incidence of serious outcomes and the clinical picture associated with loperamide toxicity we have reviewed NPDS loperamide exposure data from 2000 through 2011.

Method: retrospective review of all single substance loperamide human exposures reported to NPDS 2000–2011.

Result: there were 11,156 exposures (mean 930 exp/yr, range 761–1215) with a mean and median age of 18 and 3 years respectively, with 52 % female. There was a prominent age shift toward adults with more serious outcomes (See Table). Serious outcomes were infrequent in adults and rare in children with no fatalities and only 2 major outcomes in children < 6 yrs. During this period there was a 9% decrease in patients treated at home and a 17% increase in patient treated in a HCF, without change in medical outcome. A mean 27% of patients (all ages) were treated in a HCF with only 2% total having a moderate, major or fatal outcome. In children < 6 years old, 30% were treated in a HCF with $< 1\%$ moderate or major outcomes and no fatalities.

Discussion: Case reports suggest a risk of opiate-like effects, especially in young children. We found 3 children (14d, 4y, 7y) with significant clinical effects over a 12 year period. The increasing trend toward HCF management has not changed outcomes and may be unwarranted.

Conclusion: serious medical outcome after casual loperamide exposure is unlikely and referral to a HCF may not be warranted unless there is history of intentional self-harm, misuse and/or a large exposure.

Keywords: Loperamide, Ingestion, Outcome

Table. Results for abstract number 50.

Medical Outcome	Number of patients	% of total reported exposures	Mean and median age	% of patients < 6 yrs with outcome
Death	2	0.02%	33 yrs,	0%
Major effect	25	0.2%	41 yrs, 42 yrs	8%
Moderate effects	219	2%	40 yrs, 38 yrs	18%
Minor effect	906	8%	24 yrs, 10 yrs	46%
No effect	4499	40%	8 yrs, 2 yrs	85%

51. Pediatric ingestions of phenazopyridine

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Background: Little data exists for unintentional pediatric ingestions of phenazopyridine, an azo dye used as a urinary tract analgesic. Adult overdoses manifest as methemoglobinemia presenting within 2 to 3 hours of ingestion. Isolated case reports of methemoglobinemia in children exist, yet the ingested amounts vary widely between published reports. Phenazopyridine is available in 200 mg tablets by prescription or in 95 mg tablets over-the-counter (OTC).

Methods: 12 years Regional Poison Center (RPC) and National Poison Data System (NPDS) data from 1/1/2001 to 12/31/2012 were collected, including patients ≤ 5 yo. Cases involving co-ingestions, confirmed non-exposures, and unrelated effects were excluded. The purpose was to determine an amount at which referral to a healthcare facility for potential methemoglobinemia is warranted.

Results: The RPC found 231 cases in children aged 6 months – 5 yrs. 60.2% reportedly ingested between 95 mg and 200 mg. Overall, cyanosis was reported in 3 cases, 1 of which had a measured methemoglobin (metHgb) level of 2%. Doses associated with cyanosis were 800 mg, 95 mg, and 285 mg. 9/231 cases had a MetHgb level documented (range 0.4–12.6%); no pts received methylene blue (metBlue). 10,985 cases were identified in NPDS data in children aged 13 days − 5 yrs. Cyanosis was reported in 20 cases (0.18%) metBlue was given in 35 cases (0.3%), and cyanosis with metBlue administration was reported in 11 cases (0.1%). Actual metHgb levels were not available for this data subset. 46.8% of cases reportedly ingested 1–2 tablets, and 2 (0.04%) of these documented cyanosis with metBlue administration.

Discussion: In RPC data, subjective findings of cyanosis were coded at metHgb levels lower than the 8–12% reported in most references. There did not seem to be a correlation between the level and reported amount ingested. In comparison, published case reports reveal metHgb of 14.2% to 29.1% after ingestions of 600 mg to 3000 mg. One limitation is ingestion quantities are often

not exact, representing the maximum possible amount as a conservative estimate. Furthermore, when quantities are reported in tablet amounts, it is unknown if the higher, prescription-strength tablet or a variety of lower strength OTC tablets were ingested. Cyanosis is also a subjective finding, and may be inaccurately reported by the caller.
Conclusion: In a 12-year review of RPC and NPDS data of pediatric ingestions of phenazopyridine, 0.1% of all ingestions and 0.04% of 1–2 tablet ingestions developed cyanosis and received metBlue. It is reasonable to follow unintentional pediatric exposures with multiple follow-ups for cyanosis. In this sample, the development of cyanosis did not always correlate with the metHgb level at which metBlue is recommended.
Keywords: Methylene blue, Methemoglobin, Phenazopyridine

52. Quetiapine overdoses in children less than six

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Background: The AAPCC developed evidence-based consensus guideline for atypical antipsychotic medication poisoning and found only 1 case of quetiapine overdose in children less than 12 yo. That child (11 yo) ingested 22 mg/kg. Antia reported 40 cases of 2nd generation antipsychotics in children and adolescents. Only 8 ingested quetiapine and ages were 11–17 yo. A case report/literature review (Catalano 2002) involved a 15 yo and discussed 4 adult patients. Isbister (2005) reported on pediatric antipsychotic poisoning but found no reports of quetiapine ingestions. Current AAPCC guidelines recommend ingestions of 100mg in children less than 12 yo be sent in. Our study attempts to develop a send in guideline for quetiapine in the <6 yo age group.
Methods: Retrospective study of quetiapine ingestions in children less than 6 yo, reported to our poison system from 1/1/1999 to 12/31/2011. CHR approval was obtained and cases were blinded before analysis. Data collected: age, wt, dose, sex, symptoms (sx), treatments, admission and outcome.
Results: There were 635 cases. After excluding cases of unrelated outcomes, not followed to known outcome, unknown doses, and coingestants with sedative or cardiovascular properties, 193 cases remained. Demographics: Male 54.4%. Age range: <12 mo. 2.6%, 1 yo 35.2%, 2 yo 40.4%, 3yo 11.9%, 4yo 5.7%, 5yo 4.1%. Dose range: 4–1200 mg, mean 105. Amts ingested per weight: 0.016–82.7 mg/kg, mean 8.33. Outcomes: No effect 71%, minor 24.9%, moderate 0.04%, major 0.005%, deaths 0. Minor to no effects accounted for 95.9% of cases. Main sxs: CNS depression 26%, tachycardia 3.1%, hypotension 1.6%, ataxia 1.6%. There was 1 case each of QTC prolongation and hallucinations. There were 2 cases of respiratory depression and 1 child was intubated. Only 6 children were admitted for no longer than two days. The 1 major case was a 2 yo child with Down's Syndrome ingesting 1200 mg (82.76 mg/kg). He was lethargic, intubated, and hypotensive (on Propofol). He was extubated the next day and discharged later in the day. Moderate outcomes in 7 cases. Doses ranged from 75–400 mg (6.6–31.5 mg/kg). Sx: lethargy, hypotension, tachycardia, ataxia, hallucinations, respiratory depression and QTC prolongation. Minor outcomes occurred in children ingesting 6.25–600 mg (0.9–52.6 mg/kg). Patients with no effects ingested up to 1200 mg (62.5 mg/kg).
Conclusions: The quantity ingested is often unreliable. Most quetiapine ingestions in children <6 yo result in minor to no effects. CNS depression is the main sx. Doses of 6.5 mg/kg or higher have the potential for moderate toxicity and may need medical evaluation. Admission is rarely needed. Sx resolve within 1–2 days. Further evaluation is needed to determine an accurate send in amount.
Keywords: Pediatric, Antipsychotic, Overdose

53. Description of pediatric medication errors reported to a regional poison center

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Background: Medication errors have the potential to occur in all age groups. Children are passively at risk as caregivers are most likely in control of the administration and dose. Identifying commonalities through call records from a Regional Poison Center can quantify the number and types of errors occurring in this population. This information can subsequently be used to develop mechanisms to subvert future errors.
Objective: To describe the most common types of pediatric medication errors reported to a Regional Poison Center over a 1 year time period, and determine trends that may be helpful in targeting strategies for error prevention.
Methods: A retrospective analysis was conducted utilizing call data recorded in Toxicall® from 2010. Cases coded as a pediatric medication error in patients 0 to 10 years were identified. Information regarding patient age, specific medication, error reason (double dose, wrong medication given, dispensing cup error, etc), time of day error occurred, and management site was collected. Overall results were analyzed, and a subanalysis was conducted after stratifying by age group.
Results: A total of 923 medication error cases were reported in 2010. The most common medications/classes regardless of age were antihistamines, acetaminophen, ibuprofen, and antibiotics, accounting for approximately 40% of the cases. The most common medication error reason was administering the dose twice. In 70% of these cases the mother made the call to the Poison Center, and virtually all errors were managed at the patient's residence (98%). A significant portion of calls relating to antihistamines, acetaminophen, and ibuprofen were received between the hours of 9pm and 6am (36.7%, 34.4%, and 43.4%, respectively), while most calls for antibiotics (34.7%) were received in the afternoon. When stratified by age group, the most common medication classes were antihistamines, acetaminophen, ibuprofen and antibiotics until age 5–6 years, at which time methylphenidate and amphetamine errors increased in frequency. This trend continued for the 7–8 year age group as well as the 9–10 year age group. As was the case for the other drug categories, the most common reason for error for methylphenidate and amphetamine drugs was administering the dose twice.
Conclusion: Identifying medications and contributing factors leading to errors can help health care providers and caregivers target interventions to assist with circumventing medication errors.
Keywords: Pediatric, Poison center, Medication Error

54. Flecainide poisoning in two young children

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Background: Flecainide is a class Ic anti-arrhythmic used to treat tachyarrhythmias such as supraventricular tachycardia (SVT). Because of its narrow therapeutic window and pro-arrhythmic potential, it is usually reserved for refractory cases, and it is rarely prescribed for children. We describe two cases of flecainide poisoning in young children to help further characterize this uncommonly reported pediatric poisoning syndrome.
Case Reports: 1) A 35-month-old girl with a history of paroxysmal SVT maintained on propranolol and flecainide presented to the emergency department (ED) after an exploratory ingestion of her flecainide (max exposure 75 mg/kg). She responded only to pain, had a heart rate of 74/min with a wide-QRS (134 mSec), and a blood pressure of 98/75 mmHg with poor perfusion. She was given a total of 3 mEq/kg of sodium bicarbonate and 40 mL/kg of normal saline, then alkalemia was maintained with a sodium acetate infusion. She was given a single dose of magnesium sulfate. Serial electrocardiograms (EKGs) showed gradual QRS narrowing. She fully recovered by 48 hours. Her flecainide level was 1.78 μg/mL (therapeutic range 0.2–1.0 μg/mL) 4 hours post-ingestion.
2) A 3-year-old boy with a history of SVT, who had recently restarted flecainide, had a syncopal event and developed a wide-complex tachyarrhythmia. He was given 2 mEq/kg of sodium bicarbonate and a single dose of magnesium sulfate, after which he converted to sinus rhythm. A short run of hemodynamically stable ventricular tachycardia, 1 hour later, was treated with an additional 1 mEq/kg of sodium bicarbonate. His parents had been giving a ten-fold overdose of his prescribed flecainide; his blood level upon ED arrival was 2.03 μg/mL. His EKG normalized within 48 hours.
Discussion: Flecainide's primary mechanism of action is via sodium channel blockade which delays phase 0 of the cardiac action potential and prolongs QRS duration. Flecainide toxicity can cause wide-complex dysrhythmias. It is negatively inotropic and causes vasodilatation leading to hypotension and poor perfusion, and can manifest as altered mentation or syncope. Our patients were treated with intravenous fluids, sodium supplementation and blood alkalinization with sodium bicarbonate, and with magnesium sulfate. Both cases had good outcomes and serial EKGs which returned to baseline.
Conclusions: Flecainide can cause severe cardiotoxicity in children with a narrow therapeutic index. Our cases suggest the pediatric flecainide toxic syndrome may include central nervous system depression, syncope, QRS-interval widening, poor perfusion, and/or ventricular tachycardia. Children may be at risk from exploratory ingestion or medication administration errors.
Keywords: Cardiac toxicity, Pediatric, Flecainide

55. Lisdexamfetamine (Vyvanse®) exposure in children 5 years of age and under: stay or go? is a trip the emergency department necessary?

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Background: Lisdexamfetamine (Vyvanse®) is approved for the treatment of ADHD in children ≥ 6 years of age. It is generally believed that unintentional ingestions by children ≤ 5 years of age, have the potential to cause significant cardiovascular or neurologic symptoms. However, there are no published studies supporting this belief and no dose threshold has been established for home monitoring vs. referral to an emergency department (ED).
Objectives: Our primary goal was to evaluaten children ≤ 5 years of age, after exploratory ingestions of lisdexamfetamine, who were treated in EDs, or monitored at home, to determine a dose threshold that produces serious effects. The evaluation of children in EDs with nontoxic or minimally toxic ingestions is a significant cost. Whereas, monitoring these same patients at home could be a cost saving tool for hospitals and individuals. This is the first study to report the effects of pediatric lisdexamfetamine ingestions.
Methods: National Poison Data System (NPDS) was queried for data regarding cases of unintentional/exploratory lisdexamfetamine ingestions in children ≤ 5 years of age between January 2008 and December 2011. These cases were reviewed for clinical effects, treatments and outcome. Approximately 3000 cases were reviewed and the following inclusion criteria applied: (1) pediatric patient 5 years of age and younger (2) single medication exposure (lisdexamfetamine) (3) known amount ingested (4) exposure date between January 2008 and December 2011 (5) known clinical outcome.
Results: 208 cases met all inclusion criteria. Our data found a median age of 24 months, median weight of 13.64 kg and male: female ratio of 1.3:1. The median amount of lisdexamfetamine ingested was 40 mg. 184 children (88%) had no cardiovascular signs or symptoms. 152 children (73%) had no neurologic signs or symptoms. There were no seizures or dysrhythmias reported. Children with an exploratory ingestion of ≤ 3 mg/kg, showed no adverse or only minimal cardiovascular and neurologic effects, which were limited to tachycardia and agitation. None of the effects required treatment.
Conclusion: Children with ingestions of < 3 mg/kg did not require emergency treatment and can safely be monitored at home by poison control specialists.
Keywords: Pediatric, Amphetamine, Ingestion

56. Comparison of pediatric ingestions of imidazoline-containing preparations and clonidine reported to poison centers

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Background: Imidazoline-containing preparations (eye drops and nasal sprays) and clonidine both are agonists of imidazoline and α2 receptors which can cause serious adverse effects. The literature comparing imidazoline preparations with clonidine is limited. This study compared these 2 drugs in children regarding frequency and health impact.
Methods: Imidazoline (ophthalmic and nasal preparations containing tetrahydrozoline, oxymetazoline, or naphazoline) and clonidine

ingestions in children ≤ 5 years reported to a statewide poison center system during 2000–2012 were identified. Exposures involving coingestants and those not followed to a final medical outcome were included. The 2 groups were compared with respect to various factors by calculating the rate ratio (RR) and 95% confidence interval (CI).

Results: There were 2,172 imidazoline and 2,556 clonidine ingestions. The annual number of imidazoline and clonidine ingestions increased from 2000 to 2012 by 41% and 106%, respectively. Imidazoline and clonidine patients were, respectively, 50% vs 57% male (RR 0.87, 95% CI 0.83–0.95). 81% of imidazoline and 61% of clonidine patients were < 2 years (RR 1.33, 95% CI 1.29–1.38). Multiple substances were involved in 2% of imidazoline and 21% of clonidine cases (RR 0.08, 95% CI 0.06–0.11). The distribution by management site for imidazoline and clonidine cases was, respectively, 60% vs 14% managed on site (RR 4.18, 95% CI 3.78–4.63), 13% vs 53% already at/en route to a healthcare facility (RR 0.25, 95% CI 0.23–0.29), and 26% vs 32% referred to a healthcare facility by a poison center (RR 0.83, 95% CI 0.76–0.91). Serious outcomes were reported in 11% of imidazoline and 34% of clonidine cases (RR 0.32, 95% CI 0.28–0.36). Some of the common clinical effects in imidazoline compared to clonidine cases were drowsiness (6% vs 49%) (RR 0.11, 95% CI 0.09–0.14), bradycardia (0.2% vs 11%)(RR 0.02, 95% CI 0.01–0.05), hypotension (0.2% vs 8%)(RR 0.03, 95% CI 0.01–0.07), and agitation (0.5% vs 3%)(RR 0.14, 95% CI 0.07–0.26). The most common treatments were dilution (40% vs 8%)(RR 5.15, 95% CI 4.46–5.94), activated charcoal (10% vs 45%)(RR 0.21, 95% CI 0.19–0.24), IV fluids (4% vs 35%) (RR 0.10, 95% CI 0.08–0.13), cathartic (3% vs 13%)(RR 0.24, 95% CI 0.18–0.30), and naloxone (2% vs 20%)(RR 0.08, 95% CI 0.06–0.11).

Conclusion: The number of pediatric ingestions of imidazoline preparations and clonidine reported to poison centers is increasing. Imidazoline preparations were less likely to have serious adverse clinical effects than clonidine. Most of the imidazoline ingestion cases were managed on site whereas most the clonidine cases were managed at healthcare facilities.

Keywords: Clonidine, Imidazoline, Pediatric

57. An unintentional overdose of dexmedetomidine in the pediatric intensive care unit

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Background: Dexmedetomidine (DXMD), sold under the trade names Precedex and Dexdor, is a centrally-acting highly-selective α_2-receptor agonist that is approved by the Food and Drug Administration (FDA) for sedation in the ICU for less than 24 hours duration. Its safety and efficacy in sedation and pain control have made it an increasingly popular choice for ventilated patients in the ICU. At higher-doses, a hypertensive effect can occur via an α_{2B} adrenoreceptor mechanism located in the smooth muscle cells of peripheral vessels.

Case discussion: We present a case of an unintentional 8-fold overdose of DXMD in a post-operative patient in the pediatric intensive care unit with an arterial blood pressure monitor in place. The patient is a 21-month-old male, weighing 10 kgs, who had undergone his fifth Tetralogy of Fallot repair. He was initially on a 0.5 mcg/kg/hr dose for approximately one hour, after which the DXMD was turned off for weaning. Although the patient was supposed to receive a post-operative dose of cefazolin, he instead received an 80 mcg bolus of DXMD. Subsequently, an initial spike in blood pressure to 169/89 mmHg was observed with a concomitant bradycardia to 88 bpm. After approximately 3 hours, the blood pressure and heart rate effects had normalized. The patient had remained sedated throughout the course and had no sequlae upon discharge.

Conclusion: DXMD has become an increasingly popular sedative in intensive care. Although its safety and efficacy have been proven, few case reports of unintentional overdose exist with close cardiovascular monitoring. Although believed to be highly specific for central α2 receptors, we present a case report that shows direct hypertensive effects at higher doses.

Keywords: Dexmedetomidine, Pediatric, Medication error

58. Dopamine toxicity and its complications in a neonate

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Background: Typical dopamine (DA) dosing ranges from 1–20 mcg/kg/min (m/k/m). Doses > 50 m/k/m, exert mostly α-adrenergic effects and may result in peripheral vasoconstriction causing severe hypertension resulting in intracranial hemorrhage, pulmonary edema, or myocardial necrosis. Known adverse effects of DA toxicity include tissue necrosis after extravasation, gangrene, and ventricular arrhythmias. We present the first reported neonatal acute DA toxicity case of this magnitude.

Case report: A 7-day-old, 4.2 kg boy with transposition of the great vessels and atrial septal defect received an accidental overdose of DA. A DA solution infused through his total parenteral nutrition pump at 182 m/k/m × 15–20 minutes (min), before the child developed respiratory distress and the error was discovered. He also developed tachycardia and hypertension, which peaked with a HR of 170 BPM and BP 102/100 mmHg. He was started on a bicarbonate drip and intubated. Initial arterial blood gas revealed: pH 7.01, pCO2 41, pO2 56 and bicarbonate of 10. Cranial ultrasound revealed a germinal matrix bleed. Ejection fraction on echocardiography was 40–50%. Creatinine peaked at 1.8 mg/dL. Frank blood was suctioned via nasotracheal tube. Hematologic studies were as follows: platelets 39K/mm3, hemoglobin 11.9 g/dL, INR of 1.8. Transfusion of two units (U) of fresh frozen plasma (FFP), one U of platelets and 1 U of packed red blood cells was performed. Serum AST peaked at 628 IU/L and trended down over 10 days. Nitroprusside 3 m/k/m, milrinone 0.5 m/k/m, and prostaglandin E1 0.1 m/k/m drips were started and the patient was sedated with dexmedetomidine and fentanyl. Lactate peaked at 23.9 mmol/L trending down to 2.1 mmol/L the next morning. A head CT showed a grade 2 intraventricular hemorrhage (IVH). INR remained elevated at 1.6, requiring additional FFP. On day

15 of life a brain MRI was read as normal. By day 18, labs normalized. The patient was discharged home day 81 of life.
Discussion: This neonate received DA at >3 times the upper limit of normal for 15–20 min. Typically, DA's onset of action is 5 min and duration is <10 min. With a half-life of 2 min, it is likely that within 10 min most of the DA and its metabolites (norepinephrine 25% and inactive metabolites 75%) were renally cleared. No specific therapy exists for DA toxicity; supportive care is the mainstay. In this case, our patient benefitted from airway support, blood products, bicarbonate, and vasodilators.
Conclusion: This is the first reported overdose of DA in a neonate, which resulted in hypertension and ensuing IVH, acidosis, ischemic liver injury, and coagulopathy. Due to the drug's rapid onset of action and short half-life, after the initial insult, supportive measures predominated patient care.
Keywords: Pediatric, Overdose, Adverse drug event

59. Unintentional ingestion of topical imidazoline derivatives in pediatric patients: 10 years of experience at a single poison center

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Background: Case reports of serious adverse reactions resulting from ingestion of topical imidazole derivatives are plentiful and are documented as far back as the 1940's. The lack of child-resistant packaging allows easy access, increasing the risk of unintentional ingestion, and in 2012 the U.S. Consumer Product Safety Commission proposed a new rule on the packaging of these products to be effective December 2013. We describe a US Poison Center's longitudinal experience with topical imidazoline cases.
Methods: We performed a retrospective observational review of a single poison center's data from January 2002 to 2012. Only cases coded as unintentional ingestions of the generic substance code for nasal and ophthalmic sympathomimetics and/or tetrahydrazoline in patients less than six years of age were included. Cases involving non-imidazoline sympathomimetics or an unknown sympathomimetic were excluded.
Results: Of 364 cases analyzed, 52% involved females. Mean age was 24 months with a range from 6–60 months. The most commonly ingested imidazoline derivative was tetrahydrozoline (n = 218, 60%), followed by oxymetazoline (n = 141, 39%), and naphazoline (n = 5, 1%). Symptoms occurred in 16 patients, and were categorized as minor (n = 15, 94%) or moderate (n = 1, 6%). Reported symptoms included lethargy/drowsiness, vomiting, throat irritation, bradycardia, and miosis. Exact quantity of exposure was unknown in 326 cases (89%). One hundred and nine patients (30%) were either in route to a health care facility (HCF) or referred to a HCF. Two patients were admitted, one to the intensive care unit.
Conclusions: Our data represents a significant number of exposures to topical imidazoline derivatives in children. While the severity of clinical effects may not be alarming, the inability to accurately determine exposure amounts coupled with the known dangers of ingestion of these substances leads to HCF referral for many cases. Mandating child-resistant packaging of imidazole derivative nasal sprays and eye drops might decrease the frequency of unintentional ingestions by children, thereby resulting in less public health concern and resource expenditure.
Keywords: Ingestion, Imidazoline, Pediatric

60. Prolonged antimuscarinic delirium in a child due to benztropine exposure treated with multiple doses of physostigmine

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Background: Benztropine is a potent antimuscarinic agent used to treat Parkinson's disease and extra-pyramidal symptoms from antipyschotics. We describe a case of an 11 year old boy who was intentionally poisoned with benztropine. The subsequent prolonged delirium was successfully treated with multiple dose of physostigmine.
Case report: An 11 year old boy weighing 52 kg presented to the emergency department (ED) after family found him acting bizarrely. Police stated the child had been in the custody of his father and there was concern that the father had made the child take some or all of his medications. The father's medications were: risperidone, benzotropine, quetiapine, thiamine, simvastatin, omeprazole, and folic acid. The child was tachycardic with dilated pupils, dry mucous membranes, and anhydrosis. He was agitated and confused. His presenting vital signs were: blood pressure 125/68 mmHg, heart rate 147 beats per minute, respiratory rate 20 breaths per minute, O2 saturation 100%, and a tympanic temperature of 36.9. Basic labs, including serum aspirin level, serum acetaminophen level, serum ethanol level and a urine drug immunoassay were normal. An EKG showed a narrow complex sinus tachycardia. He was given 1.5 mg of IV physostigmine to confirm the diagnosis and to help control his agitation. Within in 5 minutes he was calm, oriented and conversant. He reported that his father had given him several "pills." After approximately 40 minutes he again became confused and agitated. He was then given 3 mg of lorazepam over 4 hours but he became more agitated. Approximately 16 hours from the initial dose of physostigmine he was given an additional 1 mg which successfully controlled his agitation. He received a total of four 1 mg doses of IV physostigmine over 6 hours to control agitation. Forty hours from presentation, the patient's mental status returned to baseline. Results of quantitative serum toxicology screen sent approximately 24 hours from arrival to the ED detected no quetiapine but showed a risperidone serum level of <1.0 ng/mL, a risperidone-OH serum level of 48.6 ng/mL (normal reference range 14–110 ng/ml), and a benztropine serum level of 20 ng/mL (normal reference range 5–25 ng/ml). Risperidone is not known to cause anitmuscarinic toxicity and the benztropine was felt to be the cause of the child's symptoms.
Conclusion: This case demonstrates that benztropine can cause a prolonged and significant delirium in children which can be successfully and safely treated with physostigmine. Multipe doses of physostigmine can be given if necessary and appear well tolerated.
Keywords: Anticholinergic, Physostigmine, Pediatric

61. Fancy footwork: Dodging a potentially fatal phenol exposure

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Background: Phenol (carbolic acid) is an antiseptic agent that has been commercially available since the early 1900's. Although safer antiseptics have since been developed, dilute phenol is still found in many topical products, which take advantage of its anesthetic properties. Although only mildly acidic, concentrated phenol is extremely caustic and this, along with its local anesthetic effects, makes it useful as a chemical exfoliant, a sclerosing agent and a neurolytic. Phenol cauterization is also commonly used to treat ingrown toenails. Unfortunately, prolonged dermal exposure or accidental IV exposure to concentrated phenol preparations have the potential to cause significant systemic toxicity and death. Multiple such cases have been reported, but here we report the accidental injection of a potentially lethal amount of phenol followed by surgical intervention and irrigation, resulting in minimal tissue damage with no systemic effects.
Case report: During a procedure to remove the toenail of a 47 year old woman, the patient's toe was accidentally injected with 7 ml of an 89% phenol solution instead of a local anesthetic. Because her toenail had already been removed, the physician was able to make 2 incisions on the toe and irrigate the tissue with 3 liters of normal saline. He then inserted a drain to avoid any potential swelling. The patient did not experience any systemic effects throughout the procedure, complaining only of minor pain following the incident. At a follow-up appointment two days later the patient was noted to have some tissue necrosis around the injection sites but overall the surgeon felt that the toe would be salvaged.
Discussion: Phenol is a caustic agent, causing cell wall disruption, protein denaturation and coagulation necrosis. Phenol is readily absorbed through the skin, with severe dermal burns having the potential to result in systemic toxicity within minutes to hours. Systemically, phenol may cause CNS toxicity ranging from seizures to coma, acute lung injury, kidney and liver failure and cardiovascular collapse. An IV injection of as little as 1 g has the potential to cause death. Although this patient was injected with approximately 6.23 g of phenol, injection into the muscle tissue versus injection into a vessel likely delayed systemic toxicity, with rapid surgical intervention and thorough irrigation of the injection sites preventing significant absorption.
Conclusion: Health care providers need to be aware of the danger of therapeutic errors with concentrated phenol solutions. Although exposures to these preparations have the potential for significant and fatal outcomes, appropriate surgical intervention and immediate irrigation may prevent systemic toxicity.
Keywords: Phenol, Caustic, Local anesthetic

62. Massive iatrogenic dopamine overdose with paradoxical hypotension

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Background: Dopamine is a natural catecholamine used in a variety of clinical settings. When dosed appropriately, IV dopamine can increase myocardial contractility, cardiac output, and blood pressure. We describe a case of 25-fold dopamine overdose.
Case report: A 56-year old, 77 kg female presented to the ED with hypotension and symptoms consistent with acute pancreatitis. After a 1L bolus of normal saline, IV dopamine was ordered at 5 μg/kg/min. The infusion was mistakenly initiated at 172 μg/kg/min and administered for 1 hour. The patient's systolic BP fell from 84/38 to 69/34 mmHg; HR increased from 70 to 97 BPM. The patient remained in sinus rhythm. A post-infusion EKG was normal except for QTc 485 ms. The patient received two 1L NS boluses within 30 minutes of the end of the dopamine and then norepinephrine infusion (NE) at 8 μg/kg/min. BP improved to 103/54 mmHg at 2 hours and 193/54 mmHg at 3 hours post-infusion. The heart rate soon stabilized at 76 BPM.
Discussion: Dopamine has a well-characterized dose-dependent response and a half-life of 1–2 min. 75% of dopamine is inactivated in vivo by monoamine oxidase and catechol-O-methyl transferase, while 25% is converted to NE. At doses of 1–3 μg/kg/min, dopamine stimulates D1 receptors, causing vasodilation in the coronary, mesenteric, and renal arterioles. Doses of 5–10 μg/kg/min typically improve MAP via β1 stimulation and increased NE release from nerve terminals. Infusion rates greater than 15 μg/kg/min produce vasoconstriction through α1 stimulation; doses >20 μg/kg/min are thought to provide minimal additional benefit. The paradoxical hypotension observed in this case may have been a function of progressive illness, of dopamine washout, or of another drug-mediated effect. Massive overdose would be expected to cause initial excessive stimulation of the sensitive β2 and presynaptic α2 receptors resulting in further vasodilation, followed by diminution of response due to depletion of dopamine at nerve terminals.
Conclusions: Given its short serum half-life, dopamine overdose can be treated successfully by ending the infusion and providing symptomatic treatment. If hypotension persists, a direct-acting vasopressor such as norepinephrine should be considered.
Keywords: Massive iatrogenic dopamine, Overdose, Paradoxical hypotention

63. Adverse reactions due to dietary supplement ingestions reported to poison centers

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Background: In March 2013, the US General Accounting Office issued a report that the Food and Drug Administration (FDA) may not be receiving information on all adverse events due to dietary supplements because individuals may be contacting poison centers about some of these events instead of the FDA. The report recommended that the FDA explore options to obtain poison center data. This study describes adverse reactions due to dietary supplement ingestions reported to poison centers.
Methods: Cases were all ingestions reported to a large poison center system during 2000–2012 where the exposure reason was an adverse reaction and the substance was assigned to the Major Category of "Dietary Supplements/ Herbals/ Homeopathics".

Individual and multiple vitamins were not included in this Major Category. Ingestions involving other substances in additional to the dietary supplement and those not followed to a final medical outcome were included in the study. The distribution by various demographic and clinical factors was determined.

Results: There were 1,667 cases representing 6% of all ingestions resulting in adverse reactions. The most commonly reported products were energy drinks (11%), Stacker™ products (10%), melatonin products (3%), Xenadrine™ products (3%), and Zantrex™ products (3%). Multiple products were involved in 21% of the ingestions. The annual number of adverse reactions increased from 95 in 2000 to 191 in 2012. The patient age distribution was 5 years or less (4%), 6–12 years (3%), 13–19 years (15%), and 20 years or more (78%); 59% of the patients were female. The management site was 56% on site, 30% already at/en route to a healthcare facility, and 12% referred to a healthcare facility. The medical outcome was 3% no effect, 20% minor effect, 15% moderate effect, 1% major effect, 2% not followed-nontoxic, 39% not followed-minimal effects, 7% unable to follow-potentially toxic, and 13% unrelated effect. The most common clinical effects were nausea (16%), tachycardia (15%), agitation (14%), vomiting (14%), dizziness (11%), chest pain (7%), headache (6%), erythema (6%), abdominal pain (6%), tremor (5%), and hypertension (5%). The most frequent treatments were dilution (19%), IV fluids (9%), antihistamines (8%), food (7%), and benzodiazepines (5%).

Conclusion: The number of these adverse reactions may be increasing. Patients tend to be adults, followed by adolescents, and female. Most of these adverse reactions are not likely to be serious and can be managed on site. The most common clinical effects tended to be gastrointestinal, cardiovascular, and neurological. This study demonstrates that poison centers can serve as a useful data source for adverse reactions to dietary supplements.

Keywords: Adverse reaction, Poison center, Dietary supplement

64. Comparison of concentrated laundry detergent pack exposures among young children by brand

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Background: In early 2012, products consisting of small, single-dose "packs," "pods," or "pouches" that contain concentrated liquid laundry detergent surrounded by a water-soluble membrane appeared on the market in the US. Brands included Tide™, All™, and Purex™. Potentially serious exposures to these products among young children were reported to poison centers. This study examines whether the exposures to the 3 brands of laundry packs reported to poison centers were similar.

Methods: This retrospective study included all laundry detergent pack exposures among children age 5 years or younger reported to a statewide poison center system in 2012 where the brand was reported to be Tide™, All™, or Purex™. Exposures involving other substances in addition to the laundry pack (n = 1) and exposures not followed to a final medical outcome were included. The distribution of exposures by various demographic and clinical factors were determined and comparisons made between the 3 brands.

Results: Of 655 total pediatric exposures, 493 (75%) involved Tide™, 81 (12%) All™, 62 (9%) Purex™, and 19 (3%) other or unknown laundry pack brands. The distribution of the 3 brands by selected variables is in Table 1.

Conclusion: The demographics and circumstances of the exposures were similar between the 3 brands, although All™ involved a higher proportion of ingestions and dermal exposures. Reported Tide™ exposures were less likely to result in serious outcomes and to be referred to a healthcare facility than exposures to the other 2 brands. A primary limitation of this study is that reporting of the exposures to the poison center system is voluntary and thus may be biased.

Keywords: Pediatric, Poison center, Laundry detergent

65. All mighty pac free and clear laundry pod® ingestions with metabolic and lactic acidosis: A laboratory analysis and investigation

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Table 1. Pediatric laundry detergent packs by brand.

	Tide™ %	All™ %	Purex™ %
Age 1 year or less	40	43	37
Male	52	52	52
Route - ingestion	89	94	89
Route - ocular	12	10	11
Route - dermal	9	12	6
Referred to healthcare facility (excludes already at healthcare facility)	22	26	35
Medical outcome - no effect	20	7	11
Medical outcome - serious (moderate effect, major effect, unable to follow-potentially toxic	10	17	16
Clinical effect - vomiting	45	69	50
Clinical effect - cough	7	21	16
Clinical effect - ocular irritation	9	9	15
Clinical effect - red eye	8	7	13
Clinical effect - nausea	6	7	2

Introduction: Laundry Detergent Pods (LDPs) were introduced into the US marketplace in 2010. Since that time there have been multiple exposures, especially in pediatric patients. During the first month of data recorded by poison centers (PC), 485 LDP exposures were reported, with 95% in children under 5 yo. Our poison center reported > 25 calls for LDP ingestions in the past 1 year (details in Table 1). The clinical presentation may include: vomiting, altered mental status, and respiratory distress. Metabolic acidosis was not previously described. We have separately reported 2 patients who developed metabolic acidosis, with significant elevation of lactate, following All Mighty Free and Clear® LDP ingestion. We investigate the contents of All Mighty Free and Clear® LDPs via gas chromatography mass spectroscopy (GCMS). Ingredients listed by the manufacturer include: ethoxylated lauryl alcohl (60–100% weight), glycerine, propylene glycol (7–13% weight), water, acrylic polyer, and disodium distyrylbiphenuyl difulfonate.
Methods: 100 microL was removed from an ALL Mighty Free and Clear® LDP. This was diluted to 5 mL with water followed by basic solvent extraction. A 1:1000 dilution was repeated followed by full scan analysis by GCMS (Agilent 9890GC with a 5973 Mass Selective Detector) with comparison to the National Institute of Standards and Technology (NIST) library standards.
Results: We found 50 different chemical signals on GCMS analysis. These included several different alcohols and glycol ethers of interest, diethylene glycols, ethylene glycol ethers or other compounds previously implicated in metabolic acidosis were not identified.
Discussion: Pediatric LDP ingestions are common. The toxins producing metabolic acidosis remain elusive. Further evaluation is warranted.
Keywords: Laboratory, Laundry Pod, Acidosis

66. Serious adverse effects from single use detergent sacs: Report from a statewide poison system

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Background: In the past year, the American Association of Poison Control Centers (AAPCC), lawmakers, media, and researchers have recognized serious adverse effects from single-use detergent sacs (SUDS), which have a candy-like appearance to children. While most exposures result in minor symptoms, there have been serious outcomes. This study aims to classify which types of serious outcomes follow SUDS exposures, and to assess, if possible, differences in toxicity between various SUDS products.

Table. Serious adverse effects of laundry packet ingestion (n = 89).

Effect	Total
CNS Effect (lethargy, sedation, seizure)	49
Respiratory distress, pneumonitis, hypoxia	24
Metabolic Disturbance (acidosis, hyperglycemia, elevated anion gap)	14
Corneal abrasion or ulceration	8
Endoscopic findings of esophageal or gastric injury	3
Laryngeal edema on bronchoscopy	2

Methods: All cases of SUDS exposures from 1 March 2012 to 31 March 2013 were retrospectively identified from a statewide poison system's database, and serious cases further analyzed for clinical details and trends. Criteria for inclusion included the following: episodes of respiratory compromise, intubation, CNS depression, metabolic dysfunction, positive endoscopy results, and ocular symptoms consistent with corneal injury, or other cases considered to have "moderate," "severe," or potentially life-threatening effects.
Results: A total of 856 cases of exposures to SUDS were identified. Serious adverse effects (Table) resulted from 89 exposures, the majority of which were exploratory ingestions in young children, with the median age being 1 year old. Hospitalization was required in 64 (72%) cases, with 15 (17%) requiring an intensive level of care. Intubation was required in 5 cases, while 4 cases had evidence of severe caustic injury documented on bronchoscopy or endoscopy. There was a variation in morbidity among the top three product brands; serious adverse effects were noted in 53/ 612 (8%) of Tide Pods, 9/35 (25%) of Purex Ultrapacks, and 13/31 (42%) of ALL Mighty Pacs exposures. The ALL Mighty Pacs product was associated with 15 % of cases with serious outcomes, despite representing 4% of the total number of exposures.
Conclusion: Exposures to liquid laundry packets can occasionally result in a range of serious toxic effects affecting multiple organ systems. This study was limited by selection bias and loss to follow-up in some cases, but adds to epidemiologic data about this new pediatric hazard. Not all products seem to cause the same amount of morbidity, for reasons which are still unclear. More studies are needed to understand why some exposures produce severe outcomes while many are asymptomatic.
Keywords: Pediatric, Surveillance, Public health

67. Airway compromise in children exposed to single-use laundry detergent pods: confirmation of toxicity in a large case series

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Background: Single-use laundry detergent pods were introduced to the United States in 2010 but had been available in Europe as early as 2001. The pods are a concentrated liquid detergent in a water-soluble polyvinyl alcohol membrane. Case reports have noted vomiting, ocular injuries, respiratory depression and central nervous system depression. We summarize clinical effects from unintentional detergent pod exposures reported to a single poison center over 15 months.
Methods: Electronic poison center records were searched using verbatim field and both product and generic codes to identify laundry pod exposures from January, 2012 through April 9, 2013.
Results: We identified 131 cases between March 2012 and April 2013. Average age was 3.6 years with four adult cases; all were coded as unintentional. The most common route was ingestion (120) followed by ocular (14) and dermal (6). Some patients had multiple routes of exposure. Of ingestion exposures 79 (66%) were managed at home and 41 (34%) were evaluated in a hospital, of

which 9 (8%) were admitted. The average age of admitted patients was 16 months (8–24 months). Relevant findings in these children included emesis (78%), CNS depression (22%), upper airway effects (56%), lower respiratory symptoms (33%), seizure (n = 1) and intubation (67%). One child with emesis initially managed at home was subsequently intubated for respiratory distress.
Conclusion: Exposure to single-use laundry detergent pods can cause significant toxicity, particularly in infants and toddlers. Compared to traditional detergents, clinicians should be aware of the potential for airway compromise following exposure to detergent pods.
Keywords: Pediatric, Detergent pods, Ingestion

68. The princess and the pod: A unique laundry detergent complication

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Background: While poison centers have reported serious toxicity in young children after inadvertent swallowing or biting into products containing concentrated laundry detergent packaged in small, single-use packets, there have been few reports of dermal burns from these products. We report a case of significant dermal burn from such a packet, in this case a Tide®Pod™.
Case report: A 43-year-old woman was seen in the emergency department (ED) with complaint of pain and itching under her right breast. Vital signs were as follows: pulse 90 beats per minute, blood pressure 151/90 mmHg, temperature 36.6°C, and respiratory rate 18 breaths/min. She stated she was using objects that were a "new way to wash clothes" and that her children were giving her a "hard time" about cleaning their clothes "the old fashioned way." The patient put three objects, Tide®Pods™ based on visual identification, in her brassiere a few hours prior to ED arrival because she did not have her purse. She forgot they were in her brassiere and fell asleep. Pain in her breast woke her from sleep whereupon she remembered the detergent pods were in her brassiere. When she removed them, she noted a discolored swollen lesion, which on exam appeared to be a partial thickness burn. The burn was dressed with bacitracin and patient was discharged. Close follow up with the ED or wound clinic was recommended; however, the patient was lost to follow up.
Discussion: Concentrated laundry detergent pods have been associated with airway edema and altered mental status in children. Ocular and dermal injuries are also reported, but the mechanisms for all of the above injuries are not clear. Poisindex® lists ingredients as anionic surfactants 15 to 40%, ethanolamine 1 to 5%, non-ionic surfactants 7 to 13%, polymer 3 to 7%, and propylene glycol 7 to 13% with a pH 6.8 to 7.4. Though caustic injury is unexpected based on the ingredient list, this patient's partial thickness burns suggest alternate mechanisms of tissue damage may play a role. Another possible mechanism is induced cell death via disruption of intracellular calcium regulation by a high surfactant concentration.
Conclusion: Prolonged skin contact with single-use packets containing concentrated laundry detergent can result in partial-thickness burns despite a relatively neutral pH.
Keywords: Surveillance, Public health, Poison center

69. First year market safety surveillance data for single-use laundry detergent packs

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Background: Single-use Laundry Detergent (LD) Packs have been available in certain Western European markets for over a decade but were only recently introduced in North America in early 2012. Prior to introduction, a study was initiated with Poison Control Centers (PCCs) in North America (US and Canada) to understand AE rates, biological response and reason for exposure to LD products. 12 PCCs in the US and 1 in Canada, representing 24% and 42% of the respective population, were enrolled following IRB approval. Population demographics among US PCC sites is representative of total US population for children < 5 years, gender, race, and median poverty rates of families with children < 5 years.
Method: This is an analysis of LD pack exposures reported from Mar 2012–Feb 2013 to US PCCs participating in the ongoing prospective observational study. The complete PCC record, including case narrative, was obtained to evaluate key study parameters including demographics, morbidity and exposure scenario (environmental/circumstantial variables).
Results: A total of 2463 LD pack cases were obtained during the 1st year of which 93% involved children < 5 years old. After an initial increase, the number of exposures per day leveled off from July 2012–Feb 2013 (range 6.8–8.6). Moderate and major outcomes were noted in 9.6% and 0.9% of exposures followed to known outcome (N = 2264); however, the majority resulted in no effect or minor effect (89%). The rate of moderate/major outcome per 100 pack cases did not change July 2012–Feb 2013.

Ingestion and ocular were the major routes of exposure (88% and 16% of cases respectively). The top five symptoms reported include: vomiting (27.4%), cough/choke (8.1%), ocular irritation/pain (7.1%), red eye/conjunctivitis (5.5%), and drowsiness/lethargy (3.8%). Ongoing review of data involving product access indicate that children often access the LD pack when it is not in the original container or when the container is left open.
Conclusions: First year surveillance data of LD pack exposures indicate the number of exposures have leveled off and suggests that exposure reduction efforts are needed. Product access data indicate that reduction efforts should emphasize both parental education and improvements in packaging.
Keywords: Laundry Detergent Packs, Market Safety, Prevention

70. Triage guidelines and referral patterns associated with single-use laundry detergent packs

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Background: U.S. Poison Control Centers (PCCs) began to express heightened concern for childhood exposure to Single-

use Laundry Detergent (LD) Packs after a series of case reports involving respiratory distress and CNS depression in May 2012. The purpose of this study was to evaluate PCC triage guidelines and referral patterns associated with LD pack exposures in the U.S.

Method: An online survey exploring formal and informal triage guidelines was conducted on 12 U.S. PCCs participating in an ongoing prospective observational study of laundry detergent exposures. The study database was queried for LD pack exposures that were triaged by the PCC outside of a healthcare facility (HCF). Each applicable case narrative was reviewed for timing of PCC triage decisions and recommendations. Survey responses were grouped by similarity and modeled to evaluate PCC referral patterns and patient outcome. Referral pattern analysis was limited to cases involving children <= 5 years between Feb 2012–Mar 2013.

Results: The survey was completed by all 12 PCC sites. Of these, 5 (42%) maintained formal LD pack triage guidelines and 3 (25%) modified their guideline within the past year. The majority of PCCs (81%) advised patients with persistent vomiting to seek care in an HCF; however there was no clear consensus for HCF referral relative to single vs. persistent drowsiness or coughing/gasping. Low threshold for HCF referral (no symptoms, any symptom) and/or hospital admission was noted in 3 PCCs.

A total of 2,520 LD pack cases involving children <= 5 years were reported, of which 45% (N = 1144) were handled in a HCF. Among LD pack exposures referred to a HCF by the PCC (N = 508), 13% (N = 68) resulted in a moderate or major outcome and 78% (N = 353) minor or no effect.

A review of 86 case narratives involving childhood ingestion with moderate/major outcome that were triaged by the PCC indicated that 28% (N = 24) were initially managed without an HCF referral. The rate of PCC HCF referral increased from 10% to 25% upon widespread notification of potential for serious respiratory/CNS effects in May 2012; however rates did not appear to be impacted based on local PCC experience.

Conclusion: PCC role in balanced risk management is critical. A consensus triage guideline for LD pack exposures is needed.

Keywords: Laundry detergent pack, Triage guideline, Referral patterns

71. Unit dose liquid laundry detergent exposures: An italian and a us poison center comparison

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Background: Liquid unit dose laundry detergents were introduced in 2001 in the UK, 2010 in Italy, and 2012 in the US. Each unit dose contains between 15–32 mL of highly concentrated cleaning agents in a water-soluble membrane. Transparency of packaging, bright colors and softness like bonbons or toys make them attractive to children. Formulations and packaging vary from country to country. Unexpected central nervous system and respiratory depression has been associated with some exposures in multiple countries.

Methods: We examined unit dose liquid laundry detergent human exposures from an Italian Poison Center (I-PC) and a United States PC (US-PC) from 1-Jul-2010 through 31-Mar-2013 using descriptive statistics, graphics over time, chi-square, and ANOVA as appropriate via SAS JMP 9.0.0 (SAS Institute, Carey, NC). Scaled exposure counts were also examined based on the population served (PS) and total number of exposure calls received by the PC. Statistical significance was defined as $p < 0.05$ (2-tailed). Data translation and harmonization was performed by the authors. Exposure outcomes were classified according to a harmonized Poisoning Severity Score (PSS).

Results: No deaths were reported.

After translation of CEs from Italian to English, 2,221 were reported for the I-PC and 459 for the US-PC. Drowsiness was reported only in the US calls. Ingestion was the most common route of exposure followed by ocular, dermal, and multiple routes.

Conclusions: Although the products were introduced at different times, the outbreak or epicurves show a similar pattern. Despite

Table. Summary of results for abstract number 71.

Measure	Italy PC	US PC	Combined
Description of Cases			
Number of Exposures	1,275	353	1,628
Date of first Exposure	29-Jul-10	28-Feb-12	
Maximum Exposures @ month	64 @22 mo	36 @ 28 mo	86 @ 24 mo
Max Exposures/month/million (PS)	1.49	3.41	4.28
Age-years: mean ± SD	3.55 ± 8.49	3.88 ± 9.03	3.62 ± 8.61
Age-years: median [25,75%] tiles	2 [1.42, 3.17]	2 [1.42, 3]	2 [1.42,3]
Gender: % females/% males	48.4/51.6%	40.5/59.2%	48.7/53.2%
Outcome: number (%)			
No effect	271 (21%)	90 (25%)	361 (22%)
Minor effect	840 (66%)	225 (64%)	1,065 (65%)
Moderate effect	80 (6.3%)	18 (5.1%)	98 (6%)
Major effect	16 (1.3%)	2 (0.6%)	18 (1.1%)
Intubation	3 (0.24%)	1 (0.28%)	4 (0.25%)
Clinical Effect Categories: number (%)			
Gastrointestinal	802 (50%)	187 (47%)	989 (50%)
Respiratory	224 (14%)	48 (12%)	272 (14%)
Ocular	164 (10%)	31 (8%)	195 (10%)
Dermal	98 (6.2%)	57 (14.4%)	155 (7.8%)

gender differences, CEs and outcomes (PSS) were similar. Global product marketing requires standardized, harmonized PC data collection to detect and provide situational awareness of cross border outbreaks. Further work in this area is recommended.
Keywords: Epidemiology, Poison center, Pediatric

72. A case series of cationic detergent ingestions in a large correctional facility

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Background: Over the past 13 years a local correctional facility has used a concentrated soap powder, Liberty L-671, a "blue soap ball" containing about 14 g of a quarternary ammonium complex, to sanitize the jail cells. The reported LD50 of L-671 in rats is 0.63 g/kg. In the course of their cleaning duties, inmates have come into possession of these packets and have intentionally ingested the contents. These exposures have resulted in calls to a regional poison control center (PCC). We aimed to characterize the symptoms, diagnostic findings, and outcomes in the cases of L-671 exposure reported to one PCC.
Methods: This was a single-site, retrospective review of prospectively collected data. Abstracted data included patient age, the presence of nausea, vomiting, stridor, drooling, oropharyngeal (OP) pain, OP lesions, abdominal pain, and evaluation by nasopharyngoscopy, esophagogastroduodenoscopy (EGD), or CT scan. Intubations, intensive care unit requirements, and outcomes were also reviewed.
Results: Of 40 charts identified, 83% identified L-671 by name. The most common symptom was abdominal pain (55%), followed by OP pain (45%). Stridor was not reported in any cases, but 43% had vomiting, 15% had drooling, and 10% had both. 30% had an OP lesion on physical examination. Nasopharyngoscopy was performed in 17/40 and revealed the following: normal (12), OP erythema (2), airway edema (1), and airway edema and mucosal ulcerations (1). One result was not documented. 14 (of whom 9/17 had nasopharyngoscopy) underwent EGD. The findings were normal (11), grade 1 lesions (1), and grade 2A lesions (1). One result was not documented. Five patients were intubated: two after a normal nasopharyngoscopy and two after edema was noted in the upper airway. One fatality was reported to the PCC by the medical examiner. Prior to death, the decedent was reported to have had hematemesis, drooling, and abdominal pain.
Conclusions: The use of L-671, a quarternary ammonium complex, in a correctional facility has resulted in a significant number of intentional ingestions by inmates. While many exposures were mild, 22/40 patients required either nasopharyngoscopy or EGD and five were intubated. One patient died from injuries due to L-671 ingestion. Although the PCC may not have been notified of mild or asymptomatic cases, our data suggest potential serious harm due to intentional misuse. Working in concert with the local Bureau of Correctional Health in the local Department of Health and Mental Hygiene the PCC was able to have the use of the product discontinued.
Keywords: Caustic, Ingestion, Public health

73. Use of N-acetylcysteine therapy beyond the 21 hour intravenous protocol for acetaminophen toxicity

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Objectives: Primarily to characterize incidence of extending *N*-acetylcysteine (NAC) for acetaminophen (APAP) toxicity beyond the 21 hour intravenous (IV) protocol. Secondarily to evaluate incidence of hepatotoxicity (defined as transaminases greater than 1,000 IU/L).
Methods: All APAP exposures that occurred from 2004–2012 handled by three regional poison centers were retrospectively reviewed. Human exposures with completion of the 21 hour IV NAC protocol as primary therapy were included. Excluded patients had a known history of hepatic disease, co-ingestions known to be hepatotoxic or coagulopathic, NAC administration error, were deemed non-toxic, or had insufficient data to determine outcome. Simple logistic regression models were used for the analysis of the primary and secondary outcomes.
Results: A total of 3,765 cases were reviewed with 618 included for analysis. There were 187 cases (30.3%) that were administered therapy beyond 21 hours. An acute ingestion receiving treatment within 8 hours was documented in 178 cases; extended therapy was given to 30 of these patients (16.9%) with 7 cases (3.9%) of hepatotoxicity and no deaths. Of the 188 cases of an acute ingestion starting treatment more than 8 hours from ingestion, 76 (40.4%) received extended therapy, hepatotoxicity developed in 69 cases (36.7%) with 7 deaths (3.7%) and 1 transplant (0.5%). Chronic ingestions were identified in 46 cases with 20 given extended therapy (43.5%), hepatotoxicity occurring in 19 (41.3%), and death in 1 case (2.2%). A group of unknown ingestions included 206 cases with extended therapy given in 61 (29.6%), hepatotoxicity developing in 33 cases (16.0%), and death in 2 cases (1.0%). Logistic regressions revealed acute ingestions starting therapy more than 8 hours from ingestion, chronic, and unknown ingestions were more likely to be given extended therapy compared to acute ingestions starting treatment within 8 hours (adjusted odds ratio of 3.34 [95% confidence interval (CI) 1.76 to 6.37], 3.79 [95% CI 1.51 to 9.52], and 2.07 [95% CI 1.09 to 3.97] respectively) and were more likely to have hepatotoxicity (adjusted odds ratio of 14.08 [95% CI 4.88 to 41.67], 17.24 [95% CI 4.90 to 58.82], and 4.65 [95% CI 1.54to 14.08] respectively).
Conclusions: In patients receiving 21 hour IV NAC protocol for APAP toxicity, patients starting treatment more than 8 hours after acute ingestion or those with chronic ingestions had more than 3 fold higher odds of receiving extended therapy compared to those with acute ingestions receiving treatment within 8 hours. Hepatotoxicity had more than 10 fold higher odds in these two groups when compared to those starting treatment within 8 hours of an acute ingestion.
Keywords: Acetaminophen (paracetamol), N-acetylcysteine, Poison center

74. Utility of a one-bag N-acetylcysteine dosing protocol for acetaminophen overdose

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Background: Since the introduction of Acetadote® to the US market in 2004, IV N-acetylcysteine (NAC) has quickly become the preferred method of antidote delivery in acetaminophen overdose. The traditional IV NAC regimen lasts 21 hours and consists of a loading dose (150 mg/kg over 1 hour) followed by two contiguous maintenance doses (50 and 100 mg/kg over 4 and 16 hours, respectively). Administration of this regimen requires three IV bags to be made. It has been noted that the nature of the three-bag regimen can bring about delayed administration and missed doses, potentially resulting in a negative impact on patient care. This study utilizes a novel one-bag delivery method of IV NAC at a large teaching institution and evaluates time required to complete the regimen before and after its implementation.
Methods: In March 2013, our institution began the exclusive use of the one-bag delivery method. This method consists of a complete course of IV NAC (300 mg/kg) placed into 1 liter of normal saline. All doses and infusion times remain identical to the traditional IV NAC regimen – only the bag concentration and infusion rates differ. Rather than hanging three separate medication bags, the nurse programs a new infusion rate and duration into the smart pump for each consecutive dose. A prospective chart review was utilized to assess post-implementation protocol adherence measured by time to deliver a full course of therapy. This was then compared to a retrospective chart review assessing adherence to the traditional three-bag regimen over a 12-month period.
Results: The retrospective chart review yielded 25 orders for three-bag IV NAC over a one year period. Of these, ten patients received a full course. The mean time taken to deliver a full course was 26 hours (range 19.9–42.1). The prospective chart review took place over a one-month period. Of three one-bag IV NAC orders placed during this time, two patients completed the course. The mean time taken to deliver a full course among these patients was 22 hours (range 21.9–22.0).
Conclusions: It would stand to reason that any intervention to potentially increase protocol compliance may result in better patient outcomes. This is the first trial to our knowledge to assess the one-bag NAC regimen. Though more data is required to perform statistical analysis, preliminary results indicate that the one-bag regimen may result in shorter delays between doses.
Keywords: N-acetylcysteine, Acetaminophen (paracetamol), Antidote

75. Redistribution of acetaminophen following hemodialysis in the setting of massive overdose

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Background: Acetaminophen (APAP) overdose is often asymptomatic early after overdose; but early acidosis and coma are described in massive overdose (MO). N-acetylcysteine (NAC) is effective at preventing hepatotoxicity from toxic metabolites, but does not mitigate acidosis and coma from MO. We present a case of MO with early acidosis and coma where the patient became alert after rapidly reducing serum APAP with hemodialysis (HD). Further, serum APAP appeared to exhibit significant redistribution kinetics post HD, which has not been described.
Case: A 20-year-old woman presented after ingestion of 400 tablets of 500 mg APAP up to 8 hours prior. At presentation, 0 hours, the initial APAP concentration was 645 mcg/ml and the patient was immediately transferred to a larger facility. At 5 hours, she had marked central nervous system depression and then had a seizure. She was intubated then received gastric lavage, activated charcoal, and was on IV NAC throughout her course. Laboratory studies were notable for serum APAP of 1106 mcg/ml, bicarbonate 5 mEq/L, pH 7.1, and PCO2 of 12 mmHg. Aspart transaminase (AST) was 35 IU/L and methemoglobin was 6%. HD was performed for APAP removal and acidosis. After 4 hours of HD, serum APAP was 225 mcg/ml and bicarbonate was normal. Her mental status improved markedly during HD such that she was extubated immediately afterward. Over the next 8 hours her serum APAP rose to 427 mcg/ml without metabolic disturbance. HD was repeated with resulting serum APAP of 105 mcg/ml. IV NAC and supportive cares continued and her AST peaked at 1016 IU/L on hospital day 3. IV NAC was discontinued on hospital day 5 and the patient was discharged without medical symptoms the next day. Of note, methemoglobin peaked at 15.3% at 24 hours post presentation, but did not require treatment.
Discussion: APAP is well known to cause delayed hepatotoxicity in acute overdose which can be mitigated with NAC. Massive ingestions may cause mitochondrial inhibition and resulting metabolic acidosis and coma through an unclear mechanism. HD can be used for toxin removal and correction of acidosis. APAP is rapidly and completely absorbed following ingestion and has a volume of distribution (Vd) of 1 L/kg at therapeutic doses, but the Vd in massive ingestion is unknown. The post HD rebound in serum APAP 24 hours post ingestion suggests a redistribution phenomenon. The rise and fall of methemoglobin suggests oxidative stress from MO.
Conclusion: We present a case of MO where mental status improved markedly during HD and serum APAP fell rapidly adding to the limited literature on the utility of HD in select APAP cases. Further, APAP exhibited significant redistribution kinetics.
Keywords: Acetaminophen (paracetamol), Enhanced elimination, Pharmacokinetics

76. Lactic acidosis with delayed hemolysis in a massive acetaminophen overdose

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Background: Acetaminophen-induced hemolysis is a rare complication in patients with glucose-6-phosphate dehydrogenase (G6PD.) Since most patients with G6PD are males, it is exceedingly rare for a female to experience this complication. Early anion gap metabolic acidosis (EAGMA) may be seen in an APAP overdose but association with hemolysis has not yet been documented. We present a case of a female with no previous history of hemolysis or

G6PD deficiency, who developed EAGMA and delayed hemolytic anemia after APAP overdose.

Case: A 40-year-old Hispanic female presented with altered mental status, vomiting and an ingestion history of 100 tablets of 500 mg acetaminophen. On arrival the patient's vital signs showed sinus tachycardia to 123 bpm. She was stuporous and confused with a normal physical exam. Laboratory values included: acetaminophen level of 806 mcg/ml; salicylate level <5 mg/dl; ethanol <10 mg/dl; venous pH 7.26; lactate 9.8 mmol/L; anion gap of 20 mmol/L, and a urine drug screen positive for benzodiazepines. The patient was started on IV N-acetylcysteine (NAC) and the 6.25 mg/kg/hr bag continued for 29 hours until her APAP level had declined to <10 mcg/ml. There was no transaminitis. Over 24 hours the patient's total bilirubin increased from 1.1 to 5.5 mg/dL (maximum 7.4 mg/dL at 62 hours) without increased direct bilirubin. During this time the hemoglobin went from 12.1 to 10.7 g/dL, haptoglobin level was low at 7 mg/dL, LDH was elevated at 377 IU/L, and a Coombs test was negative. A G6PD level was low at 105 U/10^{12}RBCS (normal range 146–376 U/10^{12} RBCS), indicating the presence of G6PD deficiency. There were no further complications. She was cleared by psychiatry, discharged home, and has been lost to follow up.

Discussion: EAGMA is thought to be due to APAP and its toxic metabolite NAPQI's mitochondrial toxicity by inhibition of mitochondrial oxidative phosphorylation and oxidant stress with depletion of hepatic glutathione. Evidence of oxidative stress and mitochondrial toxicity has been shown in both hepatocytes and erythrocytes. The hemolysis in this case could be due to oxidative effects on the erythrocytes or secondary to the buildup of other oxidative metabolites related to the lactic acidosis. NAC has previously been shown to decrease the respiratory dysfunction of mitochondria, however did not prevent hemolysis in this case. This case is uniquely rare because of the development of hemolysis after EAGMA and also that it is a case of a female presenting with APAP-induced hemolysis secondary to G6PD.

Conclusions: APAP-induced hemolysis is a rare complication in APAP overdose in patients with G6PD. EAGMA may be an early indicator for hemolysis in APAP overdose patients with G6PD.

Keywords: Acetaminophen (paracetamol), Acidosis, Hemolysis

77. A Paradigm Shift from PO to IV N-acetylcysteine and the Clinical Effects Seen

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Background/objectives: Twenty percent of toxic fatalities called to poison centers (PC) involve acetaminophen (APAP). N-acetylcysteine (NAC) the oral antidote for APAP poisoning has been available since the 70s but it is unsavory. The intravenous (IV) NAC has been used in other countries for over 20 years. The IV NAC is administered in 21 hours; PO NAC is administered in 72 hrs. A paradigm shift from PO to IV NAC has occurred. The global use of healthcare resources would be less if the total treatment for APAP toxicity could be administered in one day. Providers could surmise that choosing the IV antidote over the PO could save healthcare resources.

Methods: A retrospective review of 6 PC archives from 2007 & 2012 for human APAP exposures was conducted to compare the clinical findings of pts. treated with IV and P.O NAC. The review included human exposures, number of pts., labor hrs. for administering IV and PO NAC, and treatment modalities. The review included the following APAP products: APAP/codeine, APAP/hydrocodone, APAP/other drug-adult and pediatric formulations, APAP/other opioids, APAP/oxycodone, APAP/ propoxyphene, APAP/ adult and pediatric formulations, and APAP/ unknown formulations.

Results: The PC's received 10,343 calls on APAP exposures in 2012; 1606 pts.were treated with the antidote NAC; 564 pts. with PO, and 1,042 with IV. In 2007, 11,562 human APAP exposures were called in to the PC's; 1,214 pts. were treated with PO NAC, and 509 with IV NAC. In the 2012 archives 337 pts. developed transaminases; with AST and ALT ranging >100 IU/L but $<1{,}000$ IU/L.; 1,042 were treated with IV NAC and 564 with PO NAC. The 2007 archives showed 55 pts. received IV and 133 PO NAC. There were 166 pts. that developed AST, ALT >100 IU/L but $<1{,}000$ IU/L.; 110 were treated with IV NAC and 46 with PO NAC. In 2007, 161 pts. had AST, ALT >1000I U/L, 103 pts.were treated with PO NAC and 58 with IV NAC. The listed APAP products were associated with 19 deaths; 2 (0.35%) pts. were treated with PO NAC and 17 (1.6%) with IV NAC. Fifteen pts. developed renal failure; 2 (0.35%) were on PO NAC and 13 (1.2%) on IV NAC. Sixty-nine pts. developed tachypnea, 15 (2.65%) were on PO NAC and 54 (5.1%) on IV NAC.

Conclusions: Acetaminophen poisoning is the most prevalent toxic exposures worldwide. Treating the toxic pt. with NAC is expensive but only one aspect of the global health care resources used. Hospitalization, staffing, physicians, and family expenses make up most of the financial burden. Providers may perceive treatment by IV NAC as the prudent choice based on shorter administration time, savings of hospital beds, labor hrs, and resources. Evidence based practice is the gold standard not taking an educated guess.

Keywords: N-acetylcysteine, Poison center, Hepatotoxicity

78. Profound metabolic acidosis and hyperammonemia due to acetaminophen successfully treated with dialysis

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Background: Pyroglutamic Acid (PGA; 5-oxoproline) is an organic acid that has been reported to cause anion gap (AG) acidosis in patients with associated acetaminophen (APAP) use. Treatments have included N-Acetylcysteine, bicarbonate infusions, and discontinuation of the offending agent. Here we report a case of profound acidosis with associated hyperammonemia due to APAP use with underlying malnutrition requiring continuous veno-venous hemodialysis (CVVHD) in the setting of a national bicarbonate shortage.

Case report: A 50 year old female with history of seizure disorder and chronic renal insufficiency presented to the ED with altered mental status, vomiting, and poor oral intake for 2 weeks. The patient was tachypneic with otherwise normal vitals. She had dry mucous membranes and was drowsy but arousable. Otherwise her exam was nonfocal. Initial laboratory data revealed a profound

metabolic acidosis with an arterial pH 6.92, pCO2 11mm Hg, HCO3 2 mMol/L, and an AG of 29. Chemistries showed a BUN and creatinine of 72 and 5.2 mg/dL, respectively with a potassium of 6.3 mmol/L. Lactate and glucose were normal, and acetone levels were negative. APAP level was 14 ug/dL; AST/ALT and coagulation studies were within normal limits. Her ammonia concentration was 145 uMol/L [9–33 uMol/L]. Albumin level was 1.9 g/dL [3.4–5 g/dL] and total protein was 4.0 g/dL [6.3–7.7 g/dL]. Valproic acid was undetectable. Toxic alcohol panel resulted negative. Initial management of the patient included: IV-NAC 21 hour protocol and bicarbonate infusion; given the nationwide shortage of bicarbonate, CVVHD was instituted that evening. After 1 day of dialysis, the patient had marked improvement of her acidosis. A large PGA peak was detected on a urinary organic acid GC/MS.
Case discussion: The patient had marked acidosis with a pH of 6.9, bicarbonate level of 2mMol/L, and ammonia of 145uMol/L. The typical causes of anion gap metabolic acidosis were not present in this case. She did have severe renal insufficiency with hyperkalemia, warranting aggressive treatment. A bicarbonate infusion was initiated; however, due to a nationwide shortage of bicarbonate, CVVHD was initiated. The patient required one day of dialysis to correct her acidosis and renal insufficiency, without any further bicarbonate. This is the first reported case describing CVVHD for the treatment of marked PGA.
Conclusions: Dialysis in the setting of anion gap metabolic acidosis due to severe organic acidemia from PGA is an efficacious treatment option, especially in the setting of bicarbonate shortage. Hyperammonemia may contribute to altered mental status is the setting of acidemia from APAP induced PGA generation.
Keywords: Acetaminophen (paracetamol), Acidosis, Hemodialysis

79. A case of delayed hepatic encephalopathy in acetaminophen toxicity after demonstrated resolution of synthetic liver function

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Background: Acetaminophen overdoses resulting in hepatotoxicity remain one of the most prevalent poisonings toxicologists encounter. Classic teaching correlates resolution of hepatotoxicity and fulminant hepatic failure with normalization of biochemical markers and a return to baseline synthetic liver function. We report a case of delayed onset acetaminophen-induced hepatic encephalopathy that developed after demonstrated improvement of hepatotoxicity.
Case report: A 17 year old male patient presented after ingesting 150 tablets of 500 mg acetaminophen /25 mg diphenhydramine combination product. His initial presentation demonstrated a 4 hour acetaminophen level of 199.5 ug/mL with a clinical anticholinergic toxidrome. He was started on N-acetylcysteine within 2 hours of presentation. Of note, his acetaminophen level peaked at 14 hours at 217.4 ug/mL. Over the next 48 hours, his anticholinergic toxidrome completely cleared with a return to baseline mental status. He demonstrated acetaminophen-induced hepatotoxicity with his ALT reaching a peak of 6506 IU/L and his INR peaking at 6.48, both at hour 69. At the 96 hour mark, the patient began to demonstrate encephalopathic behavior along with a rising ammonia level despite a resolution of his other biochemical markers (see graph 1). His ammonia level continued to rise until its peak at 457 ug/mL at hour 138, correlating with the patient being fully obtunded. His INR at this time had improved to 1.56. He never received VPA and had a nondetectable VPA level. His hyperammonemia was treated with rifaxamin, lactulose and 2 rounds of hemodialysis before his ammonia level began to downtrend and his mental status improved.
Case discussion: Hepatic encephalopathy has been seen in cases of fulminant hepatic failure secondary to acetaminophen toxicity. Hyperammomenia has been associated with hepatic encephalopathy in other settings of hepatic failure. In the brain ammonia is converted to glutamine via glutamine synthetase in the astrocytes. Hyperammonemia is known to cause astroglial swelling and thought to be a major contributor in the development of encephalopathy. In the liver, ammonia is detoxified either via incorporation into the urea cycle or through conversion back to glutamine. However, encephalopathy of this severity from acetaminophen toxicity is correlated with biochemical markers demonstrating ongoing fulminant hepatic failure. We report a case of hepatic encephalopathy presenting with resolving biochemical hepatic markers.
Conclusion: Hepatic encephalopathy and hyperammonemia can occur after biochemical resolution of acetaminophen induced hepatotoxicity.
Keywords: Acetaminophen (paracetamol), Pediatric, N-acetylcysteine

80. Acidosis unknown: Fatal lactic acidosis associated with acetaminophen and NRTI use

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Background: Lactic acidosis has resulted from both massive and late acetaminophen (APAP) overdose and also chronic nucleoside reverse transcriptase inhibitors (NRTI). We describe a fatal case of severe lactic acidosis associated with APAP and NRTI use. Lactic acidosis associated with emtricitabine and tenofovir has only been previously reported in conjunction with metformin use.
Case report: A 34-year-old woman with HIV presented with drowsiness, confusion, and tachycardia. She was awake and able to answer questions, and denied intentional ingestion. Her home medications included tenofovir and emtricitabine. Initial BP was 135/45, pulse 115, and T 97.7F. Lab included lactic acid >10 mmol/L, AST 258 U/L, ALT 366 U/L, APAP 104 µg/mL, INR 1.3, anion gap 26, and pH of 7.04. No infectious cause was identified. She was started on n-acetylcysteine (NAC) infusion and aggressive IV fluid resuscitation. Riboflavin and l-carnitine therapy were not given. Later, history from the patient's family revealed daily use of APAP for back pain at an unknown dose. Despite therapy with IV fluids, multiple vasopressors and NAC, on hospital day 2 the patient's lactic acid remained elevated at 8.6mmol/L, pH declined to 6.8, hypotension and PEA arrest developed and she was unable to be resuscitated.
Case discussion: APAP has been associated with lactic acidosis via two mechanisms. In early massive overdose, NAPQI inhibits mitochondrial aerobic respiration, causing lactic acidosis. However, this only occurs at high levels of APAP and is associated with coma. Late APAP toxicity presents with lactic acidosis due

to decreased hepatic lactate clearance and tissue hypoperfusion. Our patient presented with a mildly elevated APAP level, alert and normotensive, suggesting this as a less likely etiology. Lactic acidosis in chronic NRTI therapy is rarely described, and not with tenofovir or emtricitabine alone. Symptomatic lactic acidosis with NRTI therapy occurs in 1.7 to 25.2 cases per 1000 person treatment years, with a mortality of 57%. Administration of cofactors including riboflavin, thiamine, and l-carnitine has reduced mortality.

Conclusion: APAP overdose and NRTI therapy are two rare but important causes of lactic acidosis. Early identification of lactic acidosis and aggressive therapy with IV fluids, NAC, and cofactors such as riboflavin, thiamine and l-carnitine, have decreased mortality and are essential in patient care.

Keywords: Nucleoside Reverse Transcriptase Inhibitor, Acetaminophen (paracetamol), Death

81. Enhanced toxicity or protective effect? A comparison of acetaminophen/aspirin/caffeine overdose with single component ingestions

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Background: Combination products containing acetaminophen 250 mg, aspirin 250 mg, and caffeine 65 mg (AAC) are marketed for treatment of headache. AAC has 3 potentially toxic components and is frequently taken in overdose (OD). The aim of this study was to compare the incidence of serious outcomes with those of single component acetaminophen (APAP) and aspirin (ASA) ingestions.

Methods: The National Poison Data System (NPDS) was searched for all cases of acute exposure, without coingestants, of AAC, APAP alone, and ASA alone from 1/1/2003 through 12/31/2012. Only cases treated at a health care facility and followed to known medical outcome were included. Confirmed non-exposures were excluded. NPDS was queried for medical outcome, specific clinical effects (acidosis, ALT/AST increase, hyperventilation, tinnitus, vomiting), as well as treatments recommended and/or provided (alkalinization (ALK), oral or IV N-acetylcysteine (NAC), hemodialysis (HD)). Chi square tests were used to compare variables between groups.

Results: A total of 13,812 AAC, 120,231 APAP, and 38,356 ASA cases were included for analysis. In the AAC group there were 2 deaths (0.014%) and 63 major effects (0.46%). The clinical effects of acidosis, hyperventilation, and tinnitus were reported less frequently with AAC than with ASA ingestion. ALT, AST >100 and >1000 U/L were less frequently reported with AAC than with APAP. However, vomiting was reported more frequently with AAC than with APAP or ASA. Patients with AAC OD were less likely to have ALK or HD recommended and/or provided (R/P) than ASA patients, and were less likely to have NAC R/P than APAP patients.

Percentages are in parentheses. Differences were significant to $p<0.001$ except for vomiting in AAC vs. ASA ($p<0.01$).

Conclusions: Death, major effects, specific clinical effects (except vomiting), and the need for specific therapies are all less common after acute OD of AAC combination product than with OD of APAP or ASA alone. This may be due to lower APAP and ASA content per pill (250 mg). In addition, the higher incidence of vomiting with AAC suggests a greater degree of GI irritation, possibly making it more difficult for patients to ingest large pill amounts.

Keywords: Acetaminophen (paracetamol), Aspirin, National Poison Data System

82. A tale of two treatments: Use of percutaneous left ventricular assist device (impella) and hyperbaric oxygen therapy for quinine overdose

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Background: The Impella is a percutaneous left ventricular assist device (LVAD). Current approved uses include severe left sided systolic heart failure and cardiogenic shock. There are few, if any, published cases on the use of percutaneous LVADs in poison-induced cardiogenic shock.

Acute quinine poisoning may produce a direct toxic effect on the retina in addition to tissue hypoxia, producing visual disturbances. Published case reports of hyperbaric oxygen therapy (HBOT) in quinine toxicity have reported an improvement in vision shortly following HBOT.

Case report: A 45-year-old woman who intentionally ingested undisclosed amounts of citalopram and quinine presented with seizures, hypotension (systolic blood pressure 90 mmHg), and a

Table. Results for abstract number 81.

Outcome/clinical effects/treatments	AAC (n = 13,812)	APAP (n = 120,231)	ASA (n = 38,356)
Death	2 (0.014)	316 (0.26)	142 (0.4)
Major effect	63 (0.46)	3705 (3.1)	1096 (2.9)
Acidosis	188 (1.4)		2586 (6.7)
ALT, AST > 100	30 (0.22)	5098 (4.2)	
ALT, AST > 1000	19 (0.14)	5028 (4.2)	
Hyperventilation	235 (1.7)		3843 (10)
Tinnitus	285 (2.1)		9721 (25.3)
Vomiting	3455 (25)	20922 (17.4)	9093 (23.7)
NAC R/P	1441 (10.4)	49050 (40.8)	
ALK R/P	1045 (7.6)		18117 (47.2)
HD R/P	17 (0.12)		1385 (3.6)

prolonged QRS (146 msec) and QTc (650 msec). QTc and QRS prolongation were treated with multiple doses of magnesium and sodium bicarbonate, respectively. Despite these interventions, a wide complex arrhythmia persisted. Due to worsening hypotension she required maximum dose epinephrine, norepinephrine, phenylephrine, and vasopressin to maintain a mean arterial pressure (MAP) of 50. Subsequently, a percutaneous LVAD (Impella) was inserted and remained in place for 12 hours, with an increase in MAP of 10–20 mmHg documented within 3 hours. She was extubated approximately 12 hours following removal of the device, having been weaned off catecholamines and maintaining a MAP of 70 mmHg. Unfortunately, the patient reported seeing shadows and shades of blue. The reported vision changes were concerning for retinal toxicity secondary to quinine ingestion. After discussion with a hyperbaric specialist, she was transferred to a hyperbaric oxygen treatment center and underwent one round of HBOT. At the end of her hospital course, she reported almost complete improvement in her vision.

Discussion: Percutaneous LVADs in poison-induced shock refractory to standard management and hyperbaric oxygen therapy for quinine retinal toxicity are infrequently used treatments in poisoning. This patient appeared to benefit from both treatments with no obvious adverse effects. Further studies are warranted to fully understand the risks and benefits of each of these interventions. However, due to limited treatment options, these procedures may be considered in cases refractory to standard treatment.

Conclusion: Percutaneous LVAD may be of benefit in poison-induced shock refractory to vasopressors. HBOT may improve visual disturbances associated with quinine-induced retinal toxicity.

Keywords: Cardiac toxicity, Hyperbaric Oxygen Therapy, Mechanical Support

83. Cost of continuous fomepizole during hemodialysis for methanol toxicity

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Background: The U.S. manufacturer of fomepizole recommends dosing at 4 hour intervals when used during hemodialysis for treatment of toxic alcohol poisoning. There have been European case reports of successful use of continuous infusion (1–1.5 mg/kg/hr) of fomepizole during hemodialysis for toxic alcohol poisoning. Based on review of the literature and practice guidelines, this is not a common dosing regimen in the United States and few reports exist on cost comparison of continuous versus intermittent fomepizole dosing. As fomepizole is an expensive medication, cost may be a factor in dosing recommendations. We present a cost analysis of a case where continuous fomepizole was used.

Case report: A 45-year-old man presented intoxicated after drinking "listerine and vodka". His blood alcohol content via breathalyzer was 0.115 g/dL and laboratory evaluation was significant for an anion gap metabolic acidosis, pH 7.34, creatinine 0.8 mg/dL, methanol concentration 58 mg/dL and isopropanol concentration 42 mg/dL. Fomepizole was given as a 15 mg/kg loading dose. The patient underwent a 6-hour-run of hemodialysis during which fomepizole was administered as a continuous infusion at 1.5 mg/kg/hr. A methanol concentration 4 hours into dialysis was 0, bicarbonate 30 mmol/L, and no anion gap was present. Fomepizole infusion was not discontinued until follow-up methanol concentration 9 hours post-dialysis (also 0).

Discussion: Continuous fomepizole infusion during hemodialysis is not a typical dosing regimen recommended by poison centers. The dose used in this patient resulted in less total fomepizole during dialysis (693 mg, $256.41) than the typical dosing regimen of 10 mg/kg every 4 hours during dialysis (based on time of loading dose, this patient would have received a 770 mg dose 4 hours into dialysis and 385mg at end of dialysis, total $427). Though the infusion was scheduled to be administered only during dialysis, due to a systems error it was continued for several hours post-dialysis while awaiting a repeat methanol level. This resulted in a larger dose of fomepizole administered than originally indicated, adding an additional 1039 mg with an extra cost of $385.

Conclusion: We present a case of successful fomepizole infusion during hemodialysis which potentially could have resulted in a reduction of total fomepizole dose and cost. The optimal rate during dialysis and length of time to continue infusion following dialysis has not been clearly delineated, and this may lead to additional and unneccesary fomepizole administration, making it difficult to determine the cost benefit of continuous infusion. Further studies are required before continuous infusion of fomepizole can be routinely recommended.

Keywords: Methanol, Fomepizole, Hemodialysis

84. Record ethylene glycol ingestion with delayed diagnosis and complete recovery

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Background: Ethylene glycol (EG) is a common accidental and self-harmful ingestion as it is easily accessible in common products such as antifreeze. Once absorbed EG is then metabolized by alcohol dehydrogenase (ADH) to oxalic, glycolic, and glyoxylic acids which cause both an anion gap and the harmful effects of the poisoning. We present a case of EG poisoning where treatment was delayed by 8 hours.

Case report: A 62-year-old man was brought in unresponsive by EMS with an initial EG level of 1739 mg/dL. On arrival he was intubated for a GCS of 8 and oxygen saturations of 50% and norepinephrine started via a central line for hypotension (BP 65/45). Per family he had made recent suicidal comments and had a blue discoloration around his mouth. The remainder of his exam was normal. His initial anion gap was 16 and his osmolar gap was later found to be 290. Treatment with fomepizole (load at 15 mg/kg) and HD for acidosis (VBG pH 7.06, HCO3 11 and lactate $>$ 15) was not initiated until after transfer to a tertiary care center (8 hours after ED arrival) because of lack of antidote, dialysis availability and appropriate medical expertise. His urine drug screen was positive for benzodiazepines and opiates and his initial blood ethanol was negative. HD was continued for a total of 24 hours at which point he was extubated and had a final EG level of 12 mg/dL. On hospital days 2 and 3 he remained alert, neurologically intact, normotensive and his kidney function remained intact (creatinine 0.9

on discharge). On day three he was discharged to a psychiatric facility in good condition.

Case discussion: Clinical suspicion for toxic alcohol ingestion must be high in altered patients so that anion and osmolar gaps can be used to help support or exclude intoxication. Fomepizole inhibits ADH and the formation of toxic metabolites; it is an effective treatment when used early and has few side effects. Parent compound and toxic metabolites can then be removed with HD if needed, avoiding potential sequelae including neurotoxicity, acute renal failure, shock and even death. Although far milder intoxications have resulted in organ damage and death, this patient survived with no complications following delayed diagnosis and treatment even in the setting of profound intoxication and no evidence of ADH blockade prior to presentation. This is the highest non-fatal level recorded in the literature with no evidence of end organ dysfunction.

Conclusions: A case with an extremely high EG level presented, and even with an 8 hour delay in definitive care, recovered uneventfully highlighting the importance of prompt diagnosis in order to quickly start a potentially lifesaving treatment.

Keywords: Ethylene glycol, Fomepizole, Ingestion

85. The use of hemodialysis in medical toxicology practice: The toxic experience

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On behalf of Acmt Toxic Case Registry Investigators

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Background: The use of extracorporeal treatments such as hemodialysis (HD) for the removal of toxins predates the use of these therapies for renal failure. Most published research is limited to case reports or small case series, leaving a very limited body of information to guide practitioners on their use for the management of poisonings. A previous study from the American Association of Poison Control Centers (AAPCC) described their experience with HD in poisons. The aims of this study are to describe the use of HD in medical toxicology practice through review of the ToxIC Registry and to compare it to the AAPCC experience.

Methods: The ToxIC Registry, created in 2010, provides detailed information on patients cared for by medical toxicologists at the bedside. We analyzed all cases in the registry database from Jan 1, 2010 to December 31, 2012 where providers indicated that HD had been performed.

Table. Hemodialysis for Toxin Removal.

Toxin	2010–2012 ToxIC data (%)	2001–2005 AAPCC data (%)
Ethylene Glycol	23.2	26
Lithium	18.9	32.4
Other	60.6	3.4
Salicylates	13.1	18.7
Methanol	3.9	5.8
Valproic Acid	1.2	6.5
Ethanol	0.4	3.7
Benzodiazepine	0.0	3.5

Results: From a population of 16,503 cases, we identified 273 (1.7%) that received HD. 14 (5.4%) had incomplete data and were excluded. HD was most frequently used for ethylene glycol (23.2%), lithium (18.9%), salicylate (13.1%), methanol (3.9%) and metformin (3.5%). Other poisonings where HD was used more than once were carbamazepine, digoxin, valproic acid and propylene glycol. Table compares ToxIC to AAPCC data.

Discussion: The EXtracorporeal TReatments in Poisoning (EXTRIP) work-group, convened in 2010, consists of international experts representing over 20 medical societies and is in the process of finalizing recommendations regarding extracorporeal toxin removal in poisoning based on review of medical literature. EXTRIP has called for the development of research allowing for more robust study in this area. Whereas most hospitals or sites only see a handful of poisonings in which HD is used for toxin removal, the multi-center nature of ToxIC supports the implementation of prospective multicenter studies on the use of treatments such as HD in poisonings.

Conclusion: Understanding the use of HD across the ToxIC Registry is the first step in developing an infrastructure capable of producing the research trials necessary for better informing medical practice in this area. The removal of toxic alcohols, lithium and salicylate are the most common reasons toxicologists use HD. ToxIC data is generally similar to AAPCC data in terms of overall frequency of HD for specific toxin removal.

Keywords: Hemodialysis, Poison center, Ethylene glycol

86. Does therapeutic use of tapentadol cause false positive urine screens for opiates or methadone using the Syva II EMIT immunoassay?

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Background: Tapentadol (Nucynta™) is a mu-opioid receptor agonist approved for use as an analgesic in 2008 with an extended release formulation approved in 2011. A previous study reported false positive urine screens for methadone using the DRI enzyme immunoassay.

Objective: To determine whether therapeutic use of tapentadol is associated with false positive urine screens for methadone or opiates using the Syva II EMIT immunoassay.

Methods: In this IRB-exempted study, we obtained aliquots of urine previously obtained for a another IRB approved study. In the original study, we recruited patients from a pain management clinic and a rheumatology clinic. We screened electronic clinic records to identify patients with upcoming appointments who had active prescriptions for tapentadol. We met all eligible patients on their scheduled appointment days and explained the purpose of the study. We excluded patients who had not taken tapentadol in the three days before screening. Screened patients were allowed to opt out without stating a reason. For each enrolled patient we recorded the prescribed doses of all prescription analgesics and asked patients to report the number of doses of tapentadol taken on the study day and the two preceding days. Enrolled patients then provided a spontaneously voided urine specimen. Specimens were frozen, stored, and later thawed

before testing with the Siemens Syva EMIT II immunoassay for methadone and opiates. All positive results were then confirmed by LC-MS.
Results: We screened 21 patients with recorded prescriptions for tapentadol. We excluded 10 patients (3 had not taken the drug recently, 2 had excluding medications, 2 missed their appointments, 2 declined, 1 researcher unavailable). We enrolled 11 patients (8 women, 3 men) with ages ranging from 31 to 86 years (mean 49.5, median 50). Daily dose ranged from 50 to 600 mg/day (mean 268 mg/day, median 200 mg/day). One specimen screened positive for methadone, which was confirmed by LC-MS; this patient had been prescribed methadone. Two specimens screened positive for opiates, which were confirmed by LC-MS; both patients had active prescriptions for morphine in one and oxycodone in the other.
Conclusions: No false positive urine screens for methadone or opiate occurred using the Syva EMIT II immunoassay in urine samples from patients with therapeutic use of tapentadol up to the maximum approved daily dose.
Keywords: Laboratory, Tapentadol, Urine drug screen

87. Naloxone use following oral opioid overdose

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Background: Unlike overdoses involving intravenous heroin, the optimal period of observation following oral opioid overdose is unknown. The prolonged absorption or duration of action of oral agents may require longer observation periods. This study's objective is to describe patterns of naloxone use following oral opioid poisoning in emergency department (ED) patients.
Methods: The setting was the ED of a tertiary care hospital with an annual census of 90,000 patients. Study design was an IRB approved retrospective chart review of the period between January 1 and June 30, 2012. Potential cases were obtained from two sources: ED pharmacy records of all patients with an order for naloxone; and ED billing records of all patients diagnosed with opioid poisoning (ICD-9 codes 965.0, 965.01, 965.02, 965.09). Inclusion criteria for analysis were age ≥ 18 years and diagnosis of oral opioid poisoning by history or confirmed on comprehensive urine drug screen. Pregnant women and prisoners were excluded. Abstracted data included the timing of all naloxone doses (including pre-hospital) and the type of opioid ingested. The primary endpoint was time between first and second naloxone doses. For cases not receiving naloxone or receiving one dose, the total time of observation in the ED following presentation or first naloxone dose was noted.
Results: 47 cases met inclusion criteria. 30 cases (63.8%) received naloxone; 13 cases received $>$ one dose. In cases with >1 dose ($n = 13$), median time between first and second doses was 68 minutes (range 5–1210). Cases with one naloxone dose ($n = 17$) were observed in the ED for a median time of 390 minutes (range 73–1300). Cases not receiving naloxone ($n = 17$) were observed in the ED for a median time of 390 minutes (range 111–734). Ingested opioids noted were oxycodone ($n = 19$), methadone ($n = 13$), tramadol ($n = 6$), hydrocodone ($n = 4$), codeine ($n = 4$), buprenorphine ($n = 2$), oxymorphone ($n = 2$) and morphine ($n = 2$). 3 patients ingested multiple drugs.
Discussion: In this study a majority of oral opioid overdoses received naloxone, with 13/30 (43.3%) receiving $>$ one dose. Median time to second naloxone dose was shorter than time of ED observation for the other groups (68 vs 390 min). However, there was substantial overlap in time ranges between groups. Study limitations include the inability to confirm drug dose or formulation (e.g. extended release) and the lack of pre-determined, consistent criteria for naloxone administration.
Conclusions: Many patients may require multiple naloxone doses after oral opioid overdose. The elapsed time between doses may be prolonged. Further study with a larger sample size may help better define the optimal observation period in cases of oral opioid overdose.
Keywords: Opioid, Naloxone, Overdose

88. Use of buprenorphine and clonidine in treatment of combined heroin and xylazine withdrawal

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Background: Xylazine is a veterinary anesthetic with alpha-2 agonist properties. It is similar to dexmedetomidine in effect. Sedation, decreases in heart rate and blood pressure and muscular relaxation result. In Puerto Rico it is often sold in combination with heroin and cocaine either purposefully or as adulterant. It is referred to as anestesia de caballo (horse anesthesia), or 'regalito' (little gift) when sold with the cocaine and heroin. Users of xylazine suffer unique morbidity from as it causes potent vasoconstriction if users 'miss' their vein. Ulcers and gangrene may occur due to vasoconstriction. Dependence and severe withdrawal upon cessation can occur as well with prolonged use and treatment of withdrawal may be particularly problematic.
Case: A 31 year-old male with IVDU involving heroin, cocaine and xylazine was living in Puerto Rico when his family performed an intervention and brought him back to the mainland US. He'd been "hustling" for tourists and others in San Juan, where he would receive drugs in payment for helping others find heroin and cocaine. He had a several-year history of IVDU involving primarily heroin however he'd been using heroin, xylazine and cocaine while in Puerto Rico. He'd suffered several ulcers and described extreme difficulty in any prolonged cessation due to severe anxiety, dysphoria, tremors, sweats and other symptoms. On presentation to the treatment program where he was seen for buprenorphine induction he was noted to be irritable and in moderate opioid withdrawal scale with a Clinical Opioid Withdrawal Scale (COWS) score of 21. He had tachycardia, mydriasis, was irritable and restless and described anorexia and sweats. He was yawning and had tearing in his eyes. His Blood pressure was elevated at 140–150 mmHg/90–100 mmHg. A urind dipstick confirmed use of opiates and cocaine. Screen for xylazine was not available. He described use during the past week, however, while in Puerto Rico. A 4/1 mg dose of Suboxone™ given SL improved his symptoms over 1 hour (COWS to 14) and a second 4/1 mg dose was given. Clonidine 0.1 mg PO QID for w/d was also started. The following morning he was seen, after an 8/2 mg Suboxone™ strip and 0.1 mg clonidine dose. He reported feeling, "normal" with the combined Suboxone™ and clonidine therapy. His COWS score was 0. He had no signs/symptoms of w/d.

Discussion: The combination of heroin and xylazine dependence may result in withdrawal syndrome upon cessation that involves autonomic signs/symptoms similar to clonidine (which is an alpha-2 agonist like xylazine) withdrawal.
Conclusion: Addition of clonidine to buprenorphine may be useful in the treatment of combined opiate-xylazine withdrawal syndrome.
Keywords: Withdrawal, xylazine, Heroin

89. Pediatric buprenorphine exposure – a series of three cases

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Background: Buprenorphine is a partial agonist at the μ opioid receptor used primarily for the treatment of opioid dependence. It is safe for use in opioid-dependent adults due to a 'ceiling effect' related to its partial agonist properties. In opioid naïve individuals, however, buprenorphine exposure may present similar to a full opioid agonist with corresponding toxidrome. Buprenorphine is available in combination with naloxone in a 4:1 ratio as Suboxone™, formulated both as tablets and individually wrapped, rapidly dissolving films.
Case reports: Case 1: a 2 year old male presented 30 minutes after ingestion of half an 8/2 mg Suboxone™ tablet. Activated charcoal was given. About 4 hours after ingestion, the child became somnolent with his O2 saturation dropping to the 80s. Miosis was noted. Naloxone 0.4 mg was given IV with improvement in symptoms. No further naloxone was needed and symptoms resolved by 18 hours post ingestion. Case 2: a 16 month old male presented 30 minutes after being found with half of a Suboxone™ 8/2 mg tablet in his mouth. The mother was able to remove the partially-dissolved tablet. The child was somnolent and had miosis at presentation, however no naloxone was required. He returned to baseline within 12 hours of exposure. Urine buprenorphine levels obtained 24 hours after exposure revealed total bup 9 ng/mL, total bup/creat 75 ng/mg, total norbup 25 ng/mL total norbup/creat 208 ng/mg. Case 3: a 9 month old male presented 30 minutes after ingestion of half an 8/2 mg Suboxone™ film. In the ED he was comatose and in respiratory failure with O2 saturation of 70%. After initial 0.2 mg and then 0.4 mg dose of naloxone the child awoke however had rapid recurrence of symptoms and a naloxone drip of 0.6 mg/h was started with positive effect. The drip was required for 19 hours. Urine buprenorphine levels obtained 3 hours after exposure revealed total bup 679 ng/mL, total bup/creat 1151 ng/mg, total norbup 2227 ng/mL, total norbup/creat 3775 ng/mg.
Case discussion: In a 2-year period, 3 patients ≤2 years old presented to our ED with exposure to buprenorphine. 2 of the exposures involved the tablet formulation, and one involved the film. The severity of symptoms varied among the patients. Cases 2 and 3 had rapid onset of symptoms, likely due to absorption via oral mucosa, compared to the delayed onset in case 1 when the tablet was swallowed. In case 3 the buprenorphine levels were very high.
Conclusions: We present 3 pediatric patients with buprenorphine ingestion. They developed signs and symptoms consistent with standard opioid intoxication despite the partial μ agonist effect of buprenorphine. Naloxone was effective in reversing coma and respiratory failure.
Keywords: Buprenorphine, Opioid, Pediatric

90. Pediatric ingestion of suboxone® film: a case report

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Background: Suboxone® sublingual film, in use since 2010, is indicated for the treatment of opioid dependence. Designed to address concerns regarding abuse, patient compliance and unintentional pediatric exposure, it is packaged in separate "child-resistant" polyester/foil packets with instructions to place under the tongue until dissolved. Advantages include unit-dose packaging, better taste, and rapid dissolution. It is available in four formulations of buprenorphine/naloxone (B/N). B is a partial agonist at the mu-opioid receptor and an antagonist at the kappa-opioid receptor. N is a potent antagonist at mu-opioid receptors. Comparisons of B to methadone and hydromorphone suggest that sublingual B produces typical opioid agonist effects that reach a maximum effect between 8 mg/2 mg and 16 mg/4 mg B/N. Reports of pediatric exposure to the film are rare. We describe a child ingesting an opened Suboxone® film with subsequent CNS and respiratory depression requiring naloxone and critical care admission.
Case report: A 20-month-old male was seen in an emergency department (ED) after ingesting half of a Suboxone® film. An 8 mg/2 mg film had been cut in half by a parent and left to take the next day. The child was found with residue in his teeth. In the ED, he became drowsy, with peak lethargy one hour post-ingestion; he required eight doses of naloxone. His oxygen saturation had decreased to 93%, and due to continued lethargy, a respiratory rate of 18 per minute and a blood pressure of 93/35 mmHg, he was transferred to a children's hospital. He remained afebrile, with HR ranging between 97–135 bpm, RR 16–41 and BP systolic 89–120 and diastolic 35–91. No treatment other than oxygen was given subsequently and he was discharged the next day. At 4 hours post-ingestion, the B level was 3.8 ng/ml and N was 1.9 ng/ml via mass spectrometry.
Case discussion: The child experienced significant toxicity following ingestion of a Suboxone® film. A survey of cases reported to our PCC did not reveal any pediatric film exposures, so the clinical course as compared to ingestions of Suboxone® tablets cannot be predicted. The rapid sublingual dissolution of Suboxone® film may cause more notable early manifestations than ingestions of Suboxone® tablets.
Conclusion: In spite of manufacturers' efforts to reduce pediatric exposures by the film formulation, ingestions with sublingual absorption can still occur. Health care providers should be aware that pediatric exposures to sublingual Suboxone® film can cause rapid CNS depression, requiring repetitive naloxone. Transport via 911 should be arranged to expedite immediate assessment and treatment. Community education regarding the dangers of Suboxone® film and safe storage is paramount.
Keywords: Overdose, Pediatric, Suboxone® film

91. QT risk demonstrated from oxycodone overdose, not CERT classification

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Objective: With nearly 100 deaths per day since 2007, the US is currently experiencing its worst drug overdose epidemic of all time. Drug-induced QT prolongation, a reliable surrogate for fatal dysrhythmias, occurs when the myocardial current is altered via drug interference with potassium rectifier channels. The Arizona Center for Education and Research on Therapeutics (CERT) maintains a list of drugs with high QT risk; however the utility of this list for drug overdose decision-making remains unclear. We aimed to evaluate the association between drug type, CERT classification, and QT prolongation for patients with acute drug overdose.
Methods: In a cross sectional observational study at two urban teaching hospitals, we evaluated consecutive adult ED patients presenting with acute drug overdose over a two year period. Standard demographic, racial, and clinical variables (vitals, toxicology, chemistries) were collected. QTc measurement was based on the initial ECG computer generated QTc (Bazett), the cutoff of QT prolongation was defined as 460 (men) or 470 (women). Bivariate associations with QT prolongation were according to the following drug-related criteria: (1) drug class or mechanism of action, (2) specific CERT drugs, and (3) all CERT listed drugs. Sample size was determined a priori, assuming 20% factor prevalence and a 10% rate of QT prolongation, we calculated the need to analyze at least 466 patients for 80% power.
Results: In 472 patients analyzed (46% female, mean age 42.3), QT prolongation occurred in 12.7% and the most common drug classes in descending order were opioids (21.6%), benzodiazepines (20.3%), and sympathomimetics (16.7%); CERT drugs were involved in 27.8%. Opioid drug class (OR 2.01, CI 1.1–0.94), oxycodone (OR 2.58, CI 1.01–6.8), and multidrug exposures involving methadone (OR 2.8, CI 1.2–6.6) were significantly associated with QT prolongation, while CERT classification was not (OR 1.03, CI 0.56–1.89).
Conclusion: In this large urban study of acute overdoses, we found significant drug-induced QT prolongation from oxycodone, methadone, and opioid drugs as a class. CERT classification showed no increase in QT risk. Clinicians should consider ECG screening and inpatient telemetry monitoring for patients with clinically-severe oxycodone overdose.
Keywords: Electrocardiogram, Opioid, Overdose

92. Analysis of overdose deaths involving methadone.

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Introduction: Opioid-related deaths, primarily methadone and oxycodone, are currently the most common cause of unintentional drug overdose death in the United States. In recent years, Torsade de Pointes (TdP), has been implicated in methadone-related deaths. The putative mechanism for TdP is prolongation of the QT interval. Methadone and many other drugs prolong the QT interval and increase the risk of TdP. An examination of all deaths reported by the Office of the Medical Examiner (OCME) was conducted to determine the frequency of co-occurrence of QT prolonging drugs along with methadone in post mortem examinations.
Methods: Retrospective analysis of consecutive deaths reported by a state-wide OCME to a poison center and incorporated into the poison center database as exposures with medial outcome "indirect death". QT-prolongation drugs were identified by using the drug list at www.azcert.org and literature review in PubMed. Inclusion criteria: deaths where methadone was substance #1 or substance #2 in the hierarchy of substances and where methadone was undoubtedly responsible, possibly responsible or contributory to the death. Exclusion criteria: deaths in persons under the age of 12 years and deaths where methadone was not responsible.
Results: Over the 17-month study period, 1058 OCME cases were reported to the poison center. Of these, 192 cases met the inclusion criteria, 13 met the exclusion criteria, leaving 179 cases for analysis. The median age was 42 years (range 17–66 years) and 59% were male. The mean number of substances detected post-mortem was 3 (range 1–9 substances). Of the 179 cases analyzed, 93.3% had at least one other substance detected along with methadone and only 12 (6.7%) cases were single substance methadone. The presence of other drugs detected in the post mortem examination and their frequency. The two most commonly co-detected drug classes were benzodiazepines in 45.8% and other opioids in 30.2% of cases. Methadone and one QT-prolonging drug were co-detected in 82 (45.8%) cases. Almost all of the co-detected drugs were prescription medications and promethazine was the most common. Methadone and two or more QT-prolonging drugs were detected in 11 (6%) cases.
Conclusion: In this retrospective analysis of consecutive post mortem examinations, the frequency of detection of other drugs besides methadone was 93%. The co-detection of methadone and at least one other QT-prolonging drug was 45.8%. These findings illustrate how common co-exposures are in this patient population but should not be interpreted to mean that these patients died of TdP or arrhythmias. Further research into the root causes is warranted and efforts to curb opioid deaths should consider the problem of multi-drug exposures.
Keywords: Methadone, Death, QT-prolongation drugs

93. Three autopsy cases with antemortem and postmortem blood fentanyl measurements

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Background: Fentanyl is a potent opioid analgesic available as a transdermal formulation for the management of severe chronic pain. When deaths of patients receiving fentanyl are investigated, postmortem blood fentanyl concentrations are often measured. While these measurements may be analytically reliable, proper interpretation of the measured results may be difficult. The relationship between antemortem and postmortem blood concentrations is not often established as it is unusual for antemortem drug concentrations to also be available in autopsy cases. Three autopsy cases in

Table. Data for abstract number 93.

Case Number (Age/Gender)	Patches on Body	Antemortem Fentanyl Concentration (ng/mL)	Postmortem Fentanyl Concentration (ng/mL)[a]	Delta Time (AM[b]Blood Draw to Death) (hrs:min)	Delta Time (Death to PM[b] Blood Draw) (hrs:min)
1 (45/F)	3 × 100 mcg/hr	2.4	13 (HB) 17 (FB) 9.0 (VH)	10:43	29:48
2 (30/F)	2 × 100 mcg/hr	9.0	21 (FB) 13 (VH)	00:52	~14:00
3 (46/F)	100 mcg/hr (by Rx history– no patches on body)	12	22 (HB)	15:02	25:20

[a]HB = Heart Blood; FB = Femoral Blood; VH = Vitreous Humor. [b]AM = Antemortem; PM = Postmortem

which antemortem and postmortem fentanyl concentrations were measured were located from medical investigator records using a computer query.

Case Reports: See Table.

Case discussion: All three cases involve adult females who received fentanyl from transdermal patches. In every case, postmortem blood fentanyl concentrations exceeded those measured in antemortem samples. No correlation existed between fentanyl dose, antemortem fentanyl concentration, or postmortem interval and postmortem blood fentanyl concentration. In the single case in which both heart and femoral blood fentanyl concentrations were measured, the femoral concentration was higher.

Conclusion: Consistent with postmortem redistribution theory, which will be discussed, these three cases illustrate that the measured postmortem blood fentanyl concentrations were not predictive of antemortem blood fentanyl concentrations. As such, attempts to use standard pharmacokinetic calculations, or to estimate exposure dose from postmortem blood fentanyl concentrations, should be considered unreliable and be avoided. The lack of ante-/postmortem concordance demonstrates that it is not reasonable to assess antemortem transdermal fentanyl patch performance from postmortem blood fentanyl concentrations.

Keywords: Forensics, Postmortem, Opioid

94. Risk assessment of bupropion exposures and toxicities – a multi-center retrospective study

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Study Objective: To characterize the clinical effects of acute bupropion poisonings and to assess the toxic dose of this drug in a multi-center managed care hospital setting

Methods: All patients age 13 or greater with acute accidental and intentional bupropion exposures presented to nineteen Northern California Kaiser Permanente medical centers from January 2008 thru August 2012 were retrospectively reviewed.

Results: A total of 122 cases were identified and 97 cases are intentional (79.5%). Mean age was 37.3 yrs. (SD 16.9) with a range of 13–90 yrs. Doses were known in 86 patients (71%). Tachycardia was observed in 77 patients (63%); agitation 48 (39%); nausea/vomiting 46 (38%); QTc prolongation 45 (20%, QTc > 450ms); sedation 41 (34%); altered mental status 36 (30%); dizziness 26 (21%); seizure 19 (15%); hallucination 18 (15%), headache 7 (6%), blurry vision 4 (3%), hypotension 4 (3%), chest pain 2 (2%). There were 2 deaths in the study. Assessing doses with onset of seizures, patients with doses > 1350 mg are at an increase risk of seizures ($p = 0.004$; OR 12.29, 95% CI 1.52–99). In Comparison of seizure with range of tachycardia, seizure is most likely to occur in patients with heart rate (HR) > 150 bpm as oppose to HR < 150 bpm ($p = 0.001$; OR 10.86, 95% CI 2.18–53.95). The median duration of tachycardia in patients with seizures is 11.1 hours (hrs) comparing to patients without seizures (3 hrs; $p = 0.003$). Assessing doses against QTc prolongation, patients with doses > 3000 mg are at an increase risk in prolonged QTc ($p = 0.013$; OR 3.38, 95% CI 1.26–9.02)

Conclusions: Acute bupropion poisonings most commonly result in tachycardia, agitations, and nausea/vomiting. Other commonly observed cardiac toxicity include prolonged QTc especially with doses above 3000 mg. Onset of seizures is most likely to occur with doses above 1350 mg or when HR is above 150 bpm. Long period of tachycardia also predicts likelihood of seizures.

Keywords: bupropion, Overdose, toxicity

95. A randomized, multicenter trial of crotaline polyvalent immune fab (ovine) for the treatment of rattlesnake envenomation in dogs

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Objective: To determine clinical efficacy of CroFab® (Crotaline polyvalent immune Fab (ovine); BTG International Inc., West Conshohocken, PA) against progressive crotaline envenomation in the dog as reflected in stabilization or improvement of snakebite severity scores (SSS). Additionally, due to the potential decreased half-life of the Fab antibodies in dogs, we compared SSS between dogs receiving 2 different dosing regimens.

Methods: This was a prospective clinical trial conducted at 5 veterinary emergency and critical care sites. A total of 115 client-owned Crotalid (rattlesnake) bitten dogs in whom worsening of the envenomation syndrome was observed before antivenom was administered were enrolled. A single dose (1 vial) of antivenom alone was compared with 2 doses (1/2 vial each) administered 6 hours apart. Standard supportive care was provided in all cases.

Results: Data were available for 115 patients, 9 of which were fatalities. All patients' clinical condition was documented with a standardized SSS system accounting for each major body system. Each fatality received maximum severity scores of 20. The mean severity score of the 115 patients decreased from 4.19 to 3.29 points and there was no difference between the 2 treatment groups. The mean severity score of the 107 patients without fatalities decreased from 4.16 to 2.15. Antivenom-related acute reactions occurred in 6 dogs (6%), and no serum sickness occurred within the 95 cases contacted at the 2-week post-treatment follow-up.
Conclusion(s)/Discussion: In the first randomized trial in dogs of antivenom in the United States, treatment with antivenom effectively stabilized or terminated venom effects. There were no statistical differences detected between treatment groups within the study time frame.
Keywords: Snake bite, Antivenom, Venom

96. Is manual ventilation safe and effective in Indian common krait envenomation?

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Background: Indian common krait is the commonest cause of neuroparalytic sneak bite at our institute. In this study, we looked at the safety and efficacy of manual ventilation (using AMBU bag) and compared it to mechanical ventilators in Krait envenomation.
Methods: The prospective cohort study was conducted in the emergency medicine department of our hospital. All the patients presenting with neuroparalysis without local signs and symptoms following snake bite were included in the study from January to December, 2010. All patients were electively intubated and were eligible for mechanical ventilation. the patients not receiving mechanical ventilation were manually ventilated till availability of mechanical ventilator/discharge/death. Data extracted included demographic details like age, sex, the time of snake bite, site of bite, symptoms and signs, type and duration of ventilation, duration of hospital stay, duration of ventilation, duration of intubation and final outcome. Data was presented as numbers, percentages, mean ± SD and median (IQR). Logistic regression and univariate analysis were used to predict the effect of various confounding factors on the outcome and duration of hospital stay, respectively. P value < 0.05 was considered statistically significant.
Results: 69 patients presented with neuroparalytic snake bite during this period. 78.3% victims were males. Mean age was 29 ± 3.5years (age range 19–58 years). More than half of the patients were from urban background, illiterate and were labourers. 85% were bitten during 8pm till 8 am. 68% patients were bitten between 2am till 8 am and 17% were bitten between 8 pm and 2 am. The most common site of bite was upper limb (32%) followed by lower limb (29%). Out of 69 patients, 90% required ventilation. 39% were manually ventilated by AMBU bag, 50% were mechanically ventilated with 37% mechanical ventilated within 12 hours of admission and 13% mechanically ventilated after an initial period of >24 hours of bag ventilation. Over all mortality was 8.7% with 88.4% patients improving, 2 patients did not complete treatment left against medical advise. 7.4% (2/27) patients died in manual ventilation group while 8.5% (3/35) mechanically ventilated patients died ($p = 0.076$). Ventilator associated pneumonia and pneumothorax were associated exclusively with mechanical ventilation.
Conclusion: Manual ventilation was as safe and as effective as mechanical ventilation in victims of krait envenomation presenting with neuroparalysis.
Keywords: Snake bite, Envenomation, Neurotoxicity

97. Case report: CroFab vs Antivipmyn TRI for suspected Bothrops snakebite

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Background: Exotic snakebite is rare in British Columbia, and access to antivenoms other than CroFab is limited. We report a patient bitten by a snake while in Costa Rica who developed coagulopathy, local edema, and renal failure. Treatment with CroFab had little effect, but treatment with Antivipmyn TRI resulted in rapid reversal of coagulopathy.
Case report: A 61-y/o man presented with a history of "fire ant" bites, 2 days after being bitten on the foot in the dark while vacationing in Costa Rica. The patient was seen at a local clinic in Costa Rica the day after the bite, but it is unclear why appropriate treatment was not given at the time. On presentation he had a necrotic area on his foot and epistaxis; initial PT >100 seconds

Table. Data for abstract number 97.

Date/Time	INR	PTT (s)	Fibrinogen	Platelets	Hemoglobin
19/3 02:44	>9	111		228	83
06:22			FFP		
11:00	>9	>140	<0.2	104	77
11:57		FFP, 20 units cryoprecipitate; more cryoprecipitate @ 13:50			
14:25	>9	75		CroFab @ 14:25 to 15:25	
17:30	>9	>140	<0.6	73	
20:20		10 vials Antivipmyn TRI @ 20:20 to 21:30, then 1 vial q1h ×3			
21:38	2.9	70	<0.6	86	70
20/3 00:42	1.3	37	<0.6	80	
02:40			Cryoprecipitate		
08:00	1.1	29	2.6	85	

(INR > 9); creatinine 788 umol/L. Past medical history included some renal impairment due to chemotherapy. Snake bite was suspected; although the snake was not seen, the clinical picture was consistent with *Bothrops spp*. envenomation. INR remained > 9 despite fresh frozen plasma, Octaplex and cryoprecipitate; the patient was oozing blood from line insertions and in his tears; adrenal gland hemorrhage was suspected. Intracompartmental pressures were not measured due to the severe coagulopathy. Neurological status remained normal. 6 vials of CroFab were given while arrangements were made to obtain Antivipmyn TRI from Woodland Park Zoo in Seattle. INR remained > 9 despite CroFab. Ten vials of Antivipmyn TRI were administered over 1 hour, with rapid decrease in INR to 2.9. Fourteen vials were given in total. INR normalised and remained stable over the following 2 days. Leg swelling persisted but did not require intervention, and the patient still required intermittent dialysis on discharge on day 15.

Discussion: The old Wyeth Crotalidae Polyvalent antivenom (discontinued) has been recommended for bites by other species including *Bothrops*, but experience with CroFab is limited. In this case CroFab had no discernible benefit on coagulopathy, whereas the specific antivenom, Antivipmyn TRI, led to rapid improvement in coagulation.

Conclusions: CroFab did not improve coagulopathy from Central American snake bite, but Antivipmyn TRI worked.

Acknowledgements: We wish to thank our colleagues at Rocky Mountain Poison and Drug Center, Harborview Medical Centre and Woodland Park Zoo, and BC Air Ambulance for their assistance.

Keywords: Snake bite, CroFab, Bothrops

98. Retrospective review of delayed hypersensitivity reactions after crotalid envenomation

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Background: Known side effects of Crotalidae Polyvalent Immune Fab therapy are immediate hypersensitivity reactions and serum sickness; both of which are believed to be rare and carry low morbidity. However, studies exploring the incidence of these are lacking in follow up time and power. Additionally, these same allergic reactions have been reported from venom exposures, confounding the incidence estimates. The purpose of this study was to explore the incidence of these reactions in a crotalid evenomated human population.

Methods: Retrospective review of one Poison Center's indigenous crotalid cases from 4/1/12–10/31/12. Review utilized case notes and call recordings with additional case validation by hospital record when available. Data abstracted included number of vials of antivenom administered, limb swelling severity, presence of immediate and delayed hypersensitivity reactions as well as the incidence of surgical complications.

Results: There were 512 cases, with 57.8% being male. 83% of cases were able to be followed; the average follow up time was 14.8 days. Copperheads made up the majority of cases (77.7%), with unknown crotalid being the second most common type of snake (19.6%). An immediate hypersensitivity reaction attributed to venom was noted in 6.7% of all cases. An immediate hypersensitivity reaction attributed to the antivenom was noted in 10.4% of cases but in 91% of those cases, the antivenom was able to be restarted. The average number of antivenom vials administered was 5.3. There were four dermotomies reported during that time. A delayed hypersensitivity reaction was noted in 5.3% of cases; with an 8% rate with in the antivenom group compared to the 3% in untreated patients ($p = 0.03$).

Conclusions: Hypersensitivity reactions to crotalid antivenom remain rare, and only result in a delay in therapy the vast majority of the time. The difference in delayed hypersensitivity between treated and untreated was only 5%, suggesting the absolute increase in serum sickness like illness from antivenom is very small.

Keywords: Snake bite, Antivenom, Adverse drug event

99. Fasciotomy and rattlesnake evenomations: characteristics of a statewide poison control center's experience

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Background: North American rattlesnake envenomations can lead to significant local tissue swelling and pain. These symptoms can mimic compartment syndrome and fasciotomies are sometimes preformed. There is a paucity of literature detailing the clinical characteristics of these cases. We sought to describe a state wide poison center's experience with fasciotomies and rattlesnake envenomations.

Methods: We performed a retrospective review of a statewide poison system's database from January 2001 to May 2012 for all cases of rattlesnake envenomations which had documentation of fasciotomy being considered or performed. Data collected include age, sex, bite site, antivenom given and amount, compartment pressure results, and length of hospitalization. Cases where it was not possible to determine whether or not antivenom had been given were removed. Data was then analyzed with a Chi-square test to evaluate for statistically significant difference between those who a fasciotomy was considered and not done and those who had a fasciotomy preformed.

Results: Ninety-nine cases were identified. One case was removed because it was not possible to determine if antivenom had been administered. There were 28 (28%) cases where a fasciotomy was performed. Of these patients, 22 (79%) were male with an average age of 34 years (range 16–70). Nineteen (68%) were bitten on an upper extremity. They received an average of 19.5 (SD 11.3) vials of antivenom. Fourteen (50%) received antivenom after the fasciotomy. Compartment pressures were documented in only 2 (7%) cases. They were elevated in both cases (30 mmHg and 70 mmHg) The average length of stay was 6.15 days (SD 2.78). Compared to the 71 (72%) cases for which fasciotomy was discussed but not preformed, there was no statistical difference in age, sex, bite site or amount of antivenom given. There was a statistically significant difference in length of stay (3.45 days vs. 6.15 days).

Conclusion: Fasciotomies are rarely performed in case of rattlesnake envenomations reported to a state-wide poison control center. Compared to cases where a fasciotomy is discussed but not preformed, the only statistically significant difference seen was an increased length of hospital stay for those receiving fasciotomy. Further prospective studies are warranted to determine characteristics which might predict which patient's receive fasciotomy and their outcomes.
Keywords: Snake bite, Envenomation, Poison center

100. Prevalence and characteristics of hypofibrinogenemia after North American rattlesnake envenomations reported to a statewide poison control system

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Background: North American rattlesnake envenomations are known to cause hypofibrinogenemia. There is limited medical literature concerning its prevalence and associated characteristics. We sought to identify prevalence and characteristic of hypofibrinogenemia after North American rattlesnake envenomations reported to a statewide poison control system.
Methods: We performed a retrospective review of a statewide poison system's database for all cases of rattlesnake envenomation from January 2000 until December 2009 in which deleterious hematologic effects (thrombocytopenia, hypofibrinogenemia, coagulopathy) were either coded and/or described in free text area. Data collected included gender, age, bite location, administration of antivenom, platelet count, fibrinogen levels, and INR. For this study, hypofibrinogemia was defined as fibrinogen of less than 100 mg/dL.
Results: There were 159 cases meeting inclusion criteria. Of those cases, 25 (16%) had hypofibrinogenemia reported at some point in the patient's clinical course. Hypofibrinogenemia was present on the initial lab evaluation in 12 (48%) of those cases. The average age was 39 years (range 13–83) and 23 (92%) were male. A majority were bitten on the hand or upper extremity (71%, n = 17). All of patients (100% n = 25) received Crotalidae polyvalent immune fab (ovine) antivenom with one patient also receiving Crotalidae polyvalent (equine) antivenom. An average of 22 vials of antivenom (range 4–58) was given. All 25 (100%) cases had thrombocytopenia (platelet count of less than $100 \times 103/\mu L$) reported during their clinical course. Thirteen (50%) had an INR of greater than 1.5 reported during their care. Four (16%) received cryoprecipitate.
Conclusion: Hypofibrinogenemia after North America rattlesnake envenomations was infrequently reported in this retrospective review of a statewide poison control system. When present it was associated with male sex, antivenom use, and thrombocytopenia.
Keywords: Envenomation, Snake bite, Poison center

101. Epidemiology of the Reported Severity of Cottonmouth Snakebite

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Objective: The goal of this study was to analyze trends in the annual rates of reported medical outcomes of US cottonmouth (Agkistrodon piscivorus) snakebites published in the annual reports of the American Association of Poison Control Centers over the course of 29 years.
Methods: This was a retrospective analysis of medical outcomes for cottonmouth snakebite victims who developed fatal, major, moderate, minor, or no effects. The annual rates for these medical outcomes were calculated by dividing the annual number of patients in each outcome category by the total annual number of people reported as being bitten by cottonmouths per year. Negative binomial regression was used to examine trends in annual rates.
Results: From 1985 through 2011, after controlling for the availability of CroFab, the annual incidence rate of cottonmouth snakebites causing no effect significantly decreased by 7.3%/year (incidence rate ratio [IRR] 0.927; 95% confidence interval [CI] 0.885–0.970], the incidence rate of minor outcomes did not significantly change (IRR 0.989; CI 0.974–1.006), the rate of moderate outcomes significantly increased by 2.3%/year (IRR 1.023; CI 1.004–1.042), and the rate of major outcomes did not significantly change (IRR 0.987; CI 0.935–1.041). One fatality was reported in 2011.
Conclusions: Over 29 years, annual rates of cottonmouth snakebites producing no effects significantly decreased, those producing minor outcomes did not change significantly, those producing moderate outcomes significantly increased, and those producing major outcomes did not change significantly, after controlling for the availability of CroFab.
Keywords: Snake bite, Envenomation, Epidemiology

102. Characterization of snake bites in Vietnam

Kiem X. Trinh

Background: For centuries, there have been of snake bite patients with an associated high morbidity and mortality, particularly in tropical countries such as Vietnam. There are 30,000 cases of snake bites in the country anually. However, this medical problem had been neglecte. Most snake bite victims were treated by non specific methods. So that, the mortality was very high (19.8%), permanent deformity (14%), amputation (11%). Since 1991, the venomous snakes and snake bite management have been opened with
Objective: Making AV for clinical treatment in Vietnam.
Materials & Methods: Snakes were identified and studied on geography and epidemiology to make antigens. Horses were immunized to make antibodies. Techniques for production and standardization of $F(ab')_2$ AV of Christensen P.A (1979) and Theakston

A.D.G, Warrell D.A (2003), WHO Guidelines for the production, control and regulation of F(ab')$_2$ AV immunoglobulines (2008). 3,000 cases of snake bite patients admitted to Choray and Bachmai hospitals were treated by specific AV.

Results: Two main families of venomous snakes of medical importance in Vietnam were identified, comprised 10 species. *Elapidae: Naja kaouthia* in the South West, *Naja atra* in the North, *Naja siamensis* in South East, *Ophiophagus hannah* (black & yellow), *Bungarus fasciatus*. *Bungarus candidus* in the South, *Bungarus multicinctus* and*Hydrophidae* in Phan Tiet, Vietnam (Middle sea). *Viperidae: Trimeresurus albolabris and Calloselasma rhodostoma* in the South. Five types of F(ab')$_2$ AV have been produced: *Naja (kouthia+ atra*) AV, *Ophiophagus hannah* AV, *Bungarus (candidus+ multicinctus) AV, Trimeresurus albolabris* AV, *Calloselasma rhodostoma* AV. More than 3,000 snake bite patients were treated by AV to give a good response. Comparative study with group counterpart, but not AV available for treatment before: The mortality was reduced from 19.8% to 1.5%, the mean time for recovering completely from 45 days to 3 days, permanent deformity from 14% to 5%, amputation from 11% to 1%. AV reactions was limitted lowly: anaphylactic shock (2.3%), pyrogenic reaction (15.2%), serum sickness was (1%).

Conclusion: There are ten main species belong to two families of venomous snakes of medical importance. Five types of F(ab')$_2$ AV were produced and zero therapy have been reopened for over 3,000 snake bite patients safely and effectively in Vietnam.

Keywords: Antivenom, Antidote, Anticholinergic

103. Comparing poison center data and syndrome surveillance for snake bites

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Objective: To explore snake bite frequency and geographic distribution in a Midwest state using two different surveillance systems.

Background: Some health care providers routinely request help from a PC regarding snake envenomations due to the unpredictability and complexity of prognosis and treatment, but other providers don't consult the PC. Because calling a PC is voluntary for health care providers, PC data is most likely an underestimation of the true frequency of snake envenomations. PCs typically have little opportunity to learn more about cases for which they are not consulted. In this state, the Department of Health maintains a syndromic surveillance system (ESSENCE) that captures chief complaints in emergency departments (ED). Eighty four different EDs are enrolled and account for approximately 90% of all ED visits statewide. Comparing PC and ESSENCE data for snake envenomations would enable the center to have a more accurate depiction of snake bite frequency in the state and to see where future outreach of center awareness should be focused.

Methods: Archived data from the PC surveillance system (Toxicall™) was queried for the total number of snake bite cases from 01/01/2007 until 12/31/2011. Only cases from the hospitals which also participate in ESSENCE were included. Next, ESSENCE data was used to estimate the total number of snake envenomations presenting to the EDs over this same time period. This was accomplished by searching for key terms in the chief complaints that would signify a snake bite. The results of each data search were compared and contrasted by geographic regions of the state.

Results: The Toxicall™ search showed a total of 324 snake bite cases. The initial ESSENCE data query showed a total of 1,983 snake bite cases. After certain data exclusions, there were a total of 1,763 ESSENCE snake bite visits. This suggests that approximately 18% of all snake bite visits reported in the state ESSENCE were called into the PC. The results show that the greater number of ESSENCE visits for snake bites were reported by the Southwest region hospitals, whereas the greater number of calls to the PC regarding snake bites were placed from the Eastern region hospitals.

Conclusions: The total number of snake bite cases from the regional ESSENCE ED visits is much greater than the number of snake bites cases called into the PC by ESSENCE-participating hospitals. In addition, the two surveillance systems produced different pictures of the geographic epidemiology of snake bites in the state. The overall underutilization of the poison center, especially in regions of higher incidence of snake bites presenting to EDs, demonstrates a service gap that may merit targeted professional education and outreach.

Keywords: Surveillance, Snake bite, Public health

104. Coping with a critical antivenom shortage

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Background: Antivenom treatment for coral snake envenomations has been standard therapy since the 1960's. It has prevented death and extended ICU stays. The eastern coral snake (Micrurus fulvius) has a limited range. Bites primarily occur in the peninsula of Florida, and account for approximately half of coral bites in the US each year. However, the state has faced a growing shortage of antivenom since 2008. Some patients have experienced delays in receiving it, resulting in the need for prolonged mechanical ventilation. Wyeth Pharmaceuticals discontinued manufacturing of North American Coral Snake Antivenin® in 2003. All remaining product was to expire October 31, 2008. The expiration date for vials of lot 4030026 has been repeatedly extended, but the supply of that lot is nearing exhaustion. Manufacturing by Wyeth (Pfizer) resumed in 2011, but supplies are not yet available. In April 2013, Pfizer obtained FDA approval for reintroducing a second lot of previously expired antivenom. The effect of that reintroduction is yet to be determined.

Methods: Florida Poison Information Center-Florida monitors the supply using focused phone surveys of hospital pharmacies, allowing the ability to provide information to facilities most involved in maintaining the supply. The toxicologists request to speak with the attending physicians to ensure that critical information about management are given at the time it is needed so that antivenom is timely but not used needlessly. The center continues to work toward toward securing a reliable supply of antivenom. The dedicated webpage is maintained and updated as needed. Contact with

the manufacturer was maintained so that important information could be shared. The planned study was postponed due to venom supply problems, but enrollment is anticipated once antivenom is obtained.

Results: A total of 47 coral snake bites were reported in the state in 2012. Currently, there are more vials of the lot #4030026 located in hospital pharmacies in FPICT region than in the warehouse. The reintroduction of lot #4030024 will alter the availability of antivenom at least temporarily, but a permanent solution is still needed. Frequent communications with health care pharmacies has promoted maintenance of a regionally adequate supply of this resource.

Conclusion: FPICT continues to work actively to address a significant regional shortage of an orphan drug. Some resources of the center have been dedicated to maximizing the supply of this antivenom. This is not needed in the majority of the US, but is important for Floridians, who are uniquely at risk. This crisis illustrates the value of a regional poison center to address a regional issue.

Keywords: Antivenom, Poison center, Snake bite

105. Antiplatelet antibody assays in rattlesnake bite victims

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Background: Thrombocytopenia commonly occurs early following rattlesnake bite (RSB) and, in Arizona, usually promptly responds to IV Crotalidae polyvalent immune Fab ovine (Fab AV; CroFab®). Recurrence or delayed onset (late) thrombocytopenia does not always respond well to additional AV Fab, suggesting that an immune mechanism might explain late thrombocytopenia.

Objective: To understand how antiplatelet antibody assays might be influenced by snake envenomation before attempting to use such assays in examining mechanisms of thrombocytopenia in RSB victims.

Methods: Serial blood samples from 6 RSB victims were examined using two assays: 1) platelet-bound IgG/IgM/IgA autoantibodies specific for various platelet glycoproteins using ELISA methodology, and 2) platelet-bound non-specific antiplatelet IgG antibodies using red cell agglutination. Normal blood from 4 healthy adults spiked with AV Fab to achieve peak concentrations seen with 12 vials of antivenom were also studied.

Results: No positive antiplatelet antibodies were detected in the 4 blood samples from healthy adults or in normal blood spiked with AV Fab. Four of 5 envenomated patients who had already received first doses of AV Fab, (details in Table) exhibited positive antibody assays to various glycoproteins on admission, and these assays became negative within one week of envenomation; nadir platelet counts ranged from 20 to 218 K/microL. None of the 5 envenomated patients' blood samples produced a positive non-specific antiplatelet IgG antibody assay by red cell agglutination. One non-envenomated patient that received AV Fab had negative results for all antiplatelet antibody studies.

Discussion: The formation of antiplatelet glycoprotein antibodies within a short time of rattlesnake envenomation and rapid antibody disappearance within a few days is not compatible with the time course for immunoglobulin formation and clearance, and suggests interference of the ELISA assay by circulating snake venom components. The lack of positive assays using normal blood spiked with AV Fab suggests that AV Fab is not the cause of the interference, though an interaction between AV Fab and venom components cannot be excluded.

Conclusion: False positive assays for platelet antiglycoprotein antibodies using an ELISA methodology are common in rattlesnake bite victims and must be taken into consideration when interpreting diagnostic studies pertaining to causes of thrombocytopenia.

Keywords: Rattlesnake, Snake bite, Laboratory

106. Immune thrombocytopenia (ITP) following crotaline envenomation

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Background: Thrombocytopenia (TCP) following rattlesnake envenomation (RSE) is common, and delayed recurrent coagulopathy and/or TCP following treatment with Crotalidae Polyvalent Immune Fab (AV) is well reported and typically occurs 2–7 days following AV therapy. Multiple mechanisms of crotaline-induced TCP are postulated but a single pathogenesis has not been identified. We report a case of profound immune-mediated TCP 30 days after being treated with AV for RSE.

Case report: A healthy 22 YO woman was bitten on the left foot by a rattlesnake. She received 6 vials of AV at a local hospital before transfer to a tertiary care center. She was observed 48 hours without progression. Hgb was stable, platelet count (PLT) 277 to 280 k/mm^3, and fibrinogen (FIB) was normal. She received no further AV and was discharged.

Thirty-three days post-RSE, the patient presented to a local health center complaining of easy bruising. PLT was unable to be performed and the patient was transferred to the same tertiary center. On arrival, she complained of fatigue but no active bleeding. She denied the use of any medications, supplements, or quinine products. Vital signs were normal. She had petechiae to the torso and both legs. Hgb was 9.8 g/dL, PT 14.2 s, FIB 291 mg/dL, and PLT $<$ 1 k/mm^3. She received 2 vials of AV and 2 single donor units (SDU) of platelets. Post-transfusion, PLT fell from 54 to 34 k/mm^3; coags and DIC panel were normal. She started prednisone 1 mg/kg/day without effect. She was given 1 g methylprednisolone IV and PLT fell to 13 k/mm3. She received 1 SDU of platelets and 1 g/kg IVIG; prednisone was continued. PLT rose to 112 k/mm^3 and stabilized [table 2]. She was discharged on a prednisone taper. Antibodies against platelet glycoprotein IIb/IIIa were detected in blood drawn at re-admission, 33 days post-bite.

Discussion: ITP is defined by PLT $<$ 100 k/mm^3 in the absence of other causes. Our patient met the definition of ITP. She had typical delayed thrombocytopenia after AV treatment that resolved at 15 days post-RSE. When she re-presented, she was 33 days post-envenomation, longer than delayed hematologic effects of venom are reported. She failed a trial of AV and had positive platelet glycoprotein antibodies at admission, consistent with the humoral immune response that characterizes ITP. The temporal association of ITP and the patient's RSE suggests sensitization to venom or AV might have contributed to the patient's immune response.

Conclusion: Autoantibody positive ITP developed in temporal association with crotaline envenomation and AV therapy. ITP has been reported following many different illnesses. Further study is needed to better characterize this phenomenon and its incidence in snakebite patients.
Keywords: Envenomation, Rattlesnake, Antivenom

107. Dermatonecrosis following kukulcania hibernalis (southern house spider) bite

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Background: *Kukulcania hibernalis*, the Southern House Spider, is endemic to the southern U.S. This species resembles*Loxosceles reclusa* and is frequently mistaken for the Brown Recluse. Little is known about the effects of its bites on humans. We describe and illustrate photographically a case of dermatonecrosis following a witnessed bite by this species with positive identification by an entomologist.
Case report: A 35 YO man presented 16 hrs after a spider bite to the right anterior neck. He swatted the spider and collected it [fig. 1]. Initially, pain and local redness was noted. Overnight, he developed progression of the lesion and presented to a clinic. He received ceftriaxone IM, and was prescribed ibuprofen, diphenhydramine, and sulfamethoxazole/trimethoprim, which he did not take. Due to odynophagia, he sought evaluation in the ED. He denied systemic symptoms, dysphagia, prior similar wounds, or allergies. Toxicology was consulted for "possible Brown Recluse bite".
Exam revealed normal vital signs and a 5×12 cm violaceous plaque, with partially confluent vesicles weeping serous fluid, ofthe right anterior neck. The lesion was warm; surrounding skin was normal. There was tenderness but no crepitance, purulence, or lymphadenopathy. Evaluation of the spider, which accompanied the patient, confirmed that it was *not L. reclusa*. He was given wound care and follow-up instructions, tetanus vaccination, and discharged with no antibiotics.

The spider was sent to a state university and identified by an entomologist as *Kukulcania hibernalis.* Photographs of the wound over the next 6 days were reviewed. On post-bite day 7, re-evaluation of the lesion revealed near-complete resolution.
Discussion: Spider bites are rare, yet "Brown Recluse bites" are frequently considered in non-endemic areas or with inconsistent clinical findings, perhaps due to the species' notoriety. *K. hibernalis* is often mistaken for the Brown Recluse but there are no reports in the literature about the effects of its bites. We describe the first reported case of epidermal necrosis following *K. hibernalis* bite. The witnessed bite, the available specimen, and its positive identification lend support to the case. This pt. recovered uneventfully with wound care alone, in accordance with current evidence regarding treatment of other necrotic spider bites.
Conclusion: The Southern House Spider (*K. hibernalis)* closely resembles and is often mistaken for the Brown Recluse. This case confirms *K. hibernalis* bite resulted in a dermatonecrotic wound. Conservative treatment with routine wound management and without antibiotics resulted in an excellent clinical outcome.
Keywords: Dermal toxicity, Envenomation, Spider bite

108. Serious spider bite? at least that's what the internet says

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Background: In Greek, Poecilotheria is translated as "Spotted Wild Beast". The Fringed Ornamental Tarantula (Poecilotheria ornate) is a large tarantula species native to Sri Lanka and India. Many claims of "coma" and significant morbidity from envenomation can be found on the World Wide Web that are not substantiated in medical literature. In fact, a paucity of data exists in the medical literature regarding envenomation by this species. We report a case of envenomation by Poecilotheria ornate.
Case report: A 53-year-old woman was envenomated by her daughter's pet Fringed Ornamental Tarantula on the tip of her finger on her right hand. She called the poison center 15 minutes after the event. The pain was described as intense immediately after envenomation, but had lessened to a "4 out of 10" on a pain scale by the time poison control was contacted. Her affected finger was also noted to be reddened, slightly swollen, and tingling. She reported no systemic effects. She was referred to the nearest emergency department (ED) by poison center staff. Treatment included tetanus update and general wound care; again no systemic effects were noted by ED personnel. She was discharged to home after a few hours of observation. Poison control followed up with the patient the following day. The patient reported resolution of pain, redness, swelling, and tingling, but had some arthralgia in the knuckle proximal to the envenomation site. One week post-envenomation, the patient reported full resolution of previously noted adverse effects.
Discussion: Tarantula species have varying degrees of toxicity. Most envenomations from these spiders are successfully treated with supportive care. Multiple reports of significant toxicity from Poecilotheria ornate exist on the Internet, but have not been substantiated by the existing medical literature. A review of the literature reveals one other previously reported case in 2004 where minimal effects were observed. Consideration for possible dermal and ocular effects secondary to exposure of urticaric hairs should also be part of the clinical evaluation from tarantula species.
Conclusion: We report an envenomation from a Fringed Ornamental Tarantula (Poecilotheria ornate) with short-lived local effects including pain, swelling, and redness that resulted in only mild toxicity. This case adds additional experience to a clinical scenario that is not well documented in medical literature. This case stands in contradiction to reports of serious morbidity that are prevalently described on the Internet.
Keywords: Envenomation, Spider bite, Venom

109. Baby bites spider: An unusual route of black widow spider envenomation

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Background: Black widow spiders (*Latrodectus* species) are found across the United States. Black widow venom contains alpha-latrotoxin, which causes opening of non-specific cation channels leading to an increased influx of calcium, and increased release of acetylcholine at the motor endplate. We present a case of an unusual route of pediatric exposure.
Case report: A 10-month-old male initially presented after found by mother crying unconsolably for 30 minutes; she noted a spider in his mouth which she removed and kept. On initial evaluation, the patient was extremely irritable and inconsolable, and had an episode of decreased responsiveness and respiratory depression that resolved with stimulation. His vital signs showed HR 185, RR 40, BP 107/80, and his exam showed a normal oropharynx and a rigid and diffusely tender abdomen. Labs showed WBC 22,900/mm3, serum glucose 193 mg/dL, serum bicarbonate 20 mEq/L, anion gap 20, and otherwise normal electrolytes and CBC. He received fentanyl for pain and was transferred to a pediatric emergency department, and admitted to the pediatric ICU shortly after arrival with concern for surgical abdomen such as intussusception versus black widow spider envenomation. After toxicology evaluation, the patient received treatment with black widow spider antivenin with marked clinical improvement and normalization of vital signs, and the patient was able to be discharged home within 8 hours of treatment. The spider brought by the patient's mother had an appearance consistent with *Latrodectus* species.
Case discussion: Black widow spider envenomation is associated with painful symptoms. Local signs range from mild erythema to a target lesion with a central punctate site, central blanching, and an outer erythematous ring. By 3–4 hours, painful cramping and muscle fasciculations occur in the involved extremity, which progress centripetally toward the chest, back, or abdomen, and can produce board-like rigidity, weakness, dyspnea, headache and paresthesia. This pediatric patient's unusual route of exposure, vital sign abnormalities, physical exam findings, leukocyte sis, and hyperglycemia initially caused significant concern for a possible surgical abdomen as the etiology for his symptoms. Although it was difficult to confirm envenomation by history and exam, the patient's marked improvement with antivenin and identification of the spider found in his mouth are consistent with black widow spider envenomation.
Conclusions: Black widow spider envenomation in a pediatric patient may present similarly to a surgical abdomen, and consideration of this diagnosis and treatment with antivenin may prevent excessive testing or procedures in the appropriate setting.
Keywords: Latrodectus, Black Widow Spider, Antivenin

110. Potential impact of a shortage of black widow spider (latrodectus mactans) antivenin on the management of bites

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Background: Due to a shortage of black widow spider (Latrodectus mactans) antivenin, the Food and Drug Administration extended the expiration date for one lot of antivenin provided by Merck. To determine the potential impact of the possible shortage of antivenin on the management of L. mactans bites, this study describes trends in the use of antivenin in the treatment of L. mactans bites reported to poison centers.
Methods: This retrospective study included all L. mactans bites reported to a statewide poison center system during 2000–2012. The antivenin use rate was determined for each individual medical outcome category as well as for the larger groupings of not serious outcomes (no effect, minor effect, not followed-judged nontoxic, not followed-minimal effects possible) and serious outcomes (moderate effect, major effect, unable to follow-judged potentially toxic). The antivenin use rate also was calculated for two time periods (2000–2005 and 2006–2012).
Results: Of 2,082 total L. mactans bites, antivenin use was reported in 69 (3.3%). The antivenin use rate by medical outcome was no effect (0/98, 0.0%), minor effect (16/779, 2.1%), moderate effect (39/438, 8.9%), major effect (11/38, 28.9%), not followed-judged nontoxic (0/16, 0.0%), not followed-minimal effects possible (0/512, 0.0%), unable to follow-judged potentially toxic (2/170, 1.2%), and unrelated effect (1/31, 3.2%). Of the 903 bites reported during 2000–2005, 251 (27.8%) had serious outcomes and 23 (2.5%) were treated with antivenin. Of the 1,179 bites reported during 2006–2012, 395 (33.5%) had serious outcomes and 46 (3.9%) were treated with antivenin.
Conclusion: Antivenin use was reported in only a small fraction of L. mactans bites. However, the antivenin use rate increased with the severity of the medical outcome, although even in the bites resulting in major outcomes (the most serious outcome), the majority were successfully managed without antivenin. The proportion of L. mactans bites resulting in serious outcomes were higher during 2006–2012 than during 2000–2005. It might be expected that the proportion of bites treated with antivenin also would be higher during the second part of the 13-year-period, which was what was observed. This would suggest a greater need for antivenin. In spite of this, these observations would suggest that a lack of availability of L. mactans antivenin should not negatively impact the majority of L. mactans bites managed by poison centers, even those with the most serious outcomes.
Keywords: Poison center, Antivenom, Black widow spider

111. Occupational pesticide exposures reported to poison centers

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Background: The Environmental Protection Agency estimates that annually 10,000–20,000 physician-diagnosed pesticide poisonings occur among agricultural workers. These individuals and workers in a variety of other occupations are at risk of potentially adverse pesticide exposures. The National Institute for Occupational Safety and Health and the Environmental Protection Agency conduct surveillance for occupational pesticide illness and injury through the Sentinel Event Notification System for Occupational Risk (SENSOR) program. Some, if not all, of the states that participate in the SENSOR program use poison centers as a case source. This study describes occupational pesticide exposures reported to poison centers.

Methods: This study included all pesticide exposures reported to a statewide poison center system during 2000–2011 where the exposure reason was coded as unintentional-occupational or the exposure site was coded as workplace. Exposures involving other substances in addition to pesticides and those not followed to a final medical outcome were included in this analysis because such exposures might be reported to SENSOR. The distribution of exposures was determined for selected demographic and clinical factors.
Results: Of 83,990 total pesticide exposures, 1,839 (2%) were occupational. The distribution by pesticide was insecticides (69%), herbicides (16%), repellents (6%), rodenticides (4%), fungicides (3%), fumigants (2%), and miscellaneous (1%). There was a seasonal pattern with 38% of the exposures reported during May-July and 10% reported during December-February. The rate per 100,000 population was 16.6 in rural counties and 7.3 in urban counties. The most common route of exposure was inhalation (51%), dermal (44%), ingestion (16%), and ocular (14%). Males accounted for 71% of the patients; 88% of the patients were age 20 years or more. The management site was on site (46%), patient already at or en route to a healthcare facility (39%), referred to a healthcare facility (11%), and other or unknown (3%). The medical outcome was no effect (11%), minor effect (28%), moderate effect (10%), major effect (1%), not followed-judged nontoxic (2%), not followed-minimal effects possible (29%), unable to follow-judged potentially toxic (9%), and unrelated effect (10%). The most frequently reported adverse clinical effects were nausea (10%), headache (7%), ocular irritation/pain (7%), and vomiting (7%).
Conclusion: Occupational pesticide exposures account for only a fraction of all pesticide exposures reported to poison centers. Occupational pesticide exposures were more likely to be reported during the summer and from rural areas. The patients were most often male and adult.
Keywords: Pesticide, Poison center, Occupational

112. Comparison of rural and urban pesticide exposures reported to poison centers

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Background: Potentially adverse exposures to pesticide might be expected to differ between rural and urban areas. This study compares potentially adverse pesticide exposures reported in rural and urban areas within a single state.
Methods: Cases were all pesticide exposures reported to a statewide poison center system during 2000–2011 where the caller county was known. Exposures involving other substances in additional to the pesticide and those not followed to a final medical outcome were included. Every county was classified as rural or urban based on United States Office of Management and Budget definitions of metropolitan and non-metropolitan. The exposures were grouped into those originating from rural counties and urban counties. The distribution of exposures was determined for selected factors and comparisons made between the two groups.
Results: There were 14,370 rural and 67,836 urban pesticide exposures, resulting in rates per 100,000 population of 39.9 and 27.9, respectively. The most commonly reported types of pesticide in rural counties were insecticides (49%), rodenticides (30%), repellents (13%), and herbicides (6%); the most commonly reported pesticides in urban counties were insecticides (55%), rodenticides (21%), repellents (17%), and herbicides (5%). The most common route of exposure for rural and urban cases, respectively, were ingestion (66% vs 62%), dermal (24% vs 24%), inhalation (14% vs 14%), and ocular (9% vs 11%). The patient age distribution for rural and urban cases, respectively, was 5 years or younger (61% vs 57%), 6–19 years (7% vs 8%), and 20 years or older (31% vs 34%). Males accounted for 52% of rural and 51% of urban cases. The management site for rural and urban cases, respectively, were managed on site (72% vs 79%), already at or en route to a healthcare facility (22% vs 15%), and referred to a healthcare facility (5% vs 5%). Not serious outcomes (no effect, minor effect, not followed-judged nontoxic, not followed-minimal effects possible) were reported in 89% of rural and 89% of urban cases; serious outcomes (moderate effect, major effect, death, unable to follow-potentially toxic) were reported in 6% of rural and 6% of urban cases.
Conclusion: Pesticide exposures were more common in rural than urban counties, possibly because pesticides are more likely to be used for agriculture purposes in rural areas. Although the same 4 types of pesticides were most frequently reported in rural and urban counties, their proportions differed between the areas, particularly for rodenticides. The 2 areas were similar with respect to patient demographics and outcome. Rural patients were slightly more likely to already be at or en route to a healthcare facility.
Keywords: Pesticide, Poison center, Urbanization status

113. Locating the source of public health events using intelligent adaptive systems: 2011 United States listeriosis outbreak linked to whole cantaloupes

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Background: Since 2003, Poison Center (PC) case data has been used in a variety of National Poison Data System (NPDS) volume and case-based surveillance algorithms. A major goal has been to use computerized analysis to find the index case which may be distinct from the outbreak's source. Locating the index case has remained particularly challenging. Situational awareness has been a more reliable result from analysis of NPDS surveillance data. Methods are needed that can find the outbreak source from low call volume and seemingly disparate PC cases. Topological Weighted Centroid (TWC), developed at Semeion Research Center, Rome, Italy, is a mathematical model that is an intelligent adaptive system. This method utilizes the concepts of free energy and entropy - independent of call volume to identify the source. We retrospectively applied this method to the September 2011 Listeria disease outbreak linked to cantaloupes.
Methods: NPDS was retrospectively queried for non-transferred, closed human cantaloupe exposure calls made to poison centers between 1 September and 31 December 2011. The search returned 86 closed, human exposure calls. Only the 5-digit ZIP Code and start date for each exposure were retrieved. Two calls did not have a

documented ZIP code. The remaining calls were distributed among 73 distinct ZIP codes. We analyzed these 73 ZIP codes with the TWC software.

Results: TWC identified the source within 100 kilometers of the known source (Jensen Farms, Holly, CO Latitude Longitude = 38.057215,-102.201304). Compared with the 9,826,675 square kilometers contained in the US, a 100 kilometer radius is less than 0.05% of the total US surface area.

Conclusions: Poison center call volumes continue to decrease. Our approach utilizes call location, not call volume, for an event of interest and analyzes the possible associated dynamics using the ideas of free energy and entropy. This can be done rapidly and in real-time and may be complimentary to other surveillance methods.

Keywords: Epidemiology, Poison center, Food poisoning

114. Identification of the most common controlled substances in blood of drivers involved in fatal motor vehicle crashes during 2011.

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Background: Motor vehicle crashes are a leading cause of death in the United States, resulting in 33,000 deaths per year. The Fatal Analysis Reporting System (FARS) is a database developed by the National Highway Traffic Safety Administration archiving data on vehicle crashes on public roadways leading to at least one fatality.

Methods: The FARS database was queried for motor vehicle crashes in 2011 wherein the driver of one or more of the involved vehicles had blood testing for controlled substances. The data was analyzed to identify the five most common controlled substances reported in drivers of fatal motor vehicle accidents as well as the most common combinations. All analyses were performed using SPSS version 20 (IBM, Somers, NY, USA).

Results: In 2011, 29,757 motor vehicle crashes involving 43,668 drivers were reported to FARS. Of those, 16,679 (38.2%) had blood drug test results reported. Of the drivers with blood drug test results reported, 9,689 (59.1%) had negative drug tests, 4,203 (25.2%) had one or more drugs of abuse detected in blood, and 2,607 (15.6%) had positive drug tests for "unknown" or "other" substances.

The five most common controlled substances and combinations of controlled substances present in blood of drivers involved in fatal motor vehicle accidents in 2011 are shown in Table.

Conclusions: Controlled substances are often found in the blood of drivers involved in fatal motor vehicle crashes. While the level of driver impairment cannot be determined by the detection of drugs of abuse in blood, the data we report supports directing substantial public health efforts against driving under the influence of controlled substances.

Keywords: Drug of abuse, Fatal motor vehicles crashes, Epidemiology

Table. Most Common Controlled Substances in Blood of Drivers in Fatal Accidents.

Blood Drug Test Results	Number of Drivers (% of Drivers with Controlled Substances in Blood)
Most Common Controlled Substances	
Marijuana	1515 (36.1%)
Alprazolam	434 (10.3%)
Methamphetamine	367 (8.7%)
Hydrocodone	365 (8.7%)
Cocaine	348 (8.3%)
Most Common Two-Drug Combinations	
Alprazolam/marijuana	67 (1.6%)
Alprazolam/oxycodone	67 (1.6%)
Marijuana/methamphetamine	56 (1.3%)
Alprazolam/hydrocodone	50 (1.2%)
Cocaine/marijuana	50 (1.2%)
Most Common Three-Drug Combinations	
Alprazolam/marijuana/oxycodone	8 (0.2%)
Diazepam/hydrocodone/oxycodone	6 (0.1%)
Alprazolam/diazepam/hydrocodone	4 (0.1%)
Alprazolam/hydrocodone/oxycodone	4 (0.1%)
Alprazolam/diazepam/dihydrocodeine	3 (0.1%)
Alprazolam/diazepam/meprobamate	3 (0.1%)
Alprazolam/diazepam/oxycodone	3 (0.1%)
Alprazolam/meprobamate/midazolam	3 (0.1%)

115. A case of the flu

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Background: The Centers for Disease Control and Prevention (CDC) monitors influenza-like illness (ILI) and issues weekly nationwide reports. The National Poison Data System (NPDS) tracks human medication exposures in near real-time. We sought relationships between the exposures reported for medications which might be used to treat ILI and the weekly ILI reports for Jan 2000 through Mar 2013.

Methods: We examined the changes over time for 7 NPDS medication Exposure groups and 11 CDC ILI measures by week using descriptive statistics and graphics over time; and the relation between ILI and Exposures using linear regression and ANOVA via SAS JMP 9.0.0 (SAS Institute, Carey, NC) for the last 13 years and the last 3 years. Since most measures were log normally distributed, log transformed data were also examined. Statistical significance was defined as $p < 0.05$ (2-tailed).

Results: The table shows the mean exposures/week, the rank based on the mean correlation coefficient ®, the mean r (n = 22 regressions), the largest r, and the ILI measure associated with the largest r. For example, Cough-Cold medications had a mean r = 0.779 across all ILI measures, and the highest correlation among them was r = 0.909, r squared (r-sqr) = 0.826, with ILI Age 0–4 y.

For the last 3 years (156 weeks) most (307 of 308) of the regressions were statistically significant ($p < 0.05$, $r > 0.157$, r-sqr > 0.024). For 112 of 308, the Exposure explained > 50% of the ILI variation (r-sqr > 0.50). The top 12 regressions (r-sqr > 0.706) all involved Cough-Cold Exposures. Of the top 50 regressions (r-sqr > 0.622), 26 involved Cough-Cold Exposures, 18 Promethazine-Combination, 4 Acetaminophen (APAP)-Pediatric, and 2 Codeine. Examining the data over the last 13 years (628 weeks) showed similar results – the highest correlation (r = 0.873, r-sqr = 0.762) was between APAP-Pediatric and ILI Age 0–4.

Table. Summary of Results for abstract number 115 for the last 3 years (N = 156 weeks).

NPDS Medication Exposure Group	Mean Exposures/wk	Rank	Correlation Mean	Correlation Max	CDC ILI correlated with
Cough-Cold	1,322	1	0.779	0.909	ILI Age 0–4 y
Promethazine-Combination	30.6	2	0.756	0.840	ILI Total
Codeine	37.9	3	0.710	0.793	ILI Age 0–4 y
APAP-Pediatric	595	4	0.706	0.814	ILI Age 0–4 y
APAP-Unknown	664	5	0.383	0.453	ILI Age 5–24 y
APAP-Adult	134	6	0.321	0.392	Total patients
Promethazine-Only	74.3	7	0.238	0.334	Total patients

As indicated by the r-sqr values, graphical overlay plots for the Exposures and ILI measures appear closely related.
Conclusions: Although further work is required, our results suggest NPDS exposure data may have potential value to provide multiple near real-time medication exposure signals to predict outbreak patterns of ILI and other illnesses of public health importance.
Keywords: ILI, NPDS, Epidemiology

116. The relationship of injury mechanism to drugs of abuse in trauma patients: A pilot study using confirmatory LC-TOF/MS testing

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Background: Traumatic injuries have a known association with substance abuse, such as cocaine with violent injury. Trauma injury studies traditionally rely on urine drug of abuse screens, enzyme immunoassays with false positives, false negatives and the inability to detect emerging drugs of abuse. This study characterizes the relationship between injury mechanism and drugs of abuse detected in serum via confirmatory LC-TOF/MS testing.
Methods: This is a prospective observational study conducted at an urban level 1 trauma center on nonconsecutive patients. Demographic and injury data were abstracted from patient charts. Comprehensive drug testing was done on serum samples using Liquid Chromatograph-Time-of-Flight Mass Spectrometer (Agilent LC1200-TOF 6230). Chromatograms were analyzed using Agilent's MassHunter Qualitative analysis software to determine the presence of potential drugs in the samples.
Results: From Jan-Sept 2012, 148 cases were analyzed: 37 penetrating trauma (gunshot and stab wounds, PEN), 47 motor vehicle injuries (MVC) and 64 falls (ground level and from heights). The median age for PEN patients was 29, MVC was 37 and fall was 64.5 years. PEN patients were 92% male, 43% Black and 32% Hispanic. MVC patients were 62% male, 38% Caucasian and 23% Asian. Fall patients were 58% male, 42% Caucasian and 27% Asian. No xenobiotics were detected in 24% PEN, 47% MVC and 39% fall patients. Prescription medications not causing altered mental status were detected in 19% PEN, 23% MVC and 25% fall patients. Sedative agents (benzodiazpines, carisoprodol, zolpidem) were detected in 49% PEN, 13% MVC and 19% fall patients. Opioids were detected in 5% PEN, 13% MVC and 23% fall patients. Cocaine was detected in 38% PEN, 6% MVC and 9% fall patients. Amphetamines (methylenedioxyamphetamine, 2C-T2, paramethoxyamphetamine, paramethoxymethamphetamine [PMMA]) were detected in 14% PEN, 9% MVC and 9% fall patients. Other stimulants (benzylpiperazine, phencyclidine) were detected in 5% PEN, no MVC and 3% fall patients. 2C-T2 was detected in 2 PEN patients, one of whom also had benzyolecgonine (BZE) present and the other had benzylpiperazine present. PMMA and BZE were detected in one patient, who fell 20 feet during a fight after using cocaine and "ecstasy."
Conclusions: Utilizing LC-TOF/MS, this pilot study demonstrates the presence of drugs such as novel phenethylamines in trauma patients that are not routinely detected on urine drug of abuse screening. Further analysis of this data as well as a larger multicenter study are needed to characterize the differences and relationship between trauma injury mechanism and emerging drugs of abuse.
Keywords: Trauma, Laboratory, Public health

117. Bromethalin (BR) vs. long-acting anticoagulant (LAAC) rodenticides: A 10-year comparison of exposures and toxicity.

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Background: Following Environmental Protection Agency (EPA) action to ban LAAC consumer rodenticides, BR is the emerging rodenticide of choice. Reports of increasing BR exposure and poisoning in pets prompted a review of poison center reported human exposures. Given differing toxicology and lack of antidote and consensus treatment guideline for BR, relative clinical outcomes and exposure trends may help identify future exposure risks and treatment challenges.
Methods: This retrospective study included all BR and LAAC rodenticide exposures reported to a statewide poisons center system during 2002–2011 and those included in the annual reports of the American Association of Poison Control Centers (AAPCC) from the National Poison Data System (NPDS) during the same time period. Due to a change in reporting methods by AAPCC in 2006, earlier annual reports may include combined exposures with other toxicants. This results in relatively fewer reports of adverse outcomes after 2006 in NPDS. The data from the statewide system contain single and combined exposures. Only cases followed to a final medical outcome were included in the study.

Results: During the 10 years, the statewide system reported 12,328 total LAAC and 514 total BR exposures with 4,074 LAAC and 252 BR exposures followed to outcome. There were 2 deaths (0.05%) and 14 major effects (0.34%) in the LAAC group and 0 deaths and 0 major effects reported for BR. In the same period, however, LAAC and BR resulted in a greater percentage of moderate and minor effects (1.35 vs. 3.17% and 3.31 vs. 7.94%, respectively). During the same time period, the NPDS reported 131,932 total LAAC and 5,536 total BR exposures. NPDS attributed 11 deaths to LAAC out of some 43,347 exposures with a known outcome (0.03%) over 10 years. During this same time, NPDS attributed 3 deaths to BR out of 2,312 exposures with a known outcome (0.13%). Major outcomes were reported in 200 LAAC cases (0.46%) and in 7 BR cases (0.30%). Moderate outcomes were reported in 679 LAAC cases (1.57%) and 52 BR cases (2.25%).
Conclusions: LAAC exposures outnumbered BR exposures in the statewide system and NPDS by almost 24:1. Against this background, LAAC exposures resulted in 11 reported deaths in NPDS versus 3 deaths for BR. While major outcomes appear to be similar for the two substance groups, BR appears to cause more moderate effects. Existing and pending rodenticide EPA actions will undoubtedly increase the availability of BR in households nationwide. For significant exposures, especially intentional exposures, the comparatively increased mortality rate, coupled with limited treatment options for BR, may represent a significant emerging public health issue.
Keywords: Rodenticide, Bromethalin, Brodifacoum

118. Favorable acute toxicity profile of clobazam in overdose

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Introduction: Clobazam, a 1,5-benzodiazepine with less affinity for the ω1-allosteric binding site on the GABA A receptor compared to the 1,4-benzodiazepines, has been used as an anticonvulsant in Europe since the 1970s. In October 2011 clobazam has been introduced in the USA for Lennox-Gastaut syndrome. The aim of this study was to determine the acute toxicity profile of clobazam in overdose, since information is limited.
Methods: A multicentre retrospective review of acute clobazam monointoxications involving children (< 14y) and adolescents/adults (≥ 14y) reported by physicians to German, Austrian, and Swiss PCs between January 1994 and December 2012 with a follow-up of ≥ 4 hours and a confirmed or likely causal relationship between exposure and effects for symptomatic patients and a high likelihood of exposure for asymptomatic patients, respectively. The severity of symptoms was graded by the Poisoning Severity Score.
Results: 13 children and 31 adults could be included. Mean age was 3.5 y in children and 38.7 y in adults, respectively. Mean ingested dose was 37 mg (children) and 382 mg (adults). No effects were reported in 8, minor in 33, and moderate in 3 cases. Observed symptoms and signs were drowsiness (20 cases), somnolence (6), psychomotor slowing (6), arterial hypotension (systolic 80–100 mmHg) (4), agitation (2), nausea (2), vomiting (2), coma (with spontaneous resolution after 15 minutes) (1), mild tachycardia (1), hyperventilation (1), dizziness (1), and apathy (1). Gastrointestinal decontamination was performed in 11 patients (charcoal 5, charcoal/cathartic 4, cathartic 1, gastric lavage 1). Flumazenil was administered to 3 patients with mild sedation. Serum concentration was measured in one case after iatrogenic overdose of 30 mg clobazam (clobazam 0.6 µmol/L, desmethylclobazam 1.1 µmol/L).
Discussion: 75% of all patients presented with mildly impaired vigilance but no severe symptoms were observed. This is in accordance with animal studies in which clobazam was associated with substantially reduced sedative effects compared to the 1,4-benzodiazepines (1).
Conclusions: Clobazam seems to have a favorable acute toxicity profile and significant overdoses were tolerated with only mild to moderate effects.
Keywords: Clobazam, child, adult

Reference

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119. Dabigatran associated hemorrhage; Is the poison center too far from the bleeding?

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Background: According to an analysis of the worldwide postmarketing database (March 2008 through October 2011) conducted by the drug's manufacturer, a total of 260 people have had a fatal bleed while taking dabigatran. Dabigatran was approved by the US FDA in 2010 as a competitive direct thrombin inhibitor. Indications include prevention of CVA in patients with atrial fibrillation. Dabigatran-induced bleeding poses a dilemma as there is no predictable reversal agent and a simple test to monitor its effect. The aim of this study is to determine the number and types of cases reported to our regional poison center (RPC) over a 2 year period, and to place it in context with a recently reported case series.

Table. Patients' characteristics, reason for exposure, ingested dose and outcome.

	Age range/mean(y)	Sex f/m/u	Exposure unintentional/ suicidal/ therapeutic error/unknown	Dose range/mean (mg)	Symptoms/ signs no/minor/moderate	Dose for no/mild/ moderate effect range (mg)
Children(n = 13)	0.5–10 (3.5)	5/7/1	8/0/4/1	5–150/37	4/7/2	5–150/5–100/10–25
Adults(n = 31)	14–78 (38.7)	24/7/0	1/29/1/0	30–2000/ 382	4/26/1	30–300/50–2000/ 800

Methods: Utilizing Crystal Reports (Version 11.0), all cases coded as dabigatran exposures (January 1, 2011 - December 31, 2012) were retrospectively queried. Patient age, type of exposure, bleeding complications, management, disposition, clinical effect/outcome were reported.
Results: Forty-four cases were managed with an age range of 1–92 years (median of 63 years ; 52% female). Thirty-four (77%) patients called the RPC after a double dose. Two patients took their spouse's dabigatran by mistake. Six patients (14%) (5 of whom were less than 2-years-old) were considered overdoses. The 1 adult overdose was in an 80-year-old woman with a multidrug ingestion. No bleeding occurred in any of these patients. Bleeding, however, was noted in 2 patients (0.05%) (therapeutic dosing). A 67-year-old man had a subcapsular liver hematoma per CT scan and was observed overnight. No blood products were required and the patient's hematoma improved the next day. A 71-year-old man experienced a nosebleed that required ENT consultation for proximal control and was observed overnight. This was the only case resulting in a moderate effect, whereas all others were coded as either no or minimal effect. Eight patients (18%) were either in a hospital setting or referred to the emergency department (ED) for workup.
Conclusion: A recent publication in Annals of Emergency Medicine (2013;61:475-9) reported 15 patients with bleeding diatheses (8 receiving transfusion) from a single ED over a 6 month period. While our RPC receives 90,000 calls per year, 44 cases related to dabigatran were reported. Only 2 patients had associated bleeding with one being coded as a moderate effect and no patient warranted transfusion. In light of this anemic rate of calls relating to dabigatran, these data do not reflect nor recognize more severe dabigatran-associated hemorrhagic sequelae. Our RPC data compare poorly to ED data, and is an inadequate surveillance instrument to detect and monitor dabigatran-associated bleeding complications.
Keywords: Anticoagulant, Epidemiology, Adverse drug event

120. Forensic toxicology: Killer caffeine

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Background: Caffeine and its derivatives are CNS and cardiac stimulants, which are routinely detected in toxicology samples due to dietary exposure. However, despite its wide-spread use, severe poisoning is rare. While there are no well-established guidelines for lethal dose, ingestion of 150 mg/kg is considered potentially lethal. In fatalities, post-mortem blood concentrations exhibit a wide range (79–344 mg/L) and post-mortem redistribution has been postulated as a cause of this variability.
Case report: A 36-year-old woman was found dead lying on her hotel bed, an apparent suicide with note of intent found on scene. A drinking glass containing pink powder residue was on the floor. No items in the room corresponded to the glass residue. A bottle of clonazepam, prescribed to the decedent, was noted and pill count correlated with the fill date of prescription. Autopsy was significant for diffuse pulmonary edema, apparent medication sediment in the gastric contents, and no anatomic cause of death was appreciated. Qualitative drug screen was positive for caffeine and salicylate via chromatography. Quantitative clonazepam and 7-amino clonazepam levels fell within the therapeutic range at 4.4 ng/mL and 71 ng/mL, respectively. Quantitative salicylate level was 1.5 mg/dL, well below the established reference range. At this time no cause of death had been determined. The possibility of caffeine toxicity was proposed and both a quantitative caffeine level and qualitative testing of the drinking glass residue were obtained. Glass residue was positive for caffeine and the quantitative caffeine level was significantly elevated at 240.0 mcg/mL. All quantitative testing was run from femoral blood samples. Based upon these results, the death was certified as caffeine toxicity.
Case discussion: The ever expanding sources and availability of caffeine-containing products, combined with lack of public knowledge regarding caffeine toxicity, are likely to result in an increase in healthcare visits and fatalities from caffeine intoxication. Deaths attributed to caffeine, evidenced by the recent death of a 14-year-old girl in Maryland after consuming energy drinks, make for sensational media coverage. Medical examiners and toxicologists are likely to be sought out to comment on this growing trend. This case emphasizes the importance of post-mortem drug testing, which should continue to include screening for caffeine and its metabolites.
Conclusions: Medical examiners and toxicologists should not discount the significance of positive results on qualitative drug assays for commonly abused substances such as caffeine. Quantitative values should be obtained in such cases where cause of death is not attributable to other easily identifiable means.
Keywords: Caffeine, Forensics, Overdose

121. Who's calling? changes in types of cases managed by us poison centers 2000–2011

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Introduction: Poison center hosting organizations and national certification guidelines rely on call volume to assess poison centers. These assessments presume that the population contacting poison centers is stable over time, yet no studies have been done that document this presumption. Documenting the populations using poison center services is critical to developing strategies for staffing, outreach and education, as well as for defining national poison center staffing standards. The purpose of this study is to review changes in poison center call volume over time with a focus on changes in distribution of pediatric cases, cases managed in a health care facility, and percentages of unintentional and intentional exposures.
Methods: A retrospective review of National Poison Data System (NPDS) call volume was performed between 2000 – 2011. Total call volume, reason for exposure, management site, and counts of victim age < 6 years were evaluated.
Results: The results show fluctuations in total human exposure call volume over time. The numbers of and percentages of intentional exposures reported to poison centers have increased steadily as has the percentage of patients treated in a health care facility (HCF) (see Table). The percentage of calls involving pediatric exposures has decreased over time. These findings represent changes in the population of poisoning victims.

Table. Results for abstract number 121.

Year	Human Exposures	Total Intentional	Percent Intentional	Percent HCF	Percent age less than 6 years
2000	2,168,248	244,927	11.3	23.9	54.3
2001	2,267,979	262,703	11.6	24.0	53.6
2002	2,380,028	278,597	11.7	24.3	53.9
2003	2,395,582	283,845	11.8	23.9	54.7
2004	2,438,644	301,254	12.4	24.4	54.1
2005	2,424,180	304,957	12.6	24.7	53.8
2006	2,403,539	308,483	12.8	25.4	53.7
2007	2,482,041	323,367	13.0	25.5	54.1
2008	2,491,049	337,274	13.5	25.8	54.5
2009	2,479,355	344,423	13.9	25.9	54.6
2010	2,383,815	349,734	14.7	27.0	53.1
2011	2,334,004	368,207	15.8	28.1	51.4

Conclusions: Changes in the population using poison center services have profound implications for poison centers, for sponsoring organizations, and for assessment strategies of poison centers. Additional information is needed to better define these differences and to develop strategies for poison center staffing as well as addressing the needs of poisoning victims.

Keywords: National Poison Data System, Epidemiology, Poison center

122. A Comparison of Ciguatera Poisoning in the US and the EU

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Background: Ciguatera poisoning is caused by eating tropical fish like amberjack, barracuda, and red snapper contaminated with-*Gambierdiscus toxicus* toxin. The exposure is characterized by gastrointestinal (nausea, vomiting, abdominal pain, diarrhea) and neurological effects (circumoral or extremity paresthesias, metallic taste, pruritus, and reversal of hot and cold sensations). Symptoms can last for weeks to months. Diagnosis is clinical, since laboratory confirmation is not widely available. International travel and food imports may expose consumers to ciguatera. We examined National Poison Data System (NPDS), a US poison center (US-PC), and a European Union PC (EU-PC) ciguatera exposures from 1-Jan-2011 to 31-Dec-2012.

Methods: NPDS closed human exposure calls were tallied by month and examined by linear regression and by-month averages. PC call date, patient location, age, gender, clinical effects (CEs), and outcome or symptom duration were examined using descriptive statistics, chi-square or ANOVA, Bartlett's test of SD, and distribution by country. 27 CEs were combined into 4 categories. Statistical significance was defined as $p < 0.05$ (2-tailed).

Results: The 2263 NPDS ciguatera exposures from 2000–2012 showed no overall increase or decrease.There was clear seasonality with mean peak exposure/month of 24.6 in August and 24.0 in July. Outcomes were reported differently between the centers. The US-PC reported 9 minor, 1 moderate,1 major and 1 unknown outcome; the EU-PC reported symptom resolution within 1 week (2 patients), 2 weeks (3 patients), 3 weeks (2 patients) and unknown (3 patients). EU-PC fish sample analysis showed 7/11 (64%) tested positive for ciguatoxins (CTX1B) by LC-MS/MS.

Conclusions: Many ciguatera cases are not reported to PCs, so the true prevalence of cases is unknown. In the US, confirmation of fish ciguatoxin is possible by sending samples to the FDA Gulf Coast Seafood Laboratory. While not helpful with diagnosis, confirmatory ciguatera fish testing is important from an epidemiological standpoint and to assess long-term effects. Standardization of terminology, especially terms used to describe clinical effects, would assist global data exchange and international cooperation.

Keywords: Epidemiology, Poison center, National Poison Data System

123. From ricin to castor oil: 12 Years of toxalbumin exposures reported to US poison centers

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Introduction: Ricin and other toxalbumins are natural plant toxins that have an impressive history of use and misuse. Extracts from toxalbumin containing plants have been used for a variety of purposes, including as a laxative and food additive as well as in chemical weapons. Historical information on toxalbumin exposures is often poorly documented. The purpose of this study is to review toxalbumin exposures, including ricin, reported to poison centers in the United States and to document the clinical effects and outcomes commonly encountered with these exposures.

Methods: A retrospective review of National Poison Data System data on ricin and toxalbumin containing product exposures was

Table. Results for abstract number 122.

Parameter	EU-PC	US-PC	p-value	Combined
Number of cases	10	12		22
Age-years, mean ± SD	55.6 ± 14.6	37.0 ± 12.7	0.0104	47.4 ± 16.9
Gender-%, females, males	40%, 60%	75%, 25%	ns	59.1%, 40.9%
Day of study, mean (Date)	674 (5-Nov-12)	378 (14-Jan-12)	0.0018	413 (18-Feb-12)
Date of study SD	4.56	259	< 0.0001	241
Clinical Effect Category				
Neuro-Peripheral NS	9 (90%)	8 (67%)	ns	17 (77%)
Gastrointestinal	7 (70%)	7 (58%)	ns	14 (64%)
Malaise	5 (50%)	7 (58%)	ns	12 (55%)
Neuro-Central NS	3 (30%)	4 (33%)	ns	7 (32%)

performed. The study included cases reported from 2000 thru 2011. Confirmed exposure cases with known outcomes were included in the study.

Results: A total of 1,220 exposures met the study inclusion criteria. The vast majority of exposures were ingestions (927; 76%), followed by dermal (196; 16%). Patients developed either no effects (712; 58%) or minor effects (401; 33%) in 91% of all cases. There were 99 moderate effects (8%) and 8 cases coded as major effects (0.65%). No deaths occurred during the 12 year study period. The most commonly coded clinical effect was puncture wound (270; 22%) followed by vomiting (249;20%), dermal irritation/pain (244;20%) and nausea (151;12.3%). The most common treatment was dilute/irrigate (938;77%) followed by single dose activated charcoal (343;28%), and other unspecified therapy (309;25%). Review of these cases demonstrated differences in clinical effects that varied greatly, depending on the route of exposure and reason. All 8 of the cases coded as developing major effects were adults in whom the reasons for exposure were: 2 suspected suicidal, 2 malicious, 2 unintentional general, one unintentional misuse and one unknown reason. For these 8 major cases, routes of exposure were 3 dermal, 3 ingestion, and one each for parenteral and unknown route.

Conclusions: The vast majority of cases of ricin and other toxalbumin exposures reported to poison centers over a 12 year period resulted in no or only minor effects. Rare cases of serious effects were documented. However, the available information suggests that these cases had unusual circumstances associated with the exposures.

Keywords: Plants, National Poison Data System, Public health

124. Retrospective review of 51 pediatric patients < 2 years old hospitalized for poisoning

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Background: Accidental exposures to pharmaceutical and non-pharmaceutical substances in children account for approximately one-half of all the human exposure cases called into US Poison Centers. Most recent figures from AAPCC-NPDS 2011 Annual Report indicates that 48.9% of all human exposures involved children < 6 years of age. Further breakdown of this figure indicates 20.1% of all human exposures involved children < 2 years of age. Many of these children are seen in emergency departments (ED). Detailed information on hospitalized children seen at the bedside by Toxicologists is limited as most of NPDS data has been obtained through Poison Center involvement and not from direct observation at the bedside. We review the records of a single site toxicology consult service and describe poisonings that resulted in hospitalization in children < 2 years of age.

Method: Data was collected retrospectively from over a 28 month period from January 1st, 2011 to March 31st, 2013 from a single site tertiary-care academic hospital in which all cases were seen directly at the bedside by a board-certified Medical Toxicologist. Demographic information, types of ingestions as well as outcomes including symptoms as well as the use of antidotes and supportive cares are presented.

Results: Out of 1413 cases seen during a 28 month period 51 involved children < 2 yrs (30 M and 21 F). Most of the cases (40/51) were seen in the ED. Moderate or major effects were seen in 19, minor in 15, 13 children were asymptomatic and in 3 the symptoms were unrelated to ingestion. One death occurred (from morphine tab ingestion). 24/51 cases involved pharmaceuticals and 26/51 were non-pharmaceuticals (1 unk). 46/52 (90%) were confirmed. All were acute exposures. Coma/CNS depression occurred in 18. Acute lung injury/ARDS in 6. Respiratory failure occurred in 3. Methemoglobinemia, bradycardia, hypotension, acidosis and corneal burns were other moderate and severe symptoms encountered. Decontamination was performed in 5 with whole-bowel irrigation in 3 and activated charcoal in 2. 19 cases required specific pharmacologic treatments including naloxone, methylene blue, glucagon, vasopressors, sodium bicarbonate and chelation therapy. Non-pharmacologic treatment included intubation and ventilator support, ECMO, EGD, and CPR.

Discussion: Pharmaceutical and non-pharmaceutical agents were nearly equally involved. Significant morbidity and even mortality (morphine ingestion) resulted from these exposures.

Conclusion: Pediatric poisoning may be associated with significant morbidity and even mortality in young children. Description of these cases is essential in order to better understanding how to prevent as well as treat.

Keywords: Pediatric, Medical toxicology, Ingestion

125. Development of an international registry of poisoned patients using toxic

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Background: The international toxicology community has limited communication and collaboration mechanisms. We attempted to address this issue by developing an international registry of poisoned patients to further collaboration, education, and research among physicians specializing in the management of human poisonings globally. This registry is based on the current American College of Medical Toxicology (ACMT) Toxicology Investigator's Consortium (ToxIC) Registry, a multicenter reporting, research, and toxicosurveillance network connecting over 50 sites in the USA on a web-based platform since 2010.

Methods: We identified international colleagues with an interest or need in developing a registry for poisoned patients. A web-based data form was utilized for the planning, designing, building, testing, deploying and tracking of this health informatics project. The intent was to capture anonymized demographic, clinical and management details of patients seen in bedside consultation by international members of ACMT.

Results: The International ToxIC Registry has been active since 2/1/2013. So far, ToxIC Investigators in Sverdlosk, Russia have entered a total of 56 cases in two months with 54 acute exposures, 1 chronic and 1 acute-on-chronic exposure. Forty-five patients presented with clinical signs of toxicity while 11 were asymptomatic. Most common clinical presentations were: confusion, CNS depression, agitation,

and anticholinergic toxidrome. GI decontamination was performed on 13 patients, 10 receiving gastric lavage and 3 receiving activated charcoal. Medical treatment was given to 21 patients including benzodiazepines (14 patients), antipsychotics (6 patients), atropine (2 patients), and NAC, calcium, glucose, vasopressors, high dose insulin euglycemic therapy, and intralipid (1 patient each.) The most common intoxicants were: sympathomimetics, ethanol intoxication, barbiturates, cardiovascular drugs, carbon monoxide, acetic acid, acetaminophen, and benzodiazepines. There were a total of 23 different substances ingested reported.

Other sites in the process of joining the International Registry are located in Thailand, India, Sri Lanka, and Iran.

Conclusion: Our experience suggests that an international, web-based toxicology registry is feasible. This project has the potential for creating opportunities for collaborative research and education among toxicologists, with the ultimate goal of improving the care of poisoned patients.

Keywords: Surveillance, Epidemiology, Overdose

126. Caustic injuries following high concentration peroxide ingestions: 2001–2011

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Background: Caustic injury and hollow viscus perforation have been suggested as a consequence of high concentration peroxide ingestions.

Objectives: In symptomatic peroxide ingestions of $>10\%$ concentration, to examine the role of esophagogastroduodenoscopy (EGD) in the diagnosis and treatment of caustic injuries and to examine the incidence of perforation.

Methods: NPDS was queried for ingestions from 2001–2011 coded as a peroxide product with: concentration $>10\%$, hyperbaric oxygen (HBO) as a treatment, or an outcome code of moderate effects, major effects, or death. Poison control center (PCC) charts were then obtained from all 57 open and 3/6 closed US PCC's.

Results: After elimination of low concentration peroxide ingestions, 294 cases of symptomatic high concentration peroxide ingestion were available for analysis. 130 (44.2 %) underwent an EGD, with a median time to EGD of 15 hours post ingestion. EGD was performed in 118/263 (44.9%) of those with emesis and 12/31 (38.7%) without emesis ($p = 0.57$). EGD was performed in 62/119 (52.1%) of those with hematemesis.

EGD results were recorded for 118 patients. Injury grading was: 11.9% normal, 29.7% grade 1, 54.2% grade 2, 2.5% grade 3, and 1.7% grade 4 (necrosis) with 5/118 (4.2%: CI 1.4–9.6%) exhibiting grade 3 or 4 lesions. One patient who underwent an EGD died. All 5 patients with grade 3 or 4 lesions presented with vomiting. 4/5 (80%) reported hematemesis. The age range for those with a grade 3 or 4 lesion was 42–87 years. The range of volume of peroxide ingested was 15–60 ml in those with a grade 3 or 4 lesions. 3/13 (23.1%) patients with embolic events who had an EGD experienced a grade 3 or 4 lesion compared to 2/103 (1.9%) of those without embolic symptoms who had an EGD ($p = 0.009$). All patients with grade 3 or 4 findings would be captured by restricting EGD to those with evidence of embolic symptoms, significant GI bleed (melena or massive hematemesis), pneumomediastinum, or history of gastric bypass. This would have reduced the number of patients undergoing EGD by two-thirds to 46/294 (15.6%) of patients.

2/294 (0.7%) had possible hollow viscus perforations. Both were diagnosed as possible esophageal tears with pneumomediastinum by Chest CT. Neither required surgical intervention. In both cases, it was unclear if the injury was due to vomiting or the caustic properties of peroxide.

Conclusion: Significant findings occurred in only 4.2% of concentrated peroxide ingestions who had grade 3 or 4 lesions. All patients with grade 3 or 4 findings would be captured by restricting EGD to those with evidence of embolic symptoms, significant GI bleed, pneumomediastinum, or history of gastric bypass. Possible perforation is very rare and can likely be diagnosed by CT.

Keywords: Peroxide, Caustic, National Poison Data System

127. Utility of CT and HBO therapy following high concentration peroxide ingestions: 2001–2011

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Background: High concentration peroxide ingestions have been associated with embolic events. The utility of CT and hyperbaric oxygen (HBO) therapy in these cases has not been studied.

Objectives: To examine the use of CT, early HBO, and late HBO in symptomatic peroxide ingestions with a concentration $>10\%$.

Methods: NPDS was queried from 2001–2011 for ingestions coded as a peroxide product: with concentration $>10\%$, HBO as a treatment, or an outcome code of moderate/major effects or death. Poison control center charts were obtained from all 57 open and 3/6 closed US centers. The primary outcome of embolic event was defined as seizure, altered mental status, respiratory distress, hypoxia, hemodynamic instability, pathologic EKG findings, radiographic evidence of emboli or infarct, focal neurologic deficit, or elevated troponin.

Results: After elimination of low concentration product ingestions, 294 cases were available. 14% (CI 10–18%) of included calls demonstrated evidence of embolic events. 7% (CI 4–10%) of included calls died or had residual disability at the time the chart was closed, with 5 deaths.

13/19 (68%) with an embolic event and 6/10 (60%) with a focal neurologic deficit had an initial normal head CT. 3/9 (33%) with a CT chest were positive for pneumomediastinum without other gas emboli identified.

6/33 (18.2%) with an initial CT A/P demonstrating extraluminal (mesenteric or intrahepatic) gas went on to experience an embolic event compared to 35/261 (13.4%) with a negative or missing CT ($p = 0.47$).

1/17 (5.9%) patients who had HBO prior to embolic symptoms later developed embolic symptoms compared to 34/271 (12.6%) of patients who did not undergo HBO ($p = 0.70$). In patients with a CT A/P with extraluminal gas, 1/17 (5.9%) who underwent HBO prior to embolic symptoms developed embolic symptoms compared to 3/14 (21.4%) patients who did not get HBO ($p = 0.30$). The 1 patient who developed symptoms after initiation of HBO had a seizure, but recovered completely.

3/6 (50.0%) who underwent HBO after developing embolic symptoms died or had permanent disability compared to 17/33 (51.5%) of patients who did not get HBO (p = 1.00). HBO was initiated in patients who made a full recovery at 4, 5.5, and 14 h after ingestion compared to 14, 15, and 36 h in those who did not recover.
Conclusion: A CT Head that is initially normal does not rule out a CNS insult. CT Chest may be useful to identify pneumomediastinum. The strategy of early HBO in those with a CT A/P that reveals extraluminal air demonstrated a lower incidence of progression to embolism. In symptomatic patients with evidence of embolism who underwent HBO, only those treated early in their course recovered fully.
Keywords: peroxide, Caustic, National Poison Data System

128. Hyperbaric oxygen therapy for portal venous gas after unintentional hydrogen peroxide ingestion

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Background: Hydrogen peroxide is an oxidizing agent with varying uses depending on concentration. At 3% (by weight), it is used as a household antiseptic; at higher concentrations, such as 35%, it is caustic and is generally marketed as an industrial cleaner. In recent years it has gained popularity in the health food industry and is promoted as therapy for numerous ailments.
Case report: A healthy 57-year-old woman presented to the emergency department (ED) two hours after unintentional ingestion of approximately 60 ml of hydrogen peroxide 35%, which she had purchased as a health supplement. She experienced several episodes of vomiting and epigastric pain. Vital signs were normal. An abdominal x-ray was initially read as normal, and the patient was discharged home. However, the radiologist's interpretation of the x-ray as having air in the portal vein prompted immediate reassessment of the patient. At this point she was no longer vomiting, and her epigastric pain was much improved, but not resolved. CT scan of the abdomen showed portal venous air in both left and right lobes of the liver and pneumatosis in the gastric fundus. Gastroenterology was consulted and performed an esophagogastroduodenoscopy in the ED that showed mucosal sloughing of the esophagus and inflamed and hemorrhagic gastric mucosa. Hyperbaric medicine was also consulted, and treatment with hyperbaric oxygen was administered. She was admitted to hospital for observation. A barium swallow was performed on post admission day 2 and showed no free air. A repeat CT scan was not performed. The patient was discharged home with no further sequelae.
Case discussion: When ingested orally, H2O2 is broken down into H2O and large volumes of oxygen. This gas dissolves into the patients' tissues and can result in catastrophic sequelae including portal venous obstruction, hemorrhagic gastritis and both venous and arterial emboli. Endoscopic findings may show extensive damage, even when the patient's symptoms are mild or improve significantly over time. Hyperbaric oxygen therapy (HBOT) may be of benefit in these patients both by decreasing the volume of gas in the tissues, and by increasing solubility of the gas so it is more quickly transported to the lungs and expired. There is currently no literature reporting outcomes in patients receiving HBOT compared to supportive therapy.
Conclusion: Ingestion of small volumes of 35% hydrogen peroxide can result in significant gastrointestinal injury including esophageal injury, hemorrhagic gastritis and portal venous air. Hyperbaric oxygen therapy may be a useful adjunct in the management of these patients.
Keywords: hydrogen peroxide, Caustic, hyperbaric oxygen

129. Energy drink usage and reported adverse events in adolescents

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Background: Energy drinks use is commonplace and contains caffeine or other stimulants. Previous studies on energy drink usage have primarily focused on college-age and older adults. There is a paucity of data on energy drink use in adolescents. This study evaluated demographics, prevalence, reasons and adverse effects with consuming energy beverages in adolescents.
Methods: Subjects between ages of 13–19 years utilizing emergency department (ED) services for any reason at a large county pediatric ED consented to participate in questionnaire about energy drink usage including frequency, reasons, adverse events and demographic data. Descriptive statistics utilized.
Results: 170 subjects participated, 114 answered "yes" and 56 answered "no" to previous use, 52.6% male and 47.4% female. Ethnicity: Latino 84%, African American 4%, Caucasian 3.5%, Asian 2.6%, Other 5.9%. Ages: 13y/o(10),14y/o (13),15y/o(19),16y/o(20),17y/o(15),18y/o(15),19y/o(22). 83% use 0–1/wk, 12% 2–4/wk, 4% 4–6/wk, 1% greater than 7/wk. Education: 11% middle school, 4% junior high, 65% high school, 6% college, 14% other. Reasons for use: 63% to "increase energy", 28% for studying, 27% improve sports performance, 21% "friends do", 12% "feels cool", 11% with ethanol, 11% taste, 4% for weight loss, 11% other. Adverse reactions reported in 45% including: 27 gastrointestinal upset/pain, 23 insomnia, 21 palpitations, 20 "shaky/jittery", 11 headache, 6 chest pain, 3 dyspnea, 2 seizures. 16% reported co-ingestion with illicit drugs including cocaine, methamphetamine, MDMA.
Conclusions: Our data demonstrates that energy drink use is not uncommon in adolescents including younger adolescents. Of concern, we show almost 50% of subjects report at least one adverse effect. While most of these are not severe, a small number were serious e.g., seizures. In addition, some report purposely ingesting with ethanol and illicit drugs. Further study needed to fully elucidate our findings.
Keywords: Energy Drinks, Stimulant, Adolescents

130. Two cases of pediatric iatrogenic sodium intoxication

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Background: Patients requiring dietary sodium supplementation can be given table salt. This is an imprecise dosing option with great potential for error. We describe two cases in which dosing errors resulted in significant hypernatremia.

Case 1: A 2 year-old girl (wt, 9.8 kg) with severe microcephaly and developmental delay was admitted for a nutrition evaluation secondary to hyperkalemia and weight gain issues. Admitting serum electrolytes were Na 138, K 5.7, Cl 110, HCO3 22 mmol/L with normal renal function. Parents reported her home diet to consist of 50 ml Pediasure + 50 ml free water + 1/2 tsp of salt (50 mEq of NaCl) every 3 hrs, via gastric-tube. She received 3 of these feedings over 12 hrs after admission. Repeat electrolytes were Na 186, K 3.8 and Cl 159 mmol/L. A communication error was discovered and the correct amount of NaCl should have been ½ tsp per day, not per feeding. The patient was treated with IV fluids at 80 ml/hr and after 18 hours; the serum Na was 145 mmol/L. The patient was discharged the next day without sequelae.

Case 2: A 58 day-old girl (wt, 3.1 kg) with a history of a cleft lip/palate, failure to thrive, brain tumor and SIADH was seen in an ED for a sunken fontanel, irritability, fever, vomiting, dehydration and lethargy. Serum electrolytes were found to be Na 217, K 3, Cl 175, HCO3 16 mmol/L. The patient received 40 ml/kg of NS and was transferred to the PICU of the hospital from which she had been discharged 2 days prior. Her discharge instructions had included fluid restriction and supplemental sodium of 12 meq of NaCl/day (3 mEq every 6 hrs). At the time of that discharge, the prescriber had requested of pharmacy the equivalent dose of NaCl in table salt, and was told it would be about 1/4 tsp per day. Unfortunately the prescriber wrote for 1/4 tsp per dose. This error resulted in dosing of 100 meq NaCl/day for approximately 36 hours. In the PICU she was treated with IV fluids at 12ml/hr. It required 5.6 days for the serum Na to reach 146 mmol/L. During this time the patient became more active and less fussy. She was discharged 2 days later.

Conclusion: The use of table salt for dietary sodium supplementation can lead to significant dosing errors. Standard solutions should be used and prescriptions should be written in mEq/dose to minimize the chances of therapeutic errors.

Keywords: Overdose, Pediatric, Medication error

131. Characterization of deaths and major outcomes from sodium salt ingestions reported to us poison centers

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Background: Sodium salts, such as table salt and baking soda, are readily available throughout North America. While these agents are presumed to be quite safe, anecdotal reports suggest that very small doses can cause severe toxicity and even death. A literature search identified six such cases, of which five involved unintentional poisoning. This study was conducted to better characterize ingestions that might pose the greatest risk to health, as well as to quantify that risk.

Methods: The National Poison Data System (NPDS) was queried for all closed human exposure cases given AAPCC codes 0069000 (Sodium and Sodium Salts) between 1/1/2000 and 12/31/2011. Where co-ingestants were known or suspected, those cases were excluded in order to focus the analysis on the effects purely due to the sodium salt. Fatality abstracts were made available for review and individual poison centers were contacted and provided detailed case information about the cases reported as having a major medical outcome.

Table. Results for abstract number 131.

Substance	Death	Seizure	AMS	Metabolic Acidosis	Metabolic Alkalosis	Serum Na > 165
Baking soda	5	5	5	0	5	6
Salt	2	3	4	4	0	3

Results: 43,720 records were obtained in the initial query. Of these, 29,059 cases involved single-substance ingestion of sodium salts. Eleven cases had a major medical outcome, and seven cases were fatal (see Table). Four of the deaths were therapeutic misadventures in children (e.g. to induce vomiting). Three deaths were intentional ingestions by adults.

Fatality risk is low, 0.024%, in this dataset. Dose information was inconsistently recorded or estimated amongst these cases. Doses as low as 1–3 tbsp of baking soda in a child were associated with death.

Conclusion: According to poison center data, ingestion of sodium salts rarely causes severe toxicity or death, but it certainly has that potential, even at seemingly low doses. Sodium bicarbonate ingestion appears slightly more common than sodium chloride to be associated with severe hypernatremia, seizures, other mental status changes, and death.

Keywords: Sodium chloride, Baking soda, Hypernatremia

132. A case of acute ibogaine toxicity confirmed with serum and urine levels and product contents

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Background: Ibogaine is a naturally occurring psychotropic indole alkaloid derived from the West African rain forest shrub,*Tabernanthe iboga,* and is used in spiritual ceremonies in Gabon. Since the latter half of the 20th century it has gained use in commercial and medical subcultures for its reported anti-addictive properties. Associated with its usage, there have been several reports of sudden unexpected death. The mechanism of its potentially fatal effects has not been clearly defined. Described is a rarely seen case of acute ibogaine intoxication in the United States, where it is a controlled substance.

Case report: Starting at midnight and over the course of a few hours, a 33 year-old healthy Caucasian man ingested eight ibogaine capsules purchased on the Internet**.** After several hours of nausea, vomiting, gait imbalance and experiencing feelings of dissociation he was seen in the emergency department. There was no

Table. Measured ibogaine levels in serum and urine.

Sample	Time	Ibogaine Level (ng/mL)
Serum 1	0741H	377
Serum 2	0955H	95
Serum 3	1620H	19
Urine	1124H	757

other reported alcohol, drug or pharmaceutical use. He denied any medical or psychiatric disease, family history of cardiac rhythm abnormalities or neurologic disorders. Physical exam was notable for significant dysmetria, ambulatory dysfunction, intermittent tremors, piloerection and psychomotor agitation. Labs were unremarkable. Initial ECG demonstrated sinus rhythm at 75 beats per minute and transient widening of QT interval, duration of 472 ms (QTc 527 ms), which normalized during his stay. His hospital course was uneventful. No significant dysrhythmia occurred while observed on telemetry for over 24 hours total. The ataxia and psychotropic disturbance remitted and he was discharged the next day.

Analysis with liquid chromatography- time-of-flight mass spectrometry (Agilent LC1200- TOF/MS 6230) of urine and serial serum samples confirmed the presence of ibogaine and its primary biologically active metabolite noribogaine (Table). An intact 1.374-gram capsule the patient provided was determined to contain 479 mg of ibogaine. The half-life calculated is 67 minutes between serum samples 1 and 2 and 162 minutes between serum samples 2 and 3.

Discussion: This case of acute ibogaine intoxication not only provides clinical characteristics but also confirmed serial serum levels and a urine drug level.

Conclusion: Our patient demonstrated physical and psychotropic manifestations previously reported in the literature. We also observed transiently prolonged QTc interval on ECG and nonlinear elimination kinetics over the nearly 9 hours of sampling.

Keywords: Ibogaine, Withdrawal, Alternative medicine

133. Caffeine: What's the Buzz?

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Background/Objectives: With increasing popularity and marketing of energy drinks, consumption and sales have increased yearly since the new millennium. Energy drink sales in 2011 increased 19% compared to 2010, reaching $6.9 billion in U.S. sales. Most companies brand their products as dietary supplements and not beverages or drugs as the FDA does not require ingredient listing on energy drink labels nor does it limit the concentration of caffeine within the drink. The generally regarded as safe level for soda in 71mg/12oz, but energy drinks are able to exceed this limit. According to the SAMHSA, energy drink related emergency department visits have nearly doubled from 2007 to 2011. Because of growing consumption of energy drinks and increasing ED visits due to these products, it is of interest to compare the adverse effects of energy drinks to other caffeine related products. This study evaluates the types of products and related symptoms reported to our poison center.

Methods: All cases of intentional ingestion of caffeinated products made to a regional poison center (RPC) from January 1st, 2011 to January 1st, 2013 were analyzed for type of caffeinated product, estimated amount and adverse health effects. Substances were categorized as coffee, energy drink, and caffeinated pills. Intentional ingestions over the age 7 were analyzed.

Results: Of 262 calls made to the RPC, 233 had complete data and were analyzed (see Table).

Average age of adult exposures ranged from 23 years of age for caffeinated pills, 25 for energy drinks, and 32 for coffee products. Caffeinated pills resulted in the largest number of cases (103), followed by energy drinks with 77 calls. Approximately 27% of cases originated from health care facilities (HCF). The most common adult symptoms reported for all caffeinated products were nausea, vomiting, palpitations, tachycardia and feeling nervous/jittery. Of all the energy drinks, 5-hour ENERGY® resulted in the greatest number of calls to the IPC.

Conclusions: Coffee can have a higher level of caffeine per ounce than energy drinks, but is usually served hot and is sipped as opposed to being consumed quickly. Energy drinks are cold, sugary drinks and are often consumed very quickly (especially energy shots) thus providing a large amount of caffeine in a short period, not unlike caffeine pills. From our review of RPC date for intentional ingestions, the more concentrated the caffeinated substance the more likely patients were to have adverse effects and present to a HCF.

Keywords: Caffeine, Adverse drug event, Poison center

134. Fatal pulmonary emobolism associated with use of supplements containing synephrine: two case reports

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Background: Synephrine is a common additive in over-the-counter weight loss supplements. While the manufacturers of such supplements make claims as to the safety and efficacy of their products,

Table. Results for abstract number 133.

Caffeinated Substance	Coffee	Energy Drinks	Energy Drinks & Caffeine Pills	Caffeine Pills
Number of cases	31	77	22	103
% HCF calls	13	29	41	64
Avg. Age (yrs)	32	25	22	23
Avg. Caffeine Concentration	8 to 20 mg/oz	10 to 100 mg/oz	-	100 to 200 mg/pill

multiple case reports describe serious complications associated with synephrine use.

Case Reports: A 27-year-old male presented to the Emergency Department with complaints of dyspnea, and was found to be tachycardic, tachypneic, and hypoxemic. The patient reported taking JetFuel® supplements over the past two weeks. Laboratory evaluation revealed an elevated D-dimer and severe dysoxia. Non-invasive positive pressure ventilation was initiated, and the patient was admitted to the ICU. A lower extremity ultrasound revealed deep venous thrombosis, and a heparin infusion was initiated. The patient continued to decline, requiring endotracheal intubation. Shortly thereafter, the patient experienced cardiac arrest and expired after 60 minutes of unsuccessful resuscitation, which included the administration of r-tPA. Autopsy revealed a large left pulmonary embolus.

In the second case, a 28-year old male presented to the ED after developing palpitations and dyspnea. The patient was noted to be tachycardic, hypoxemic, tachpyneic, and in extremis. Endotracheal intubation was performed. The patient's spouse reported that he regularly used fat-loss supplements, including Anadrox® and Lipo-6 Black®. Lab results obtained after intubation revealed a severe mixed acidosis and persistent hypoxemia. CT angiography revealed bilateral pulmonary emboli with RV strain. The patient suffered cardiac arrest, with return of spontaneous circulation after five minutes of resuscitation and administration of r-tPA. His condition worsened, and he expired in the ICU ten hours after presentation.

Discussion: In the above cases, the patients developed fatal pulmonary emboli while using supplements containing synephrine. This association is strengthened in that neither patient had a personal or family history of thrombotic disease, nor any risk factors for thrombus development. Urine and serum drug screens were negative, and neither patient had a previous medical history of cardiovascular disease. Indeed, their *only* significant risk factor for thrombosis was the use of supplements containing synephrine.

Conclusions: While previous reports have outlined associations between synephrine use and cardiovascular complications, we present here two cases involving a previously unreported association. While the specific link between the pharmacology of synephrine and its adverse cardiovascular effects remains unclear, these cases illustrate a need for further study in order to establish safety.

Keywords: Adverse drug event, Dietary supplement, Death

135. Toxicity in a tank

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Background: Palytoxin (PTX) is considered one of the deadliest marine toxins in the world. Although rare, reports of human exposure from consumption of PTX have described significant morbidity and mortality. PTX is the suspected agent in Haff disease, in which rhabdomyolysis occurs within 24 hours of eating contaminated fish such as Buffalo fish. PTX is primarily present in soft corals or in dinoflagellates, and it can contaminate crustaceans and other fish as it bioaccumulates up the food chain. Only 23 cases have been reported in the U.S., including 2 recent cases in New York City. Reports of inhalational exposure to PTX are uncommon.

Case Series: We describe a case series of 6 patients, including 4 adults and 2 children, with inhalational exposure to PTX aerosolized from*Palythoa* corals. Their symptoms included some degree of respiratory involvement, myalgias, paresthesias, fevers and gastrointestinal symptoms. Fortunately, there were no serious outcomes and all patients survived without sequelae.

Discussion: The majority of previous reports of PTX exposure have been secondary to the consumption of fish contaminated by the dinoflagellate*Ostreopsis* species or that feed on *Palythoa* species and bioaccumulate PTX. There have been reports of PTX-poisoning via dermal exposure as well. The largest suspected report of inhalational exposure to PTX was in 2007, where more than 200 patients developed respiratory symptoms after an *Ostreopsis ovata* algal bloom in Italy.

Most patients with PTX exposure develop elevations in their LDH and CPK. The mechanism of action by which PTX achieves this is complex, and has been the focus of several *in-vitro* and *in-vivo* animal studies. There are two types of Na^+/K^+-ATPase toxins: the cardiac glycosides such as digitalis and ouabain, and PTX. While the cardiac glycosides inhibit the action of the Na^+/K^+-ATPase, PTX turns the pump into a non-selective ion channel resulting in cell lysis.

We were unable to performed high-pressure liquid chromatography to detect PTX. We were also unable to obtain the original coral to detect PTX in the source as well. Thus the diagnosis was made on recognition of the coral and by the symptoms.

Conclusion: Although rare, exposure to palytoxin is not restricted to people visiting marine environments because of *Palythoa* coral in some home aquariums. Routes of exposure go beyond consumption of fish that feed on the coral, and include dermal as well as inhalational exposure. Palytoxin exposure should be considered in the differential diagnosis of patients who own or work with fish tanks, and present with symptoms that include respiratory complaints, myalgias, neuromuscular dysfunction, hemolysis and cardiac toxicity. There is no direct antidotal therapy and treatment should focus on meticulous supportive care.

Keywords: Marine, Palytoxin, Inhalant

136. Starfruit toxicity in the absence of renal insufficiency: A case report

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Background: Starfruit (*Averrhoa carambola*) is cultivated and consumed for its unusual appearance and citrus flavor. Cases of starfruit toxicity have been described in patients with chronic or, less commonly, acute renal insufficiency and renal failure. Effects of starfruit toxicity include renal injury with acute oxalate nephropathy due to soluble calcium oxalate deposition, and neurotoxicity due to an unknown neurotoxin (AcTx). We present an unusual case of probable starfruit toxicity in a patient with normal renal function.

Case: A 53-year-old woman presented to an emergency department for intractable hiccups, agitation, nausea, bilateral hand paresthesias, and self-described "fuzzy thinking". The symptoms developed over the week prior to arrival, and the patient was evaluated for similar hiccups several days prior. She had no past medical history of persistent hiccups or neurologic complaints. On evaluation, the

patient was afebrile with normal vital signs. She had a normal physical exam and neurologic exam aside from persistent hiccups. On further history, the patient endorsed drinking several quarts of starfruit juice per day for the past three weeks, and her diet prior to this time period did not typically include starfruit. Evaluation in the emergency department included a normal ECG, urinalysis with no abnormalities and no crystals on microscopic evaluation, serum creatinine 1.1 mg/dL, BUN 19 mg/dL, serum potassium 4.4 mEq/L, and ionized calcium 1.2 mEq/L. She was treated with benzodiazepines and hydration, and she had resolution of hiccups and was discharged home with instruction to avoid starfruit ingestion.

Case discussion: Starfruit toxicity is rare. A rat model of starfruit toxicity has identified a nonproteic neurotoxin (AcTx) that inhibits GABA binding. Previous literature has described neurotoxicity including intractable hiccups (the most common finding associated with starfruit toxicity), paresthesias, altered mental status, seizures, and status epilepticus in patients with renal failure. Previous authors have suggested that toxicity could occur in patients with normal renal function who ingest extremely large quantities of starfruit as did our patient. A limitation of our case is the absence of toxin concentrations, although the presentation is consistent with previous toxicity descriptions.

Conclusions: While starfruit toxicity is rare, the diagnosis should be considered in patients with large ingestions presenting with persistent hiccups or neurologic complaints. Patients with suspected starfruit toxicity should have evaluation of their renal function, as patients with neurologic symptoms and renal failure may benefit from dialysis.

Keywords: Starfruit, Averrhoa Caramboia, Neurotoxicity

137. Seizure and vomiting with accidental ingestion of oil of RexallTM

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Background: Oil of RexallTM is an herbal liniment used to relieve muscle pain. This herbal preparation contains camphor and phenol and is rubbed into the skin. Camphor is well known to cause seizures in toxicity. Phenol, which is commonly found in topical skin products, can also cause seizures and gastrointestinal (GI) irritation when ingested. Concentrations of camphor in commercial products are limited to no greater than 11% by the Federal Drug Administration (FDA) and its use is discouraged by the American Academy of Pediatrics. A case of accidental ingestion of Oil of RexallTM is described.

Case report: A 4 year-old-boy presented to the emergency department (ED) with a witnessed generalized tonic-clonic seizure at home. He was being treated by his mother with Oil of RexallTM, an herbal supplement containing 10.8 % camphor and 4.7 % phenol, dermally to his chest, and RobitussinTM (unknown formulation) for a cough. The boy's grandmother, mistaking the Oil of RexallTM for Robitussin, administered the patient one teaspoon of the preparation. Realizing her error, she washed his mouth out and administered one teaspoon of RobitussinTM. Five minutes later, the child vomited and had a generalized tonic-clonic seizure that resolved spontaneously. Upon arrival to the ED the patient was at his baseline mental status with normal vital signs. Venous blood gas, serum electrolytes, liver enzymes, coagulation profile and lipase were within normal limits. Serum acetaminophen and salicylate levels were undetectable. Chest x-ray and electrocardiogram were normal. He was observed overnight and discharged home without any further incident.

Case discussion: Herbal liniment preparations containing camphor are a source of potential toxicity. Ingestion is the most common route of toxic exposure, with rapid onset of effects. Ingestion of phenol can also cause vomiting and seizures. In combination, these compounds may increase the incidence of seizure. This patient ingested one teaspoon of Oil of RexallTM, which contains both camphor and phenol, and experienced vomiting and a generalized seizure. Poison Centers recommend that patients who ingest more than 30 mg/kg of camphor be referred to the ED for evaluation. Assuming a density of 1 g/cm3, with one teaspoon equaling 5 grams of product, our 18.5 kg child ingested ~30 mg/kg camphor and 13 mg/kg phenol based on the history.

Conclusion: Oil of RexallTM is an herbal liniment containing phenol and camphor which can cause GI and neurotoxicity with as little as one teaspoonful. These products may work synergistically to increase the likelihood of seizure. It is important to consider formulations that are available over the counter when evaluating toxicity due to herbal preparations.

Keywords: Camphor, Seizure, Oil of Rexall

138. Poison center plant identification

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Background: About 10% of plant exposures reported to a poison control center (PCC) in 2011 were coded as "unknown plant". Correct plant identification (ID) is important for a more accurate risk assessment.

Objectives: To evaluate how callers to a PCC identify plants involved in exposure calls and identify PCC based tools to aid in plant identification.

Methods: A template was created for all plant exposures to document caller knowledge of the plant in question and to identify what tools were used to ID plant. The template was available for use for all human exposures involving plants from 4/1/2012 to 10/31/2012. SPIs collected the name of the plant, how the caller knew the plant name, and a description of the plant. Cases were excluded if the template for data collection was not used.

Results: A total of 633 plant exposures were documented between 4/1/2012-10/31/2012. The template was used in 309 (49%) and included in the analysis. The caller knew the name of the plant in 179 (58%) cases. The source of the plant name was caller's knowledge alone in 120 (67%), through use of internet in 24 (13%), with the help of a lay person in 15 (8%), the label in 12 (7%), the PCC website in 6 (3%) and a plant professional in 2 (1%). Of the 130 unknown plants, 62 (48%) were positively identified in collaboration with the PCC. In 53 cases the caller emailed the photo to the PCC resulting in 35 (66%) successful IDs. In 26 cases, the caller used the PCC website

resulting in 16 (61%) successful IDs. In 15 cases, callers conducted an internet search with the help of a SPI resulting in 7 (47%) successful IDs. In 1 case the caller took part of the plant to a nursery where it was identified. In 3 cases the plant was ID'd by SPI based on description and in the remaining 32 cases, no ID tools were used.
Conclusions: Most callers rely on their own knowledge to ID plants involved in exposures. Tools that may help ID unknown plants include SPI review of plant photo and plant websites. Successful identification of the plant leads to better risk assessments and more accurate substance coding.
Keywords: Plants, Poison center, Internet

139. Unusual marine poisonings after ingestion of Mediterranean sea figs of the Microcosmus genus

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Background: Mediterranean sea figs or sea violets of the *Microcosmus* genus are eaten in South-eastern France where these ascidians are a part of local seafood platters (marine animals also eaten in Italy, Croatia and Chile). Recent studies proved that tunicates are able to accumulate phycotoxins (1). In Croatia a human collective paralytic shellfish poisoning has been described in 2012 after a meal containing sea violets (2).
Case series: In January 2011, 6 adults shared a seafood platter near Narbonne. Two of them (men, aged 30 and 52 years) ate sea violets: in one hour diplopia, accommodation difficulties, ataxia, dizziness and diarrhea were reported lasting 20 hours in both patients. In December 2011, 2 women (70 & 78 years), 30 minutes after eating sea violets in Marseille complained of ataxia, dizziness, sweating, vomiting and diarrhea lasting 24 hours. In January 2012, a woman aged 55 years ate sea figs near Marseille inducing within half an hour diplopia, ataxia, vomiting and diarrhea lasting 24 hours. In March 2012, in a Marseille restaurant, colleagues shared a seafood platter (no alcohol during this professional meal). Two of them (men of 33 and 44 years) ate sea violets: in 30 minutes, they both experienced dizziness, headache and difficulty in walking lasting 24 hours. A similar case was report in Christmas 2012 in Marseille with a 60 years old man who ate several sea figs for this special feast meal.
Case discussion: The clinical picture reported by the 8 patients was homogeneous and different from other seafood poisonings with moderate digestive troubles and a cerebellar syndrome appearing 30 to 90 minutes after the Microcosmus ingestion. The responsible toxins are still unidentified but samples were taken during the first and the last episodes in order to analyze the implicated sea figs as soon as possible.
Keywords: Marine, Food poisoning, Poison center

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140. What's the cost of better joints? move free advanced leading to hepatotoxicity

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Background: Chinese Skullcap (*Scutellaria baicalensis*) and Black Catechu (*Acacia catechu*) have demonstrated in-vitro anti-inflammatory properties resulting in their incorporation into arthritis supplements such as Move Free Advanced (MFA). Within the literature, in-vitro studies have shown that Skullcap can lead to hepatoxicity via idiosyncratic immunologic reactions as well as hepatocyte apoptosis due to cytochrome P450 mediated activation of its diterpenoids.
Case report: A 46 year old male with a past medical history of arthritis and gout presented to the emergency department with the complaints of episodic fevers to 40.3°C, nausea and non-bilious, non-bloody emesis that have been present for the last 5 weeks. These episodes prompted 2 hospital admissions in which no infectious (viral hepatitis, HIV, EBV and CMV) or malignant causes were identified. During these hospital stays, there was complete resolution prior to discharge. On his last admission, the patient considered an association between MFA, his arthritis supplement, and his illness. Prior episodes occurred after 2–3 doses of MFA, but on this presentation it took only one dose for symptoms to resume. He denies feeling symptoms in the absence of supplements and he indicates that supplement consumption has ceased during all hospitalizations. Social history is significant for occasional alcohol use, but he denies tobacco consumption and illicit drug use. Physical exam was notable for tachycardia and fever. Laboratory abnormalities included a transaminitis (AST = 137 U/L and ALT = 55 U/L) and bilirubinemia at 4 mg/dL. MFA was stopped on hospital admission. On day 3, ALT peaked at 120 U/L, bilirubin peaked to 4.3 mg/dL, but by discharge all hepatic enzymes were down trending.
Case discussion: Previous cases in the literature have described hepatitis occurring after the use of MFA which contains Chinese Skullcap and Black Catechu in a proprietary formulation. In these three cases, elderly women were noted to have markedly elevated liver enzymes after starting MFA within 3 weeks of presentation. Upon discontinuation of the supplements, liver enzymes returned to the normal range. This case describes the first male patient to suffer from elevated liver enzymes in the context of MFA exposure.
Conclusions: This is the first report of a male experiencing hepatotoxicity after using Move Free Advanced. Further studies will be needed to identify the particular agent responsible for hepatotoxicity.
Keywords: Hepatotoxicity, Move Free Advanced, Skullcap

141. Yellow oleander toxicity caused by naturopathic use for weight loss

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Background: Yellow oleander (Thevetia peruviana) is known to contain the cardioactive steroid thevetin which inhibits cellular

Na+/K+- ATPase. Ingestions of yellow oleander are most commonly reported in cases of intentional self-harm in Southeast Asia. Brady- and tachydysrhythmias are the manifestations of life threatening cardiotoxicity. We report a case of cardiotoxicity following ingestion of a fragment of yellow oleander seed purchased in the United States from a natural practitioner treating for weight loss in the Mexican community.

Case: A 30-year-old Hispanic female presented to the Emergency Department with vomiting and diarrhea nine hours after ingesting part of a nut. This nut was identified by the patient as "codo de fraile" and obtained at a Mexican herbal store for constipation and weight loss. The patient was noted to have sinus bradycardia with heart rate 30–60 beats per minute (bpm), occasional premature supraventricular complexes, and hypotension with systolic blood pressure (SBP) 70–80 mmHg. Her electrocardiogram had QRS and QTc of normal duration and did not show ST segment changes typical of cardiac glycoside toxicity. She was not found to have electrolyte abnormalities. Digoxin concentration was <0.3 ng/mL, however the assay used at our institution is not known to cross-react with other cardioactive steroids found in plants. She was treated with intravenous fluids and repositioning. She was then admitted to the Medical Intensive Care Unit (MICU). She received one dose of activated charcoal with sorbitol. The patient did not require atropine or cardiac pacing. Digoxin-specific antibody fragment administration was deferred, as the patient tolerated the bradycardia and she improved to SBP 120–140 after fluid administration. The patient was observed in the MICU for 36 hours and did not suffer additional arrhythmias. She was discharged in sinus rhythm with a pulse of 79 bpm and BP of 120/74, asymptomatic.

Case discussion: Manifestations of yellow oleander ingestion include abdominal pain, vomiting, diarrhea, and a variety of dysrhythmias. Activated charcoal reduces systemic absorption of thevetin and enhances elimination by interfering with enterohepatic circulation. Severe yellow oleander toxicity has been treated successfully with digoxin-specific antibody fragments, though in this case they were not necessary.

Conclusions: Consumption of Yellow oleander, which contains the cardioactive steroid thevetin, is well documented to cause lethal dysrhythmias, especially in suicidal ingestion. Clinicians should note that its seed is marketed as a weight loss supplement and laxative in certain Latino communities with potential toxicity as illustrated by this case.

Keywords: Cardiac glycoside, Herbals, Plants

142. Toxic Internet

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Background: Monkshood (or aconite) is very popular Chinese herb used for musculoskeletal pain. It is recognised that aconite has very narrow therapeutic index and hence is toxic in inexperienced user. For the same reason, aconite has long been used as a poison in either suicide or murder cases. We report a case of aconite poisoning in suicidal patient.

Case report: A 52 years old man researched suicide methods on the internet and decided to take aconite as it was quoted as a "queen of poisons". He was found drowsy by his wife and transfered to the hospital by paramedics. On arrival patient felt dizzy and numb all over his body. His initial assessment was normal however his pulse rate varied from 66 to 180. Venous blood gas showed hyperkalemia of 8.2 mmol/L and treatment with Calcium Gluconate and dextrose-insuline infusion was initiated. Subsequently patient developed laibile blood pressure and was given Intralipid 20% and Sodium Bicarbonate. He was admitted to Intensive Care Unit and required inotropic support overnight. Patient was discharged 48 hours after admission.

Case discussion: This patient presented with well recognised symptoms of aconite poisoning and was treated with Intralipid as part of the novel treatment protocol. He recovered fully. This case, as far as we are aware, is the first documented case of Intralipid use in aconite poisoning.

Conclusion: Poisoning with herbal preparations is uncommon in the UK and is likely to become even less so with recent european legislation. Aconite toxicity is more commonly seen in Asia and would be quickly recognised by a physician there. With the advent of the internet era however, the actively suicidal or the deliberately criminal can research uncommon or highly toxic compounds. Plants with significant toxicity are often more freely available than pharmaceutical medications. Physicians need to be aware of significantly toxic plant poisons even if they are not geographically common in their place of work.

Keywords: Plants, Cardiac toxicity, Internet

143. A case of antimuscarinic toxicity from lupini bean ingestion

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Background: Lupini beans are known to result in antimuscarinic toxicity when improperly prepared. We present a case of antimuscarinic toxicity associated with lupini bean consumption.

Case report: The patient is a 35 year-old physically-fit Asian-American male who presented to the Emergency Department (ED) complaining of blurred vision, dry mouth, and palpitations. He also had difficulty initiating urination but was ultimately able to void. He had eaten a half-cup of lupini beans with breakfast approximately 90 minutes prior to symptom onset. The patient reports he had purchased the beans from an organic grocery store chain and prepared them according to the grocer's instructions. The instructions were to soak the beans in salted water overnight, then rinse and boil in fresh water for 3 hours before consumption. Upon arrival to the ED, he had a heart rate of 94, blood pressure 152/93, and temperature 97.3°F. On exam, he had mydriasis (7mm pupils) and dry mucous membranes. His exam was otherwise unremarkable. He denied illicit drug use or ingestion of other known antimuscarinic agents. He was observed in the Emergency Department for several hours with gradual improvement in symptoms. Vital signs showed improved heart rate of 65. He was ultimately discharged home without intervention.

Case discussion: This patient presented with symptoms of antimuscarinic toxicity in the setting of recent ingestion of lupini beans. These beans are the bitter seeds of the *Lupinus albus* plant, a member of the Leguminosae family. They contain high levels of quinolizidine alkaloids, which must be removed through an extensive debittering process. This process involves repeatedly soaking and boiling the beans in water that is changed frequently to discard

the leached alkaloids. This process typically takes a minimum of 4 days. Our patient followed instructions provided by the grocer, which were insufficient in adequately removing the antimuscarinic alkaloids from the beans prior to consumption.
Conclusions: Lupini bean ingestion is an uncommon cause of antimuscarinic toxicity. Food suppliers must be aware of this potential for poisoning and advise their customers in the proper preparation of lupini beans.
Keywords: Anticholinergic, Plants, Ingestion

144. Pediatric antimony toxicity treated with succimer

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Background: Little information is available about the clinical effects of excessive body burden of antimony or the management of this situation. Recently, some production lots of a liquid zinc product used widely in the complementary-alternative medicine approach to autism were discovered after distribution to have excessive antimony content. A child receiving this product from one of these lots had documented elevated levels of antimony, which improved with chelation.
Case report: A 14 year old, 75 kg, boy with autism was being treated with a liquid zinc supplement. One bottle from which he was being treated was subsequently recalled by the manufacturer due to its excessive antimony content, thought to have originated from the stevia sweetener used as an excipient in the product. The child's behavior regressed, based on maternal report, while on this product from the recalled lot. The use of this product was discontinued by his mother, who then sought toxicology attention. A 24 hour urinary antimony level showed 266 μg/L (lab normal, 0–9 μg/L). A course of oral succimer was administered as 700 mg three times daily for 5 days, followed by an additional 700 mg twice daily for 5 days. The boy's behavior improved after chelation, though not fully back to his baseline. A subsequent 24 hour collection for urinary antimony obtained several days after the end of the course of succimer, on a similar diet as that eaten during the previous collection period, was 5 μg/L (lab normal, 0–9 μg/L).
Case discussion: Succimer appears to be effective at mobilizing antimony and decreasing the body burden of this heavy metal. In this case, antimony toxicity appeared to be manifest as behavioral regression in a child with autism. Further corrobation is needed to arrive at an optimal management strategy for people with an excessive body burden of antimony.
Conclusions: There is limied information about the human effects of elevated body burdens of antimony. In this case, succimer chelation appeared to be effective in reducing the body burden of antimony, both from a clinical perspective and from lab data.
Keywords: Chelation, Pediatric, Antimony

145. Cardiac manifestations during treatment with ibogaine

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Background: Ibogaine is an alkaloid from the *Tabernanthe Iboga* shrub. It has traditionally been used in religious rituals, but recently proposed for use in treatment of addiction. Though the mechanism has not yet been fully elucidated, it is thought that ibogaine and the active metabolite noribogaine interacts with several different neurotransmitter receptors including mu and kappa opioid receptors. However, the use of ibogaine for treatment of addiction has been limited by reports of adverse cardiac effects, including prolonged qtc and ventricular arrhythmias due to inhibition of cardiac hERG/IKr potassium channels.
Case report: A 55-year-old woman traveled to Mexico to undergo treatment with ibogaine for management of withdrawal from buprenorphine. She presented to an emergency department upon her return to the United States with hallucinations, hypovolemia, and electrolyte abnormalities including hypokalemia and hypomagnesemia. Her calcium level was normal. On ECG, her QTc was prolonged at 630 msec. Her electrolytes were replaced and over the course of the next several hours her QTc trended down to <500 msec. She did not experience any cardiac arrhythmia.
Discussion: Currently, ibogaine is classified as a schedule I drug in the United States. Due to the relative unavailability and unaccepted medical use of ibogaine in the United States, patients may not be well-educated regarding the potential adverse effects of this drug, leaving them at increased risk for cardiac toxicity such as prolonged QTc and dysrhythmias.
Conclusion: Ibogaine is increasingly being used in certain patient populations for treatment of addiction; it is important to consider this drug in patients presenting with cardiac related toxic effects such as prolonged qtc or ventricular arrhythmias, or in patients reporting to take an herbal compound for treatment of addiction.
Keywords: Cardiac toxicity, Herbals, Substance abuse

146. Paralytic shellfish poisoning: A case series

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Background: Descriptions of outbreaks of paralytic shellfish poisoning (PSP) are rare in the medical literature. The wide distribution of shellfish as a food product makes the ability to recognize PSP important to providers regardless of location.
Case report: Seven patients presenting with symptoms of PSP shortly after eating mussels. Four patients were admitted to the hospital. One required endotracheal intubation. Symptoms reported by the patients included; peripheral paresthesias (7/7), nausea (5/7), vomiting (4/7), diarrhea (3/7), ataxia (3/7), weakness (2/7), and shortness of breath (1/7). A 62 year old female developed dysarthria, a floating sensation, and became weak. She was intubated and ventilated for 24 hours. All patients made a rapid and full recovery.

Saxitoxin levels were measured at 6250 micrograms per 100 grams of shellfish meat.
Case discussion: Paralytic shellfish poisoning (PSP) develops after consumption of shellfish contaminated with saxitoxin and can produce rapidly progressive muscle paralysis with the need for ventilation.

PSP is a growing problem worldwide. Saxitoxin is produced by dinoflagellates and concentrated in the flesh of filter feeding mollusks, including clams, oysters, and mussels. Dinoflagellate blooms are commonly called "red tide," but can occur with other color changes in water (green, brown, or yellow) and toxic levels of saxitoxin can occur in clear-appearing water.

Victims of PSP develop gastrointestinal distress and neurological symptoms, ranging from circumoral paresthesias and tingling of the extremities to ataxia, dysphagia, and changes in mental status. Only two of our seven patients described the characteristic sensation of "floating" or dissociation. Most patients recover without treatment, but weakness may rapidly progress to respiratory paralysis and asphyxiation. There are no antidotes and treatment is supportive.

The summer of 2012 was unique with many days of sun and light wind in Puget Sound. This promoted the growth of *Alexandrium*, a toxic algae that produces saxitoxin.

Conclusions: Patients with shellfish poisoning most often present in coastal locations. However, the wide distribution of shellfish as a food product makes knowledge of shellfish poisoning syndromes, especially PSP, important to providers regardless of their location.

Climatic conditions promoting the growth of algae that produce saxitoxin may be becoming more common, increasing the worldwide risk of PSP.

The prompt recognition of cases of paralytic shellfish poisoning can prevent complications and death in individual patients, and provide an opportunity to limit the impact of an outbreak by coordinating investigation and intervention with the local health department.

Keywords: Marine, Neurotoxicity, Public health

147. Zinc-Containing denture adhesives, toxicity and causal inference

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Background: Copper (Cu) is a metal and essential trace mineral that is required for the normal activity of numerous enzymes and is essential for normal hemoglobin synthesis and neurologic function. Its deficiency can manifest as anemia and leukopenia with myelodysplastic manifestations and a neurodegenerative syndrome. Excessive zinc (Zn) intake is associated with copper deficiency, and there is concern that misuse of Zn-containing denture adhesive may cause copper deficiency. The purpose of this investigation was (1) to summarize and analyze the current epidemiological literature that associates the use of Zn-containing denture adhesives with hematopoietic and neurologic abnormalities and (2) alert physicians and others to the possible hematologic and neurologic effects associated with zinc-containing denture adhesives but masquerading as other maladies.

Methods: A PubMed literature search was conducted linking the terms, zinc, copper, and denture adhesives/creams to hematological or neurologic toxicity.

Results: The current body of literature consists of 14 case reports describing 27 patients. 22 patients used excessive amounts of denture adhesive. All cases had hypocupremia; 25 also had hyperzincemia and 9 had low serum ceruloplasmin. Myeloneuropathy generally involved an initial ascending sensory neuropathy followed by ataxia, wide-based gait, loss of balance and limb weakness (distal greater than proximal); all patients developed difficulty walking. 26 cases presented with concurrent hematologic abnormalities: anemia in 12, leukopenia and/or neutropenia in 8, and pancytopenia in 11. Myelodysplastic syndrome was diagnosed in 4. Copper supplementation and discontinuation of Zn-denture adhesive corrected the hematological abnormalities, including the myelodysplastic changes, returned serum Cu and ceruloplasmin to normal values, and reduced or returned Zn concentrations to normal values. In most cases the myeloneuropathy stabilized but did not objectively improve.

Conclusions: Using a recently published framework the causal relationship between excessive use of Zn-containing denture adhesive leading to hyperzincemia, secondary hypocupremia and reduced serum ceruloplasmin, reversible hematologic abnormalities, and myeloneuropathy falls into the category of "uncertain" with high biological plausibility but weak epidemiological evidence. Individuals presenting with hematologic abnormalities such as anemia with neutropenia, myelodysplastic syndrome, and myeloneuropathy should be examined for copper and zinc status. These studies also suggest that copper deficiency can masquerade as myelodysplastic syndrome.

Keywords: Essential trace metals, Denture Adhesive, Myelodysplastic syndrome, Myeloneuropathy

148. Made to deliver: a comparison of lead contamination in imported and non-imported spices

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Background: Although early human civilizations used lead in daily cooking, we now know that lead is a serious contaminant. Many US studies have reported lead poisoning in children and pregnant women who had used imported spices and ethnic products. The US Food and Drug Administration (FDA) is overwhelmed by the sheer amount of imports arriving at US shores; they are only able to inspect $<2\%$ solely by sensation and without laboratory analysis. Sri Lanka is the eleventh leading exporter of spices in the world, and retains the same position for US spice imports. More recently, a ban on lead-based paint was passed in Sri Lanka, and lead awareness prompted an evaluation of the country's curry powders.

Objectives: To compare lead concentrations between imported and non-imported spices, atomic absorption spectrophotometry (AAS) was conducted on powders purchased in Sri Lanka and imported into the US.

Methods: Three commonly used spices in Sri Lanka (curry powder, turmeric powder and chili powder) were collected in a random market-basket survey of 14 randomly selected districts representing seven of the nine provinces of Sri Lanka. Two convenience samples of curry powder purchased in the US and originating from other countries, were sent to Sri Lanka by air for analysis. All of these samples were assigned numerical identifiers prior to being sent to the laboratory where they underwent AAS. Blanks and standards for appropriate instrument calibration and measurement

accuracy were utilized. Acid digestion of the samples in a lead-free vessel produced an analytical solution, and the lead concentration of this sample was measured. Two different laboratories validated the results.

Results: Among local Sri Lankan samples, the mean lead level was 0.055 mcg/g, with a maximum level of 0.087 mcg/g. The two samples obtained from the US had higher lead concentrations—1.979 and 10.145 mcg/g.

Conclusions: Local Sri Lankan samples were found to have lead levels below the FDA action level of 0.5 mcg/g, whereas US samples exceeded this level. These preliminary results suggest that manufacturing but also exportation processes should be evaluated in causing lead contamination. Further studies are needed to assess larger and more representative samples of imported and non-imported spices from all countries involved in the trade.

Keywords: Adulterant, Lead, FDA

149. Severe hyperkalemia associated with household fertilizer ingestion

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Background: Many household fertilizers contain nitrogen, phosphorus and potassium. They are considered relatively harmless. However, large ingestions could have life-threatening consequences.

Case report: A known 62 y.o. schizophrenic woman was brought to an outpatient clinic after drinking a whole 567 gram bottle of Miracle-Gro® LiquaFeed® all purpose plant food concentrate 12-4-8. Time of ingestion not specified. She had vomited once but was now symptom-free with normal vital signs. The poison control centre (PCC) was called and she was discharged with instructions to go to the hospital if she vomited again. Two hours later, a physician called the PCC: the patient was under his care after a new vomiting episode and she was being treated for hyperkalemia at 9.8 mEq/L with obvious signs on the ECG. Other relevant laboratory values were: sodium 150 mEq/L, BUN 94 mg/dL (33.6 mmol/L), creatinine 1.15 mg/dL (88 µMol/L), hyperchloremic acidosis (chloride 123 mEq/L, bicarbonate 18 mEq/L). Serum phosphate, calcium and magnesium, done 4 hours later, were normal. With calcium and insulin, her ECG took 1 hour to normalize but her kalemia did so over 8 hours. Her hyperchloremic acidosis improved but persisted, probably because she was medicated with topiramate.

The product's material safety data sheet (MSDS) mentioned « this material is not considered hazardous by the OSHA Hazard Communication Standard» and « this product contains the following non-hazardous ingredients: Urea, Potassium phosphate, Potassium chloride, with Manganese- and Zinc-EDTA micronutrients». Furthermore, the manufacturer provided by email a more detailed composition including boron, copper, iron and molybdenum.

Discussion: This case is a good illustration of the risks associated with misusing « harmless » products, especially via large ingestions. Furthermore, it reminds us that the ingredients listed on the product's label don't necessarily match the exact composition. Thus, it is advisable to consider that if the label states "Guaranteed minimum analysis: Soluble Potash (K_2O) 8%", this stipulates over 45 grams of potassium are available – for a plant OR a human being – in the 567 grams of the product. This, despite such a fact not being clearly specified on the container and even if the ingredient K_2O itself is absent. This holds true for phosphate as well, since phosphorous pentoxide (K_2O_5) is not present in the actual product. Other ingredients could also have their own toxicities.

Conclusion: Serious poisonings can occur when ingesting household fertilizers, especially if the amount is very large. It would be easier to optimally manage these cases if the exact ingredients were stated on the label.

Keywords: Ingestion, Intoxication, Cardiac toxicity

150. Button batteries: potential for burns shown in a hotdog model

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Background: Button batteries are found in many household items. As a result, these 'bite-size' batteries are often within the reach of children and present an attractive hazard. A recent case of a child expiring after ingesting such a battery led to our investigation into the pathogenesis of the injury which produces life-threatening consequences.

Case report: A 3 year old male was well until he vomited bright red blood and became unresponsive; EMS transported the patient to the hospital. He arrived in asystole cardiac arrest, with blood around his nose and mouth with continuous Pediatric Advanced Life Support. Despite PALS, he expired.

At post mortem, a button battery was found impacted the esophagus at the level of the transverse aorta. There was a fistula connecting the esophagus and aorta, with the esophagus packed with bright red blood, and with gastric content of dark colored large blood clots. The small and large bowels are also found to be packed with darkly colored stool.

Methods: We attempted to recreate the battery injury in the laboratory using a variety of button batteries and a frankfurter model of tissue destruction. A blister pack of common batteries of different sizes (.9 cm to 3 cm), voltages (1.5 v to 3 v) and types (Lithium and alkali oxide) were placed into beef franks that were slit in the middle to simulate the tissues of a collapsed esophagus. The hot dog was in constant contact with both sides of the battery for the duration of the 6 hours. The area was irrigated with 3 milliliters of normal saline to approximate physiologic fluids, every 30 minutes. At the end of the trial, the batteries were removed, and the slit cut down to halve the section of frankfurter. The temperature, length and depth of the charred surface of the hot dog that was in contact with the battery was measured.

Results and Conclusion: All the batteries tested caused charring, increasing damage correlating to the increasing size of the battery. Voltage did not seem to make any difference to the size of the charring. Temperature also was stable for all the models and did not seem to contribute to the damage observed. Further studies may include longer interaction times with more physiologically accurate models that will allow for measurement of voltage and temperature changes.

Keywords: Battery, Foreign body, Death

151. Intentional pine-sol inhalation injury leading to a hemorrhagic pneumonitis

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Background: Pine oil is distilled from conifer trees of the genus pinus. Alpha-pinene, its active ingredient, is easily absorbed from the gastrointestinal (GI) tract. Pine oil is also a volatile compound with low viscosity, making aspiration a frequent complication.
Case: A 31 year old female with no known past medical history presented to the hospital two days post cesarean section with complaint of chest pain and dyspnea. She was initially diagnosed with post partum cardiomyopathy. However, her subsequent echocardiogram demonstrated a normal ejection fraction and her basic natriuretic peptide was not elevated. She remained dyspneic with diminished oxygen saturations in the low 90s even on supplemental oxygen. Five days following initial hospital admission she continued with dyspnea and low oxygen saturations. Subsequent bronchoscopy revealed diffuse alveoloar hemorrhage. She had no findings consistent with other end organ pathology. Upon repeat questioning the patient finally admitted to huffing Pine-Sol® daily throughout all three trimesters of her pregnancy.
Case discussion: The active ingredients in Pine-Sol® include pine oil (10–20%), isopropyl alcohol (4–7%), and alkyl alcohol ethoxylates (2–6%). There are scattered cases in the literature of pine oil causing a pneumonitis with an associated A-a gradient following ingestion. Brooks et al (1989) describe 22 patients with intentional pine oil ingestion and found that pneumonitis was the most common complication after GI irritation and lethargy. Alveolar hemorrhage and necrosis also have been seen on autopsy in a patient who intentionally ingested a cleaning product containing pine oil. Turpentine which contains alpha-pinene as its main ingredient has been reported to cause a hemorrhagic cystitis. This is the first reported case of chronic pine oil inhalation abuse causing symptomatic alveolar hemorrhage.
Conclusions: Inhalation abuse of pine oil containing products may result in hemorrhagic pneumonitis. A patient presenting with hemorrhagic pneumonitis should be questioned regarding the possible use of inhalant abuse.
Keywords: Huffing, Inhalant, Abuse

152. Pattern of toxicity in patients poisoned with PPD among Sudanese population

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Background: Paraphenylenediamine (PPD) is available in Sudan in the form of pinkish grey powdery lumps commonly added to Henna (Lawasonia Alba) in the preparation of ornamental dyes applied to the hands and feet of ladies. Hair dye formulations available worldwide commonly contain PPD at a concentration ranging from 2 to 4 percent (1). In contrast, this chemical is sold in Sudan as a raw material of almost of 97% purity. Suicidal ingestion of PPD, or accidental massive exposure via skin absorption, is known to result in a severe clinical syndrome of laryngeal edema, rhabdomyolysis and subsequent renal failure, neurotoxicity and acute hepatitis. Because tracheotomy is the common life saving procedure and the main treatment for patients poisoned with PPD, almost all of the patients are initially treated in ENT (Ear, Nose, and Throat) hospitals.

Table. Results for abstract number 152.

Year	Number of Cases	Exposure			Mortality
		Tracheotomy	Suicidal	Accidental	
1995	45	13	30	15	12
1996	77	40	52	25	15
1997	85	30	55	30	9
1998	95	51	74	21	11
1999	278	82	185	93	23

Objective: The goal of this study was to examine the pattern of PPD intoxication in Sudan in terms of incidence, intentional versus accidental exposure, and mortality.
Methods: After the study had been approved by the committee on research and ethics, two physicians retrospectively reviewed medical files for patients admitted with PPD exposure in the ENT hospital of Khartoum, a tertiary care referral center. Study was limited to the years 1995–1999, a 5 year period for which data was most complete and accessible.
Results: 580 patients were admitted in the hospital in this five years period, the following table demonstrates the pattern of exposure. Approximately 82% of all exposures occurred among females. About 70% had suicidal intent. Percentage of deaths among cases was 12%.
Discussion: Ingestion of PPD appears to be increasingly more common as a means of suicidal poisoning in Sudan, particularly among females. This may be a consequence of its widespread availability in an inexpensive and concentrated form. There are few epidemiological studies worldwide of this potentially fatal intoxication, which may possibly be prevalent in other developing African and Asian countries where skin ornamentation with Henna is practiced.
Conclusion: In view of the escalating trend of poisoning by this commonly available agent, additional research is warranted regarding its detection, treatment, and prevention.
Keywords: Death, Ingestion, Neurotoxicity

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153. Neuropathic itch syndrome associated with mercury toxicity

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Background: Chronic organic mercury poisoning is associated with painful peripheral neuropathy characterized by demyelination of nocioceptive fibers. Neuropathic itching is infrequently described. Neuropathic Itch Syndromes typically result from non-toxicological demyelinating injury. We present a case of neuropathic itching as the initial manifestation of organic mercury toxicity.

Case report: In preparation for elite sports competition, a 26 year-old female triathlete consumed 3–4 ounces of fish three times per day from March to September 2012. In August, she noted "bruises" on her lower extremities. Intense itching developed as the skin lesions transitioned to papules. Dermatologic consultation resulted in multiple treatments for presumed infestations and allergic reactions despite unremarkable skin scrapings and negative patch testing. Her papules resolved but intense pruritis persisted. She then developed diffuse persistent burning in her extremities. Additional symptoms included episodic nausea, headache, fatigues, and dysgeusia. In October, testing revealed a whole blood mercury value of 92 μg/L (ref range: <10). MRI of the brain was unremarkable. Skin biopsy of the affected area revealed diminished sweat gland nerve fiber density consistent with small fiber polyneuropathy.
Case discussion: Neuropathic itching has been described in non-toxicological small-fiber demyelinating diseases, such as diabetes and multiple sclerosis. Pruritus is mediated by the same thinly myelinated A-delta neurons that transmit pain. Dysfunction of these nocioceptive small-fibers results in small-fiber polyneuropathy (SFPN). Diagnosis of SFPN is based on characteristic distal-leg skin biopsy with immmunolabeling, revealing diminished epidermal and/or sweat gland nerve fiber density. Chronic organic mercury toxicity is classically associated with sensory polyneuropathy - often painful paresthesias of the extremities. Sural nerve biopsies in organic mercury-poisoned patients reveal demyelination and axonal degeneration. However, the peripheral neuropathy of organic mercury poisoning is considered a large-fiber axonopathy. Our patient's histopathology reveals evidence of small-fiber injury. Her mercury exposure may have preferrentially damaged small A-delta nocioceptive fibers -resulting in pruritus - to a greater degree than the larger axons typically inured in mercury-associated painful sensory neuropathy.
Conclusion: We present the first case of organic mercury associated neurop[athic itch syndrome with histopathologic correlation. Toxicologists should consider pruritus a symptom of SFPN in the context of elevated whole blood mercury values.
Keywords: Mercury, Neuropathy, Neurotoxicity

154. Maternal-Fetal Lead Poisoning From Pottery Pica Treated with DMSA and Exchange Transfusion

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Background: Pediatric lead exposure typically occurs due to factors in the environment in which the child lives. Pica during pregnancy places the mother and fetus at risk of exposure. We present a case of severe maternal and fetal lead poisoning associated with premature delivery of the infant.
Case report: A 36-year-old woman at 31 weeks gestation presented to the ED with hip pain and premature rupture of membranes. She was oriented and complained of bone pain and nausea and vomiting. She had arrived in the United States from Mexico 2–3 months prior and had been eating pieces of Mexican pottery daily. CBC showed Hct 27.4% and basophilic stippling. Maternal blood lead level (BLL) was 183 mcg/dL, zinc protoporphyrin (ZPP) 326 umol ZPP/mol heme (Ref. Range: 30–80 umol ZPP/mol heme). Succimer was administered; 5 days after succimer BLL was 72.3 mcg/dL. She delivered a premature infant 72 hours post initiation of succimer therapy. At delivery, the infant weighed 1.87 kg with Apgar scores of 8–9. Cord BLL was 93 mcg/dL, ZPP 171 umol/mol heme, Hct 45.8%. A double exchange transfusion was performed 12 hrs after delivery. Twelve-hour post-transfusion BLL was 50.2 mcg/dL. Succimer was begun 72 hrs post-delivery at 350 mg/m2 three times daily for 5 days, then twice daily for 14 days through a nasal-gastric tube. An MRI of the brain showed no lead storage. Succimer was tolerated well; neonatal BLL was 31 mcg/dL at discharge, 8 weeks post-delivery. At 6 months of age, infant's weight 6.8 kg (19th percentile), Hct 37.6 and BLL 37.1 mcg/dL. She appeared healthy with normal motor movement and strength. Mother was lost to follow-up.
Case discussion: Maternal and fetal lead poisoning was associated with pica involving clay pottery. Maternal lead encephalopathy was notably absent despite extremely high BLL. Elevated ZPP suggested the exposure was chronic. Exchange transfusion lowered the neonatal BLL by 46%; the 31 week infant tolerated oral succimer. Depending on the trimester when the exposure occurred, serious impact on fetal development may occur.
Conclusions: Pregnant women with a history of pica should be assessed for lead exposure. Exchange transfusion was effective in lowering neonatal blood lead in this case.
Keywords: Lead, Pediatric, Chelation

155. Malaysian diaper powder as a source of elevated blood lead

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Introduction: Though the majority of childhood lead exposure in the U.S. results from ingestion of lead-based paint dust, non-paint sources are increasingly implicated. We present a case of elevated blood lead (EBL) in a 9 month-old infant due to a Malaysian folk remedy.
Case report: An infant girl born in the United States to a Malaysian father and Taiwanese mother had an elevated screening capillary blood lead level (BLL) of 18 mcg/dL (CDC reference <5 mcg/dL) at her 9-month health supervision visit. Confirmatory venous BLL four days later was 13 mcg/dL. Her zinc-chelated protoporphyrin levels, CBC and iron studies were normal. She was asymptomatic with normal past medical and developmental histories; she was not yet independently mobile. Though she exhibited age-appropriate hand-mouth behavior, there was no history of pica. Environmental history was negative for residential lead hazards; the family's home was built in year 2000. Further history revealed that parents were applying a non-commercial diaper powder solely to her vaginal area once or twice weekly. Four weeks after discontinuing its use, the infant's venous BLL fell to 8 mcg/dL. The powder was produced by a Malaysian corner store/pharmacy and sent by a relative. Quantitative analysis indicates the pale yellow powder contains 62% lead. Mineralogical analysis confirms the powder is largely composed of lead monoxide (litharge), and also contains magnesium carbonate and the magnesium silicate mineral talc. Scanning electron microscopy shows all particles measure less than 250 μm, the EPA-designated size below which hand-mouth transfer can occur, and many are of respirable sizes ($<2-5$ μm).

Discussion: In Latin American and Asian cultures, powders containing lead oxides are used as folk remedies or traditional medicines for skin care. Lead oxides have been implicated in cases of EBL internationally and among Hispanic children living in Rhode Island. A prospective cohort study of Chinese children showed a statistically significant dose-response relationship between lead powder use and BLL. Though some inorganic lead can be absorbed via dermal tissues including mucosae, our patient was likely exposed through hand-mouth transfer, inhalation of airborne powder and swallowing of lead particles cleared from the respiratory tract, contamination of foodstuffs, and contact with contaminated surfaces. To our knowledge, this is the first case of EBL due to Malaysian infant diaper powder brought into the United States.
Conclusion: Folk remedies including skin care products are a potential explanation for EBL in childhood, particularly in children for whom no residential source of lead is discovered.
Keywords: Lead, Pediatric, Environmental

156. Chronic neurologic complaints in two patients exposed to high levels of fipronil

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Background: Fipronil is a relatively new but commonly used phenylpyrazole insecticide that acts as a noncompetitive blocker of the GABA-gated chloride channel. Prior studies have shown acute exposure to fipronil to be associated with mild temporary health effects; animal studies have shown chronic exposure can lead to seizures. However, minimal data on human toxicity exists. We present two patients with chronic neurologic symptoms following exposure to fipronil.
Case Reports: A family home was treated for termites with a commercially applied termicide containing fipronil. Due to incorrect application, a large amount seeped into the living area, visibly soiling the floor of the home. Shortly after application, the family dog developed hindquarter paralysis and was euthanized. All members of the family experienced generalized malaise and acute respiratory irritation, which subsided within days of removal from the environment. However, the 37-year-old male developed headache, frequent syncope, and short-term memory loss. His symptoms resolved 1 week after removal from the environment, but recurred 1 year later upon revisiting the house. The 9-year-old son had a previous history of frequent eye blinking and mood disorder. After exposure to fipronil, he developed tic-like movements, seizure activity, and a depressed affect. His symptoms gradually improved throughout one year, however, upon re-exposure 1 year later, his symptoms acutely worsened. Fipronil was found in the dirt surrounding the home at 183 ppm (comparable literature value after similar use, 0.032 ppm).
Discussion: Fipronil acts on the relatively selective GABA neuronal receptor at GABA gated chloride channels, resulting in excessive neuronal stimulation. CNS over-excitation leads to death in the target insect. This CNS stimulation may cause seizures acutely and the frequent abnormal movements noted in the case above. The reported half-life of fipronil is several days, and a highly active metabolite lasts for further days, supporting the possibility of chronic symptoms after large exposure.
Conclusions: Our two patients demonstrated chronic neurologic effects after exposure to very high levels of fipronil. These two cases support potential chronic toxicity after acute exposure to high levels of this new insecticide.
Keywords: Fipronil, Insecticide, Neurotoxicity

157. Methemoglobinemia secondary to benzocaine application to Ostomy site

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Background: Methemoglobinemia may occur after exposure to certain xenobiotics. Significant symptoms associated with increasing methemoglobin (metHgb) levels are due to cellular hypoxia which include CNS depression, seizures, acidosis and levels $>70\%$ may be fatal. We present a case of severe methemoglobinemia in a patient following an accepted dose of topical benzocaine.
Case report: A 4 year-old female (18kg) presents to pediatric ED from surgery clinic with altered mental status, hypoxemia, and cyanosis. In clinic she had her g-tube exchanged, during which topical anesthesia with 2cc of 20% benzocaine (400 mg) was placed on the stoma. Ten minutes later she developed acute confusion and respiratory distress (O2 saturations in the low 80 s on 15 L/M NRB mask). Exam revealed cyanotic skin, nails, and lips, heart rate of 167 bpm and respiratory rate of 48 breaths/min. Remainder of the exam was unremarkable. She was intubated and placed on 100% FiO2 with O2 saturations consistently in the high 80s. Her metHgb level was 74%. She was given 2 sequential methylene blue (MB) doses of 1mg/kg over 5 min and approximately 1 hour later repeat analysis showed a metHgb level of 23%. Her diffuse cyanosis resolved, replaced by a rosy pink color to her lips, cheeks, and nail beds. She was transferred to the PICU where she was given a third MB dose (1mg/kg) for a metHgb level of 20%. Her metHgb level 3 hours later was 4%. She was extubated uneventfully on hospital day #1 and transferred out of the PICU on hospital day #3.
Case discussion: MetHgb is an altered state of hemoglobin (Hgb) where iron is oxidized into the nonfunctional ferric state (Fe^{3+}) from the normal ferrous state (Fe^{2+}). Oxygen is unable to bind Hgb which results in a functional anemia. In this patient with baseline Hgb of 10.5g/dL, a metHgb level of 75% creates a functional anemia (3g/dL), thus explaining her rapid onset of altered mental status. The administered benzocaine dose is generally well tolerated and methemoglobinemia is typically not encountered unless larger doses (>22–40mg/kg) are administered. With application to a relatively new gastrostomy tube stoma, higher absorption may have occurred. Treatment for methemoglobinemia is securement of the ABCs initially and methylene blue as an antidote. MB facilitates the reduction of metHgb by NADPH metHgb reductase.
Conclusion: Severe methemoglobinemia from benzocaine application during a therapeutic procedure resulted in severe diffuse cellular hypoxia and metHgb level of 74%. Rapid recognition of methemoglobinemia and treatment with MB resulted in timely

reduction of metHgb levels and prevented severe long-term sequelae from this potentially fatal metHgb level.
Keywords: Methemoglobin, Methylene blue, Pediatric

158. Pretty flower, ugly consequences: ingestion of piers japonica by a two-year old female

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Background: Pieris Japonica (Andromeda Japonica), from the Ericaceae family, contains grayanotoxin, a diterpene and sodium-channel toxin. Poisoning occurs from eating any part of the plant and may include gastrointestinal, cardiovascular and neurologic toxicity. We report a case of Pieris Japonica ingestion by a 2 year-old child resulting in significant clinical effects.
Case report: A normally healthy 2 year old female consumed a cluster of budding flowers from a Pieris Japonica Shrub. Soon after, she had profuse vomiting, continuous sneezing, and drowsiness. Her mother noted up to 20 buds in the child's vomitus. The child was transported by her father, an EMS technician, and presented to an ED with lethargy, cold clammy skin, vomiting and bradycardia. Her heart rate was in the low 60s. The child barely responded to intraosseous needle placement. An IV fluid bolus of 60 cc/kg was given and a dose of atropine, 0.02 mg/kg was delivered. The heart rate improved to the 140s; her BP was 76/36 mm Hg and temperature 34° C. A nasogastric tube was placed and produced a large amount of hematemesis. The child was started on Zantac and an antiemetic. After she was stabilized, she was transferred to the P.I.C.U. and monitored over night. By morning she was awake, alert, tolerating fluids and food without further vomiting. Heart rate remained in the 90 s-110 and she was discharged home.
Case discussion: The patient's clinical presentation is atypical of most pediatric accidental ingestions of a plant containing grayanotoxin, although emphasizing the potential for toxicity with significant exposure. Though the kinetics of grayanotoxin ingestion in humans have not been studied, the rapid presentation of symptoms, within 1 hour, indicates rapid absorption, similar to cases of "mad honey" disease, from the ingestion of grayanotoxin-contaminated honey. With aggressive supportive treatment, patients usually recover with no sequelae.
Conclusion: The majority of plant exposures in young children are associated with absent or minimal clinical effects. This case illustrates the potential of significant toxicity after grayanotoxin ingestion by children, requiring aggressive supportive care.
Keywords: Ingestion, Plants, Pediatric

159. Carbon monoxide poisoning among recreational boaters

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Background: Carbon monoxide poisoning has previously been reported in the setting of recreational boating. However, the incidence, epidemiology, and characteristics of carbon monoxide poisoning among recreational boaters in the United States has not previously been reported.

Table 1. Carbon Monoxide-Related Recreational Boating Accidents, Injuries and Deaths Per Year.

	Mean	95% Confidence Interval
Accidents	14.5	12.1–16.9
(Percent of all recreational boating accidents)	(0.29%)	(0.24–0.34%)
Injuries	30.9	22.4–39.4
(Percent of all recreational boating injuries)	(0.90%)	(0.66–1.14%)
Deaths	6.7	4.5–9.0
(Percent of all recreational boating deaths)	0.95%	(0.63–1.27%)

Table 2. Carbon Monoxide-Related Accidents, Injuries, and Deaths by Vessel Type.

Vessel Type	Accidents*	Injuries*	Deaths*
Cabin Motorboats	49	123	29
Open Motorboats	46	45	12
Houseboats	27	73	9
All Other Vessel Types	6	3	4

*Accident and death totals are for the full nine-year study period (2002–2011), while injury data was reported for only the eight most recent years (2003–2011).

Methods: We undertook a study of United States Coast Guard recreational boating data from the most recent 10 years available (2002 – 2011) to determine the incidence, epidemiology, and characteristics of carbon monoxide poisoning among recreational boaters. Regression analysis was performed to determine statistical significance for trend.
Conclusions: Carbon monoxide-related recreational boating accidents constitute an uncommon but important cause of injury and death each year in the United States.
Results: The mean and 95% confidence interval for carbon monoxide-related boating accidents, injuries, and deaths per year are reported in Table 1. Regression showed no overall linear trend in the number of carbon monoxide-related boating accidents, injuries, or deaths as an absolute number or as a percent of all boating accidents, injuries or deaths over the study period. The vast majority of carbon monoxide-related boating accidents, injuries and deaths occurred with cabin motorboats, houseboats, and open motorboats (Table 2). Among other vessel types, auxiliary sailboats accounted for 4 carbon monoxide-related boating accidents and 3 deaths, pontoon boats accounted for 1 accident and 1 death, and personal watercraft accounted for 1 accident and no deaths over the study period.
Conclusions: Carbon monoxide-related recreational boating accidents constitute an uncommon but important cause of injury and death each year in the United States.
Keywords: Carbon monoxide, Environmental, Epidemiology

160. Two cases of carbon monoxide toxicity due to mud bogging

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Background: "Mud bogging" is a form of off-road motorsport popular in the United States. The goal of this sport is to successfully

drive a vehicle through a pit of mud. The recent death of a cast member on MTV's Buckwild, David Gandee, from carbon monoxide (CO) toxicity demonstrates the dangers inherent in such activities. We describe two cases of CO toxicity from mud bogging.
Case Series: 1) A healthy 16-year-old girl presented to an outside emergency department (ED) after passing out while riding in the passenger side of a Jeep™ stuck in mud hole. She and her companion were mud bogging. While the driver attempted to free the vehicle from the mud, she became slightly lightheaded and nauseated. She subsequently experienced a headache and lost consciousness. The patient and driver of the car were pulled out by the driver's father. Upon arrival to the ED, the patient's vital signs were within normal limits. The laboratory evaluation was remarkable only for 14% carboxyhemoglobinemia on co-oximetry. The patient was transferred to a tertiary care center for hyperbaric oxygen (HBO) therapy. She received one HBO treatment at 2 atmospheres without complications. She was then discharged home without symptoms after declining further HBO treatments.

2) A healthy 18-year-old man was transferred to our tertiary care center after passing out while mud bogging. He was the driver of the Jeep™. Upon arrival to the ED, the patient's vital signs were within normal limits. The laboratory evaluation was remarkable only for 18.5% carboxyhemoglobinemia on co-oximetry. He received one HBO treatment at 2 atmospheres without complications. He was then discharged home without symptoms after declining further HBO treatments. Of note, his father stated that they were aware of the possibility of CO toxicity due to word of mouth, but did not think it would happen to them.
Discussion: CO toxicity is a result of incomplete combustion of hydrocarbons. Any vehicle whose exhaust is occluded is a potential source of CO exposure.
Conclusions: Mud bogging is associated with CO toxicity. We recommend portable CO detectors for any person that participates in an off-road activity that may lead to occlusion of their exhaust pipe and subsequent CO toxicity.
Keywords: Carbon monoxide, Mud Bogging, Public health

161. Twisted sisters: the carbon monoxide toxicity that wasn't

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Background: Clustered symptoms, such as headache, vomiting, and vague neurologic symptoms in carbon monoxide (CO) exposure, suggest a common toxin. Carboxyhemoglobin levels are often unavailable, and clinical suspicion often guides management. In this series, we report three sisters transferred from a rural hospital for CO toxicity. Their history betrayed the true exposure.
Case report: 3 sisters ages 3, 5 and 5, were transferred from a rural hospital for CO toxicity. The mother reported 1 week of headaches in her children. The children described acute nausea and intractable vomiting on arrival to an aunt's home that afternoon, unchanged by prochlorperazine. Relatives sharing space with the children denied similar symptoms. Outside workup revealed moderate leukocytosis and normal metabolic panels in all three patients. The elder children suffered brief seizures prior to transfer; additional medication exposures were denied. Accompanying blood samples were sent for carboxyhemoglobin content.

Table. Approximate 10 hour bupropion levels.

Serum drug level	5 yo	5 yo	3 yo
bupropion (ref: 50–100 ng/mL)	220	138	< 10
hydroxybupropion (ref: 600–2000 ng/mL)	4808	4151	714

On arrival, the patients were tachycardic but otherwise vitally normal. Both elder children were incontinent of urine. All were markedly mydriatic and variably agitated. All had gait instability; one child actively hallucinated. All remained altered until admission, nearly 10 hours past presumed exposure.

Parents were pressed separately regarding additional history. The mother's fiancé confided that she was "on the highest dose" of bupropion XL; she admitted to finding this out of place. One of the 5-year olds endorsed finding the pills and feeding them to herself and her sisters.

The children were admitted to the pediatric intensive care unit with child protective services and poison center input. Carboxyhemoglobin levels were normal, and the three were discharged the next day. 9 days later, bupropion and hydroxybupropion levels returned markedly elevated (Table).
Case discussion: This cluster of pediatric bupropion overdoses was complicated by seizure activity and missed diagnosis. The initial diagnosis of CO toxicity led to transfer to a hyperbaric center, but serial inquiries by staff in light of an incongruous clinical setting led to the diagnosis. Early discordance between symptomatic patients and asymptomatic relatives was highly suggestive of an exposure other than CO, and subsequent history gathering made the diagnosis.
Conclusion: History matters in the workup of potential exposures. This case demonstrates both the importance of accurate history-taking and the effect of premature closure in clinically significant bupropion toxicity.
Keywords: Pediatric, Antidepressant, Triage

162. Effects of hydroxocobalamin on measured carboxyhemoglobin under physiological and pathological conditions

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Background: Carbon monoxide poisoning is a leading cause of toxin-induced death in the US, with the majority of fatalities related to fires. In fires, cyanide is also liberated from the incomplete combustion of household products, and if inhaled, can lead to rapid death. Since cyanide poisoning is difficult to identify and requires immediate treatment, pre-hospital empiric hydroxocobalamin (B12a) administration is advocated. B12a interferes with the accuracy of measured carboxyhemoglobin (COHb) but this relationship is poorly defined. This study describes the in vitro effects of B12a on measured COHb in human blood using two different co-oximeters at both physiologic and pathologic COHb levels.

Methods: Venous blood was collected from 3 healthy, non-smoking volunteer donors. Samples were incubated with high concentrations of CO to reproduce pathologic COHb levels. Samples from three ranges of COHb (< 3%, 25–30%, and 40–55%; n = 3, 1, and 2, respectively) were 'spiked' with B12a at reported therapeutic concentrations (250–4000 mg/L) to simulate CN antidote treatment. COHb levels were measured in triplicate using two common commercially available blood gas analyzers with integrated co-oximetry, the Siemens Rapidpoint 500 and the Radiometer ABL 700, and reported as mean ± SEM; Clinical significance was defined as a > ±5% change in measured COHb with B12a administration.

Results: RAPIDPOINT B12a caused a dose-dependent false decrease in measured COHb levels at all baseline COHB levels. At lower COHb concentrations, B12a caused a greater decrease on measured COHb. The addition of 2,000, 2,500 and 3000 mg/L of B12a to a blood sample containing 29.5 ± 0.21% COHb significantly reduced the measured COHb to 17.6 ± 0.59%,12.2 ± 0.38% and 9.3 ± 0.31%, respectively.

RADIOMETER The effect of B12a on measured COHb depended on the background COHb level. B12a (2000 mg/L) caused a dose-dependent increase in measured COHb at normal physiologic COHb from 1.31 ± 0.12 to 5.97 ± 0.14 at 0 mg/L. At 3000 mg/L there was no significant effect at a baseline COHb level of about 30% (28.1 ± 0.06% and 28.9 ± 0.0). However 2000 mg/L B12a decreased a baseline COHB of 51.3 ± 2.2 to 42.3 ± 10.3.

Conclusions: B12a interfered with measured COHb in human venous blood at physiological and pathological COHb levels; this effect depended upon the individual co-oximeter, the COHb level and the B12a concentration. In one replicated scenario hyperbaric oxygen may have been withheld due to a false lowering of measured COHb. Our findings emphasize the importance of obtaining COHb levels on blood collected prior to B12a administration, as well as clinician awareness of errors associated with B12a administration.

Keywords: Hydroxocobalamin, Carbon monoxide, Laboratory

163. The acute laboratory and clinical effects of active and passive group indoor water-pipe (Narghile) smoking

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Background: Group indoor water-pipe smoking (WPS), especially in coffee shops, has been increasing worldwide. Objective: Comprehensive laboratory and clinical evaluation of the effect of active and passive indoor group WPS.

Methods: Prospective study comparing pre- and post-30 minute active and passive group indoor WPS. Outcome parameters: carboxyhemoglobin (COHb), nicotine, and cotinine; complete blood count; cardio-respiratory and clinical parameters; exhaled breath condensate (EBC) cytokines and endothelial function only in active smokers. Statistics: Student's *t*-test, Wilcoxon, Fisher exact, ANOVA, and Neuman–Keuls where relevant.

Results: Sixty-two volunteers were included; age 24.9.6 ± 2 years, 47 active and 15 passive smokers. COHb increased post-active WPS (2.0 ± 2.9% *vs.*17.6 ± 8.8%, $p < 0.00001$); >25% in six (12.7%) subjects, >40% in two (4.2%). Plasma nicotine increased post-active WPS (1.2 ± 4.3 *vs.*18.8 ± 13.9 ng/mL, $p < 0.0001$), plasma cotinine, and urinary nicotine and cotinine significantly increased. EBC IL4, IL5, IL10, IL17, and gamma interferon significantly decreased post-active smoking; endothelial function did not change. WPS was associated with cardio-respiratory changes, decreased visual analog score (VAS) of general feeling and clinical symptoms. In passive smokers COHb increased (0.8 ± 0.25 *vs.* 1.2 ± 0.8%, $p = 0.003$), respiratory rate increased, and VAS decreased.

Conclusions: One session of group indoor active WPS resulted in significant increases in COHb and serum nicotine (8- and 18-fold, respectively), and was associated with adverse cardio-respiratory health effects. The minor effects found in passive smokers suggest that they may be subjected to some adverse effects of WPS. Our results call for interventions to limit the continuing global spread of WPS in coffee shops.

Keywords: Carbon monoxide, Nicotine, Water-pipe

164. Geriatric poisonings called to a regional poison center

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Background: The uniqueness of geriatric poisoning is incompletely characterized and is potentially under-appreciated. The objective of this project was to characterize geriatric toxic exposures in our state and to determine whether geriatric toxic exposures differ from the types of exposures otherwise encountered by the general population.

Methods: A comparative analysis was performed to determine whether geriatric exposures (those involving individuals ≥65 years) differed from those of the general adult population. The data studied was from the case database of a single regional poison center. This center has statutory statewide designation and is the only regional poison center for the state. All adult human exposures cases called to the center from 2009 through 2011 were logged by specialists into a SQL database, and all were included in the analysis. Variables of greatest interest included patient (Pt) age, substance, intent of exposure and medical outcome.

Table. Suspected suicide accounted for 50% of the reported geriatric deaths (abstract number 164).

Pt	Substance Class					Intent		Outcome	
Age	Sedative Hypnotics	CV drugs	Anti-depressants	Analgesics	Opioids	Suicidal	Unintentional	Severe Illness	Death
18–64	10.35%	3.59%	7.26%	13.58%	2.57%	25.66%	17%	3.15%	0.21%
≥65	3.89%	14.38%	2.82%	8.43%	1.91%	3.47%	51%	2.21%	0.23%

Results: Of 39,990 documented human exposures during the study period, 12% occurred in geriatric patients and 2.33% were in the advanced elderly (≥ 85 years). Women accounted for 64.4% of cases.
Conclusion: Significant differences exist between exposures in the geriatric and the general adult population in this center's region, in terms of substance category and reason for exposure. A better appreciation of the unique poisoning profile of the geriatric population could lead to better targeting of educational resources and may better guide prevention efforts.
Keywords: Geriatric, Poison center, drug exposures

165. Illicit marketing of prescription drugs: report of an overdose and a city-wide market survey

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Background: Prescription drugs can be purchased from unlicensed vendors in markets serving ethnic minority populations. We report a case of life threatening cinchonism due to illicit purchase of chloroquine, which triggered a survey of local markets to determine which other medications are being sold without a prescription.
Case report: A 44 yo Hmong female presented with abdominal pain and vomiting 30 min after ingesting 20 pills in a self-harm gesture. She presumed that the pills were acetaminophen and denied any co-ingestants. Initial vital signs were normal and electrocardiogram (ECG) showed normal sinus rhythm at 81 bpm, PR interval 204 ms, QRS 130 ms and QTc 455 ms. Within minutes, she became hypotensive to a systolic blood pressure (BP) of 84 mm Hg, which did not resolve with 3L NS bolus. Four 50 mEq NaHCO3 boluses were given with improvement in BP. Serum labs were significant for K 2.8 mmol/L, Mg 1.8 mg/dL, and negative for acetaminophen, salicylate, digoxin and ethanol. 2.5 Hours after arrival, family brought in the medication which was purchased from the same market vendor. It was identified as 250 mg tabs of chloroquine phosphate. Repeat ECG showed a QRS 114 ms and QTc 588 ms. K and Mg were repleted and she was admitted to the intensive care unit without further complications. A plasma chloroquine level at 9 hours after ingestion was 530 ng/mL (toxic at > 600 ng/mL). By the next day, her ECG normalized and she was cleared for psychiatric evaluation. We identified local markets selling illegal prescription medications through patient referrals, referrals by other emergency department employees, and internet searches. Four markets were visited, of which 3 had booths selling prescription medications. Thirty five different prescription medications were identified, five of which are listed as discontinued drug products by the FDA (diphenidol, phenacetin, metamizole, phenylbutazone, and sibutramine). Antibiotics were the most common medication being sold (14/35, 40%), followed by analgesics (5/35, 14%), antihypertensives, topical steroids, antihyperglycemics, oral contraceptives, intramuscular contraceptives, oral steroids, antiemetics, muscle relaxants, anorexiants, ovulatory stimulants, antispasmodics, antitussives, and bronchodilators.
Conclusions: A wide variety of prescription medications and five drugs listed as discontinued by the FDA are available in markets serving our community's ethnic minorities. Health care workers should be aware of this public health risk, which can result in serious toxicity as described in this case of inadvertent chloroquine overdose.
Keywords: Public health, Cardiac toxicity, Surveillance

166. US poison center recommendations for HBO in the treatment of CO poisoning

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Background: Carbon Monoxide (CO) poisoning is a leading cause of fatal poisonings. We queried US poison control centers (PCCs) on practice recommendations for Hyberbaric Oyxgen Therapy (HBO) in the treatment of CO exposures.
Methods: A 10-item computerized questionnaire was developed and mailed to the managing and medical directors of American Association of Poison Control Center (AAPCC) member PCCs from Oct 2012 through Mar 2013. Descriptive statistics were performed on the collected data.
Results: 43 of 57 PCCs (75%, 73% of US population) responded. HBO was recommended in the treatment of CO poisoning by 38 centers. Number of recommendations for HBO per year by PCCs were <= 5 (50%), 6–10 (21%), 11–20 (18%), > 20 (3%), and unknown (8%). CoHb levels in asymptomatic patients were not used in determination for HBO by 12 PCC; 13 use a level > 25%,7 use > 30%, and 6 a level > 40 as indication. Pregnancy with a level > 15% was regarded as absolute criteria for HBO by 2 centers. PCC recommended HBO up to 6hours by 13 centers, 6 use a limit of 12 hours, 5 use a limit of 24hours and 14 use no time limit following brief (< = 1hour) CO exposures. Following prolonged exposure (> 1hour), 5 centers recommend HBO up to 6hours following exposure, 6 use 12hours, 11 use 24hours, while 16 use no time limit. HBO trained provider available for consultation was reported by 14centers (37%). Distance to the nearest HBO chamber and associated delays in treatment was reported by 27 centers (71%) as a significant determinant in whether HBO was recommended. Additional clinical scenarios are presented in Table.
Conclusion: HBO in the treatment of CO is recommended by the majority of PCCs; typically less than 10 times per year. There are centers that never recommend HBO, however. Indications for HBO (COHb levels, history, physical findings, etc) are not uniform among PCCs. Distance to a HBO chamber and delays to treatment were described as a significant determinant of whether HBO was recommended.
Keywords: Carbon monoxide, Hyperbaric Oxygen, Poison center

Table. Clinical Scenario # of centers recommending HBO.

Adult unconscious, COHb 9.5	33
Adult initially unconscious, arrives awake, assymptomatic, normal examination, COHb 9.5	24
Adult, COHb 9.5, Assymptomatic, no loss of consciousness	0
Adult, no loss of consciousness, COHb 9.5, headache and dizziness	1
Adult, no loss of consciousness, COHb 9.5, EKG suggestive of acute ischemia	23
Adult, no loss of consciousness, COHb 9.5, ataxia	25
Adult, no loss of consciousness, COHb 25, normal neurological examination, Assymptomatic	16
5 year old, CO level 10, assymptomatic	3

Table. Results for abstract number 167.

Level of Familiarity	Cap	Stem	Gills	Ring	Cup/volva	ID at least one toxic species	ID both toxic species
Little or none (N = 61)	53 (87%)	58 (95%)	49 (79%)	35 (57%)	32 (52%)	3 (5%)	0 (0%)
Low (N = 27)	25 (93%)	26 (96%)	25 (93%)	19 (70%)	18 (67%)	3 (11%)	0 (0%)
Moderate (N = 20)	20 (100%)	19 (95%)	20 (100%)	18 (90%)	16 (80%)	3 (15%)	0 (0%)
High (N = 8)	8 (100%)	8 (100%)	8 (100%)	6 (75%)	6 (75%)	0 (0%)	0 (0%)

167. FUNGUS AMONGUS- Testing the Public's Ability to Identify Mushrooms.

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Background: Identifying potentially poisonous mushrooms over the telephone can be a difficult task for poison specialists. Risk assessment is ultimately dependent on the ability of callers to provide details regarding the color and anatomical features of the given mushroom. This study was designed to test the public's capacity to correctly identify mushroom anatomical parts and toxic vs. non-toxic mushroom species.
Methods: A booth with a variety of poisonous and non-poisonous mushrooms was set up at a public park during an annual mycological society "fungus faire". Random, voluntary participants were asked: to estimate their level of mushroom familiarity (high, moderate, low, little or none); to look at a large mushroom specimen and point to the: cap, ring, cup, gills, stem; and to identify the 2 toxic species (clitocybe illudens (Omphalotus olearius) and Entoloma Ferruginans) out of a group of 6 mushrooms. Mushrooms were identified and chosen with the assistance of mycologists associated with the faire.
Results: Of the116 individuals surveyed, 61 had little or no familiarity with mushrooms, 27 had some, 20 had a moderate amount and 8 had a lot. (see Table)
Conclusions: Most individuals were able to correctly identify some of the important anatomical features of a mushroom, but not all. The majority of people, regardless of their level of familiarity could not identify both of the toxic specimens. Future educational efforts may need to focus on informing the public about local toxic mushroom species as well as mushroom anatomy so that callers to a poison center can properly describe the characteristics of an ingested mushroom.
Keywords: Mushroom poisoning, Public health, Poison center

168. Management of hydrofluoric acid ingestion with early aggressive calcium and magnesium supplementation

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Introduction: Hydrofluoric acid (HF) ingestions are associated with significant risk of morbidity and mortality. Hypocalcemia, hypomagnesemia, QTc prolongation, cardiac arrhythmias and gastrointestinal mucosa necrosis can occur.
Case report: A 44 year-old female presented to the emergency department (ED) 30 minutes after accidently ingesting approximately 30 mL of a mixed acid chrome cleaner containing 11.4% of 70% HF. She had one episode of emesis prior to ED arrival. She complained of severe epigastric and substernal chest pain but her airway remained patent. No abdominal free air was seen on chest x-ray. Six grams (g) of oral calcium carbonate (CaCO3), 2 g of intravenous (IV) magnesium sulfate (MgSO4) and 450 mg of IV calcium gluconate were administered within 2.5 hours of ingestion. The total calcium (Ca2+) decreased from 9.1 mg/dL to 7.1 mg/dL and the QTc interval prolonged from 459 msec to 487 msec within 2 hours of presentation despite Ca2 + and magnesium (Mg2+) supplementation. Additional calcium gluconate and MgSO4 IV boluses were administered and a continuous infusion of calcium gluconate 900 mg/hr was started. A total of 9 g of oral CaCO3, 10.2 g of IV calcium gluconate and 8 g of IV MgSO4 were administered within 12.5 hours of admission. Ca2 + and Mg2 + supplementation continued with serum levels in the upper normal range. Total Ca2 + and the QTc interval normalized within a few hours. Continued esophageal and epigastric pain were relieved with oral magnesium hydroxide. Two asymptomatic episodes of ventricular tachycardia (V Tach) occurred 96 hours after admission. Electrolytes, at that time, were normal and the QTc interval was narrow. No further episodes of ectopy were noted. Care was deescalated on hospital day 5 and she was discharged on day 7.
Case discussion: Both survival and fatal cases have been described after HF ingestions with a reported lethal dose of 20 mg/kg or 1.5 g. Our case ingested 1.6 times the reported lethal dose (32 mg/kg or 2.39 g) and did well. In several prior survival cases Ca2 + was given after profound hypocalcemia, ECG abnormalities and/or cardiac arrhythmias evolved. We initiated early, aggressive Ca2 + therapy prior to the development of these findings and initiated Mg2 + and intensified Ca2 + therapy once QTc widening and hypocalcemia were noted. No clinically significant arrhythmias developed. Hypocalcemia and QTc prolongation stabilized in a few hours. The delayed episodes of V Tach are perplexing, and its relation to HF ingestion is unlikely.
Conclusion: Early, aggressive calcium and magnesium administration are potentially life saving interventions with HF ingestions.
Keywords: Hydrofluoric acid, Ingestion, Calcium therapy

169. Adjunctive use of low dose intralipid associated with hemodynamic improvement in combined amlodipine and labetalol overdose refractory to standard therapy

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Background: Hypotension and bradycardia from calcium channel blocker or β-adrenergic blocker overdose can be refractory to traditional antidotes. Intralipid emulsion (ILE) is a novel rescue therapy for toxic ingestions of lipophilic medications. The recommended bolus dose is 1.5 mL/kg of 20% ILE over 1 minute, followed by an infusion of 0.25 mg/kg/min. We present a case of amlodipine (AM) and labetalol (LA) overdose with cardiovascular toxicity refractory to standard treatments that responded to adjunctive low dose ILE infusion and supportive care.
Case report: A 55 y/o 100 kg male presented with altered mental status after ingesting an unknown amount of AM and LA 2–5 hours before arrival. Initial vital signs were: BP 62/41 mmHg, HR 57 bpm, RR 12 rpm and SaO2 100%. The patient required endotracheal intubation for airway protection. He was treated with 2L normal saline, 9mg glucagon and infusion at 7 mg/hr, 4g calcium gluconate, 2g calcium chloride, and norepinephrine (NE) up to 40 mcg/min. Hyperinsulinemia-euglycemia (HIE) was titrated up to 250 U/hr. Four hours after arrival, the BP was 68/40 mmHg and HR was 55 bpm. Due to profound refractory hypotesion, 20% ILE infusion was initiated at 0.167 mg/kg/min and continued for 3 hours at an average dose of 0.25 mg/kg/min. Within minutes of initiating ILE the BP increased to 92/52 mmHg. Two hours after initial improvement, vasopressin (V), dopamine (DA), epinephrine (EP) and phenylephrine (P) were added to maintain hemodynamics. Four hours after ILE was discontinued, it was re-initiated at 0.167 mg/kg/min for 90 minutes. Five hours after 2nd ILE infusion, P and EP were discontinued. Over 20 to 40 hours from the 2nd ILE infusion, DA, V, NE were weaned in conjunction with a third low-dose (0.004 ml/kg/min) ILE infusion. The hospital course was complicated by transient acute kidney injury, but no other evidence of organ injury. Serum AM and LA levels from the initial blood sample were 140 ng/mL (ref. 3–11 ng/mL) and 1000 ng/mL (ref. 84–205 ng/mL), respectively.
Discussion: Treatment with ILE for combined AM and LA overdose has not been reported. The log P of AM is 3.0 and LA is 3.1 which make them amenable to treatment with ILE. In this patient, 0.167 mg/kg/min low dose ILE appeared to significantly improve BP after above therapies failed. ILE is typically considered rescue therapy during arrest or peri-arrest from cardiotoxic overdose. This case suggests ILE could be considered earlier as an adjunct rather than reserved for rescue only.
Conclusion: Early adjunctive use of ILE was associated with clinically significant improvement in blood pressure despite doses below standard recommendations.
Keywords: Lipid therapy, Calcium channel blocker, Beta blocker

170. One poison center's experience with lipid resuscitation therapy: frequency of recommendation and subsequent treating-physician administration during a one-year period

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Background: Lipid resuscitation therapy (LRT) refers to the administration of intravenous fat emulsion as treatment for lipophilic drug toxicity. Poison centers (PCs) track the recommendation and administration of 68 different therapies and antidotes. However, PCs currently do not have a mechanism to monitor LRT recommendation or subsequent administration. We sought to determine the frequency of LRT recommendation by a statewide PC and the subsequent administration by treating physicians.
Methods: This was a prospective observational study of human exposure calls to a single PC over a one-year period. A special call designation code was created in the PC's electronic database denoting LRT recommendation. Specialists in Poison Information (SPIs) were asked to code all instances of LRT recommendation using the designation, a practice equivalent to typical case coding procedures. The authors reviewed the PC charts of marked calls and abstracted demographic, exposure, clinical effect, and outcome information. Substances of exposure were categorized by drug classification. Data was analyzed using descriptive statistics.
Results: Data from December 1, 2011 to November 30, 2012 was analyzed. Among 64,776 human exposure calls, LRT was recommended in 7 cases (0.01%) and administered in 4 cases (0.006%). Median patient age was 54.5 years and 57% were female. The median number of exposure substances per case was 2 (range 1–6). The most common exposure substances were calcium channel blockers (N = 3), beta-blockers (N = 2), local anesthetics (N = 2), and antidepressants (N = 2). The most common clinical effects were hypotension (N = 6), bradycardia (N = 4), conduction disturbance (N = 3), and drowsiness (N = 3). Outcomes in the 7 cases were 1 death and 6 major.
Discussion: This data shows it is feasible for PCs to track LRT recommendation and administration, despite it being infrequently recommended. Limitations of the study include the possibility that not all instances of LRT recommendation were appropriately coded by SPIs. Case charts did not consistently include information about the patient response immediately after LRT administration, which precluded analysis of efficacy in these cases. Data on efficacy could potentially be included in PC charts if SPIs are trained to ask specifically about response after LRT.
Conclusions: LRT was an infrequently recommended treatment by our PC. Expanded PC tracking of LRT could potentially be used to better inform appropriate clinical use of this therapy and provide new information about the treatment's efficacy.
Keywords: Poison center, Lipid therapy, Antidote

171. Prolonged lipemia and pancreatitis due to extended infusion of lipid emulsion in bupropion overdose

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Background: Lipid emulsion is gaining popularity as an antidote for lipophillic drug overdose, and is generally considered safe at doses recommended for antidotal therapy. However one case of lipemia and one case of amylasemia have been reported following extended infusions of lipid emulsion. We report a case of asymptomatic pancreatitis following extended infusion lipid emulsion.
Case report: A 14 year-old female presented to the emergency department actively seizing after ingesting 9 g of bupropion and unknown amounts of hydroxyzine and citalopram. Lorazepam was given and she was intubated for airway protection. GI decontamination was performed with activated charcoal. Her QTc was initially

Table. Data for abstract number 171.

Day	Trigs (mg/dL)	Amylase (U/L)	Lipase (U/L)
1		38	33
2	>5000		
3	>5000	48	77
4	2877	89	291
5	368	125	471
6	203	47	142
7	160	48	120

527 ms, which was treated with potassium and magnesium. Sodium bicarbonate was administered for metabolic acidosis and QRS widening. Upon transfer to the pediatric intensive care unit, she seized again, which responded to midazolam, and developed worsening hypotension, which was treated with an epinephrine infusion. She subsequently developed a junctional cardiac rhythm and a lipid emulsion bolus was recommended. She received two 100 mL boluses which was associated with an improvement in her hypotension and conduction abnormalities. She was then started on an infusion of lipid emulsion at 0.25 ml/kg/min and received over 4 L (46 ml/kg) in less than 12 hours. Her blood was noted to be pink in color and viscous, which prompted the cessation of the lipid infusion.

Her toxicity resolved and she was extubated on hospital day 5. The lipemia complicated her blood and serum analyses and she had mild pancreatitis that resolved over several days. She was medically cleared and transferred to psychiatry on hospital day 9.

Case discussion: In our patient, the infusion of large doses of lipid emulsion resulted in lipemia, severe hypertriglyceridemia and pancreatitis. This is the third reported case of adverse effects from lipid emulsion therapy used for overdose.

Conclusions: Lipid emulsion infusion may carry greater risk of adverse effect than bolus administration. If the infusion is administered the dose and duration should be monitored closely with attention given to the blood characteristics and triglyceride level in order to prevent or mitigate unintended consequences such as the lipemia, elevated triglycerides and pancreatitis.

Keywords: Lipid therapy, Lipemia, Pancreatitis

172. Hydroxychloroquine overdose treated successfully with intravenous fat emulsion

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Background: Hydroxychloroquine (HCQ) is used primarily in the treatment of certain inflammatory disorders and for prevention and treatment of malaria. Overdose may result in altered mental status, seizures, coma, and quinidine-like cardiotoxicity. Intravenous fat emulsion (IFE), an antidotal therapy with proposed but not clearly elucidated mechanism of action, has been used in many overdose scenarios in both human case reports and animal studies but has not been used with success in the context of HCQ exposure. We report a case of hydroxychloroquine overdose treated successfully with IFE along with other standard therapies.

Case report: A 51-year-old woman presented to a rural emergency department (ED) 1–2 hours after ingesting 35 oxycodone/acetaminophen 5/325 mg tablets and 60 HCQ 200 mg tablets. The patient was drowsy with a blood pressure (BP) of 80/44 mmHg. She received naloxone, epinephrine (EPI) at 0.25 mcg/kg/min, and diazepam 150 mg. She was intubated and transferred by helicopter to a tertiary care center. En route the patient had a ventricular fibrillation arrest that resolved with 10 chest compressions. Upon tertiary ED arrival, the patient had repeated systolic blood pressures (SBP) in the 70's despite her EPI drip. A bolus of 20% IFE 100 mL was given with immediate hemodynamic improvement; within 5 minutes her BP rose to 115/66. EPI was weaned to 0.15 mcg/kg/min within 8 minutes of IFE bolus. Serum potassium returned at 2.2 mEq/L; ECG revealed large U waves. A vasopressin infusion was started at 0.04 U/min. Hypotension to systolic BP 70 was again observed, however this resolved with infusion of 900 mL of 20% IFE over 30 min. During this second IFE infusion the patient awakened and spontaneously opened her eyes, and additional sedation was required. Vasopressors were weaned off within 9 hours of initial IFE dosing and the patient was extubated neurologically intact 2 days later.

Case discussion: HCQ overdose can manifest rapidly with severe cardiotoxicity. This patient exhibited toxicity consistent with HCQ with poor response to standard therapies. IFE has not been successfully described in the literature for use in this scenario. IFE's proposed mechanism is mainly lipid sink, with efficacy relating to the drug's lipid solubility or the log P octanol/water partition coefficient. The log P of HCQ is >3, making it an ideal drug for IFE use. The use of IFE in this case was successful and could be considered for future overdose cases of HCQ. As the global burden of malaria is high exposures to HCQ are likely to continue.

Conclusion: This case demonstrates the potential usefulness of IFE in the context of hydroxychloroquine poisoning.

Keywords: Lipid therapy, Cardiac toxicity, Antibiotic

173. Delayed cardiovascular toxicity after inadvertent subcutaneous injection of bupivacaine successfully treated with intravenous fat emulsion

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Introduction: Inadvertent intravascular administration of local anesthetics (LA), particularly bupivacaine, results in significant morbidity and mortality. Intravenous fat emulsion (IFE) 20% is shown to be life-saving and is accepted as first line therapy in intravascular LA-induced cardiovascular collapse. We describe a case of delayed onset cardiovascular toxicity after an inadvertent subcutaneous injection of bupivacaine with successful use of IFE.

Case report: A 66 year old female was transported to the Emergency Department (ED) from an outpatient pain clinic. The patient inadvertently received a subcutaneous injection of hydromorphone 60 mg and bupivacaine 420 mg while having her intrathecal pump refilled. Initial central nervous system depression responded to 0.4 mg intravenous(IV) naloxone. After transport to the ED, approximately 30 minutes after the error was identified, the patient was awake and alert. A second dose of 0.4 mg IV of naloxone was required. Initial vital signs included: heart rate, 86 beats per minute; blood pressure, 199/120 mmHg; respiratory rate, 16 breaths per minute; 100% saturation on 100% non-rebreather. Fingerstick

glucose was 211 mg/dL. Initial electrocardiogram revealed a sinus rhythm with a QRS complex duration of 92 msec and QTc interval of 402 msec. 60 minutes after arrival, the patient had a generalized tonic-clonic seizure that responded to 2 mg intravenous lorazepam. Endotracheal intubation was performed due to declining mental status and respiratory rate. She became hemodynamically unstable with a systolic blood pressure of 60 mmHg with a heart rate of 81 beats per minute. ECG and cardiac monitoring revealed narrow QRS complexes. Sodium bicarbonate intravenously was empirically given. Dopamine was initiated for hypotension. IFE 20% 500 mL was given twice within the first 2 hours of ED presentation. Ice packs were applied every 20 minutes to the injection site. Once stabilized, the patient remained hemodynamically stable with a blood pressure of 96/69 mmHg and heart rate of 69 beats per minute. She was extubated the following morning and discharged to home without sequelae.

Discussion: We describe a case of delayed onset of toxicity of bupivacaine due to the subcutaneous route of administration successfully treated with empiric sodium bicarbonate infusion and IFE. Intravenous bupivacaine is well-described to cause rapid onset of cardiovascular collapse though SQ exposure is expected to cause more delayed symptoms. Conclusion: We describe successful use of IFE after a potentially catastrophic exposure to bupivacaine subcutaneously.

Keywords: Cardiac toxicity, Lipid therapy, Local anesthetic

174. Syncope and recurrent polymorphic ventricular tachycardia following loperamide misuse

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Introduction: We report three episodes in two adults of recurrent polymorphic ventricular tachycardia (PMVT) following loperamide abuse.

Case 1: A 43 year old female was admitted following syncope and PMVT. She reported ingestion of 140 tablets daily of loperamide 2 mg to prevent opioid withdrawal. She had recurrent PMVT requiring dozens of defibrillations, multiple medications including lidocaine, amiodarone, sodium bicarbonate and magnesium, and eventually required transvenous pacemaker for sustained control.

Cardiac catheterization was normal. There were no further episodes of PMVT and the patient was discharged well on day 5. Electrocardiogram (ECG) was normal with a normal QT interval. A serum loperamide level was sent however was not reported due to laboratory error.

Case 2: A 28 year old male with a history of Crohn's disease and depression was admitted following syncope and recurrent PMVT. His initial ECG revealed a QTc interval of 509 msec. He was treated with amiodarone and potassium supplementation and experienced no further arrhythmias. He was discharged after 4 days with a normal ECG (QTc 430 msec). One year later the patient was readmitted with syncope and prolonged QTc interval. The patient experienced recurrent episodes of PMVT over the first 16 hours unresponsive to magnesium, sodium bicarbonate and lidocaine. After multiple defibrillations control was achieved with a transvenous pacemaker with overdrive pacing. The patient subsequently reported chronic abuse of loperamide, up to 400–2 mg tablets daily for opioid withdrawal. He was discharged after 12 days with a normal ECG. A serum loperamide level on hospital day 1 was 130 ng/mL.

Discussion: Various internet sites discuss the use of loperamide for opioid withdrawal and an opioid substitute. Both patients reported escalating use of loperamide to ameliorate opioid withdrawal. Neither was using any other drug known to affect cardiac conduction at the time of these events. The use of a p-glycoprotein inhibitor such as quinine has been reported to enhance transport of loperamide into the brain. Our patients denied this and both had negative quinine levels. There is only one previously published report of ventricular tachycardia following loperamide abuse. A FDA Medwatch® query done through December 2012 reported only 3 other cases of ventricular tachycardia, arrhythmia or death with loperamide as the only substance. Loperamide plasma levels following therapeutic doses of 4 and 8 mg are 0.24 to 1.2 ng/mL, respectively. Our patient's level was four orders of magnitude higher.

Conclusion: Massive loperamide abuse may result in QTc prolongation and subsequent recurrent ventricular arrhythmias.

Keywords: Abuse, Cardiac toxicity, Substance abuse

175. Carbamazepine induced seizures and ventricular dysrhythmias

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Background: Carbamazepine (CBZ) is an anticonvulsant, which is also used for treatment of bipolar disorder (BPD) and neuropathic pain. Its anticonvulsant activity results from inhibition of sodium channels and NMDA receptors; muscarinic acetylcholine and adenosine receptor antagonism also occurs.

Case: 52 year-old woman with a history of BPD presented following an ingestion of CBZ (700 mg), fluoxetine (20–30 mg), aripiprazole (36 mg), diazepam (60 mg), trazodone (2400 mg), and ropinirole. EMS found her comatose with shallow respirations. Upon arrival in the ED, vital signs included a BP of 114/70 and HR 92. She was intubated and started on a propofol infusion.

Initial laboratory results included a lactate of 7.2 mmol/L and a CBZ level of 53 mcg/mL. The EKG revealed sinus tachycardia with a QRS of 110 msec.

In the ICU, 6 hrs after EMS was first contacted, the patient remained comatose. Serum CBZ = 83.2 mcg/mL and QRS was 122 msec. Urine drug analysis by GCMS revealed nicotine, cotinine, propofol, trazodone, caffeine, diphenhydramine (DPH), CBZ. Only the CBZ spike was large. Serum DPH was non-detected. The patient received 150 mEq of IV sodium bicarbonate (NaHCO3). The QRS narrowed to 108 msec, and she was started on a NaHCO3 infusion. Approximately 4 hours after arrival to the ICU she developed a generalized tonic clonic seizure, prompting the administration of 390 mg of phenobarbital. Upon termination of the seizure, a wide complex tachycardia without pulse developed. An additional 200 mEq of IV NaHCO3 was administered. Torsade de pointes followed, prompting the administration of magnesium sulfate. The patient continued to have wide-complex tachycardia alternating with a few minutes of spontaneous perfusing rhythm for the next

24 minutes. Intravenous lipid emulsion (ILE) therapy (1.5 mEq/kg) was bolused with termination of the dysrhythmias. A hemodialysis (HD) catheter was placed, and the patient was started on high-flux HD. One hour into HD, pre and post cartridge CBZ concentrations were 87.2 and 66.8 mcg/mL, respectively (flow 400). The patient was continued on HD for a total of 18 hours. In an attempt to remove the CBZ more rapidly, the patient was given a trial of plasmapheresis, for which she had 3277 mL exchanged. Because the clearance of CBZ did not appear to improve significantly during plasmapharesis compared with HD, HD was resumed.

The patient made a full recovery.

Conclusion: This case highlights the potential for CBZ to cause intraventricular conduction delay and arrhythmias, in addition to seizures and coma. This case is unique not only in the high peak CBZ concentration, but also in that the patient had resolution of the dysrhythmias temporally associated with the administration of ILE.

Keywords: Anticonvulsant, Lipid therapy, Electrocardiogram

176. A retrospective review of a US poison center's experience with dabigatran

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Background: Since its approval in 2010, dabigatran has been associated with bleeding rates in excess of predictions based on pre-marketing studies. While bleeding is expected, the lack of effective reversal is problematic. Because of the limited availability of epidemiologic data, we chose to describe dabigatran exposures reported to a single poison center (PC).

Methods: We retrospectively reviewed prospectively collected data on all dabigatran exposures reported to a single US PC. Abstracted data included date, exposure, context, age, gender, therapeutic interventions, and outcome.

Results: 68 dabigatran exposures were reported to the PC between 11/2010 and 3/2013. 34 (50%) were hospital-based calls and 34 (50%) were home calls. 24 (70.6%) of the hospital calls involved active bleeding. Of the remaining hospital calls, 4 (11.7%) involved extra doses of their own medication, and 3 (8.8%) were children exposed to a family member's medication. 2 (5.9%) were inquiries about possible toxicity associated with dabigatran in patients with kidney failure. One (2.9%) patient's dabigatran use was unrelated to the PC call.

Of the 24 bleeding patients, 16 (66.7%) were >75 years of age, 6 (25%) were between 70 and 75 years of age, and 2 (8.3%) were between 50 and 59 years of age. 2 (8.3%) were prescribed dabigatran for off-label reasons. 17 (70.8%) patients spontaneously bled, whereas 7 (29.2%) patients bled following trauma. 10 (41.7%) were noted to have kidney disease, though GFR calculation was not always possible due to limited data. 8 (33.3%) of the bleeding patients were maintained on at least 1 additional antithrombotic. The following treatments were given: transfusion, 9 (37.5%); cryoprecipitate, 1 (4.2%); FFP, 7 (29.2%); platelets, 3 (12.5%); prothrombin complex concentrates, 2 (8.3%); DDAVP, 3 (12.5%); Vitamin K1, 4 (16.7%). 4 (16.7%) of the patients underwent hemodialysis while 3 (12.5%) required emergent surgery. One (4.2%) of the bleeding patients died. 9 (37.5%) of the callers asked about antidote availability for their patients.

Sources of bleeding were: GI, 11 (45.8%); intracranial, 3 (12.5%); nasal, 3 (12.5%); retroperitoneal, 2 (8.3%); pericardial, 2 (8.3%); intramuscular, 2 (8.3%); intraperitoneal, 1 (4.2%); GU, 1 (4.2%), and pulmonary, 1 (4.2%). 2 patients bled from multiple sites.

Conclusions: This case series demonstrates significant morbidity associated with dabigatran. Risk factors for bleeding such as advanced age, kidney disease, off-label use, trauma, and co-administration of additional antithrombotics were prevalent in the bleeding subset of patients. Because of the lack of consensus regarding reversal, the treatments administered varied on a case-by-case basis.

Keywords: Anticoagulant, Adverse drug event, Poison center

177. Hemolytic crisis and methemoglobinemia following pegloticase infusion in a patient with normal G6PD activity

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Background: Although synthetic uricase was pioneered for tumor lysis syndrome, its indications have expanded to include severe refractory gout. Rasburicase, the first recombinant uricase to be approved by the FDA, causes hemolysis and methemoglobinemia (MetHb), primarily in patients with glucose-6-phosphate dehydrogenase (G6PD) deficiency. Pegloticase, a pegylated uricase with an extended duration of effect compared to rasburicase, is thought to pose the same risk. We report a case of severe hemolysis and MetHb after pegloticase administration in a patient, and subsequent treatment with plasma exchange.

Case report: A 38 year-old man with tophaceous gout and normal baseline G6PD activity was given pegloticase 8 mg IV. Over the following two days he became jaundiced, developed generalized weakness and malaise, and noted dark urine. He presented to the ED for evaluation. His blood pressure was 130/88 mmHg; pulse, 101/minute; and oxygen saturation, 81% on a nonrebreather face mask. He had scleral icterus and jaundice, without stigmata of liver disease. His left great toe metatarsal phalangeal joint was edematous, erythematous, and tender. His laboratory evaluation was significant for a white blood cell count of 44,000/microliter, hemoglobin 8.9 g/dL, AST 73 U/L, ALT 50 U/L, total bilirubin 7.2 mg/dL, indirect bilirubin 6.5 mg/dL, lactate dehydrogenase 1878 U/L, and methemoglobin 10.1%. He was transfused a total of three units packed red blood cells (PRBC) and given corticosteroids for the hemolysis. On hospital day (HD) #1 he underwent plasma exchange to clear pegloticase from the serum. He was initially given broad spectrum antibiotics for a septic joint and his left great toe joint fluid aspirate culture was positive for *Streptococcus pyogenes*. He was discharged home on HD #5 with a stable hemoglobin and improved bilirubin.

Case discussion: Rasburicase is associated with hemolysis, but only in patients with G6PD deficiency. We report a case of hemolysis and MetHb, following pegloticase in a patient with normal G6PD activity, possibly due to oxidant stress. The patient's infection may have provided an additional stressor. Due to the pegylation,

the uricase has a long half-life and small volume of distribution, prompting the use of plasma exchange to enhance elimination, which was reported in cases of hemolysis due to rasburicase.
Conclusion: While rasburicase is associated with adverse effects in patients with G6PD deficiency, we describe a case of hemolysis and MetHb following pegloticase administration in a patient with normal G6PD activity. This event was reported to the FDA.
Keywords: Adverse drug event, Enhanced elimination, Hemolysis

178. Longing to look good

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Background: In the past, dietary supplements not regulated by the FDA have demonstrated potential for consumer harm, as with the case of ephedrine. Consumers may mistakenly use supplements as ''safe'' alternatives to prescription medications, not realizing that supplements can have adverse effects as well.

We present a case of a female after taking the recommended dose of a new weight loss supplement developed progressive QTc lengthening.
Case: A 56-year-old female presents to the emergency department with tremors, headache, flushing, and nausea. She reports ingesting 2 tablets of a diet supplement (MethoxyBurn) 8 hours prior to arrival. Vital signs on arrival were: HR 94; BP 209/109 mmHg; RR 19; 98 % on RA; and 36.8C. Initial electrocardiogram (ECG) was normal sinus rhythm (NSR) at 83 BPM with a QRS of 88 and QTc of 517ms. Approximately 45 minutes later she developed bigeminy. The next ECG showed a QTc of 595 ms. Laboratory values included: K + 3.0; Mg 2.1; Phos 1.8. Two hours after arrival a repeat ECG showed a QTc of 619ms. She was admitted for monitoring. The QTc prolongation peaked at 634ms approximately 16 hours post ingestion. The following morning the ECG showed NSR at 58 BPM with a QTc of 475ms. Cardiology was consulted and felt that the electrical aberrations were likely related to the dietary supplement, not congenital or structural pathology.
Discussion: Ingredients listed in this supplement were: thiamin disulfide (30 mg), nicotinic acid (20mg), cyanocobalamin (500 mcg) and "Concentrated Energy Matrix" (392mg), which contained undisclosed amounts of various compounds including: caffeine, Ilex paraguariensis (yerma mate), and theobroma cacao seed. These herbal components have various levels of methylxanthine-like compounds. Methylxanthines possess adenosine antagonism, which some suggest may decrease potassium efflux leading to a prolonged QTc, however, there is limited evidence. However, tachycardia would be expected in this toxicity not bradycardia. It is concerning that the listed ingredients do not likely fully explain the persistent widening of the patient's QTc, however, with the return to baseline within 24 hours it is highly suggestive of a pharmacologic effect. It is possible the patient had an unknown underlying QT prolongation syndrome that was brought out upon use of this supplement.
Conclusions: Unregulated health supplements continue to pose unanticipated health risks to the consumer
Keywords: Electrocardiogram, Public health, Herbals

179. A poison center study of QTc-prolongation and 14 cases of Torsades de Pointes

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Background: Torsades de Pointes (TdP) is a feared complication of drugs associated with QTc prolongation. This study describes maximum QTc prolongation (maxQTc) and TdP cases reported to our poison center.
Methods: A Toxicall® search cases in years 1999–2012 looked for QTc prolongation ≥ 440 milliseconds (msec) and instances of TdP. The population was sampled for hospitalized cases with any of the following codes: asystole, cardiac arrest, conduction disturbance, ECG change, dysrhythmia (ventricular tachycardia, fibrillation or other). MaxQTc was grouped as follows: I = 440–499, II = 500–549, III = 550–599, IV = ≥ 600.
Results: Hospitalized human exposures numbered 26,622 with 2,223 cases (including 210 fatalities) having at least one of the cardiovascular inclusion criteria. The substances cited for these patients numbered 4,776 (2.2 per case). Out of these cases, 378 had recorded a maxQTc, 9 with fatal outcomes. TdP was seen in 14 cases with 2 fatalities, but only 3 TdP cases specifically recorded the maxQTc.
Conclusion: The 2223 patient sample had a specific maxQTc recorded 17% of the time and only 14 instances of TdP (0.6%). Magnesium was used preventively in 28% of cases with prolonged QTc, but whether this practice resulted in the low TdP prevalence is unknown. This study finds QTc prolongation may be commonly reported, yet cases of associated TdP are not.
Keywords: QTc, Torsades de Pointes, Overdose

Table 1. Case Demographics in maxQTc Groups I-IV (n = 378) and TdP cases (n = 14) (abstract number 179).

		378 cases with QTcMax Groups I-IV				
Demographics	Findings in 2223 patient sample	I (n = 189)	II (n = 121)	III (n = 37)	IV (n = 31)	Tdp cases n = 14
maxQTc Mean (msec) ± standard deviation	511 ± 52 median: 500 (n = 378)	474 ± 17	519 ± 14	571 ± 15	635 ± 39	569 (3 cases)
Male:Female ratio	1 : 1.5	1 : 1.9	1 : 3.2	1 : 3.6	1 : 3.4	1 : 1
% of cases Magnesium used	not determined	17%	35%	41%	48%	93%
Cases with cardiac arrest and/or Vtach/Vfib (% of group)	401 (18)	8 (4.2)	5 (4.1)	3 (8.1)	2 (6.5)	14 (100)

Table 2. Substances found in Groups I-IV and in TdP cases (abstract number 179).

Substance categories	Total citations in category	Groups I-IV (n = 378) # of citations (% in category)				# Citations in TdP cases
		I	II	III	IV	
SSRI	280	49 (18)	34 (12)	5 (1.8)	13 (4.6)	3
Atypical Antipsychotics	288	42 (15)	37 (13)	13 (4.5)	6 (2.1)	2
Tricyclic antidepressants	450	43 (9.6)	22 (4.9)	4 (0.9)	5 (1.1)	4
Antihistamines-only	216	17 (7.9)	16 (7.4)	5 (2.3)	9 (4.2)	1
Bupropion	88	18 (21)	9 (10)	4 (4.6)	4 (4.6)	2
Venlafaxine	53	9 (17)	4 (7.6)	1 (1.9)	1 (1.9)	1
Trazodone	167	26 (16)	28 (17)	5 (3)	3 (1.8)	0
Methadone	44	2 (4.6)	3 (6.8)	1 (2.3)	2 (4.6)	0
Tramadol	34	1 (2.9)	3 (8.8)	2 (5.9)	3 (8.8)	0
Valproic acid	41	5 (12)	4 (10)	2 (4.9)	1 (2.4)	1
Cesium	2	0	0	0	0	2
Haloperidol	12	1 (8.3)	2 (17)	2 (17)	0	1
Quinine	9	0	0	0	1 (11)	1
Methamphetamine	29	1 (3.5)	2 (6.9)	1 (3.5)	0	1

180. Cases of QT interval prolongation reported to the toxIC (toxicology investigators consortium) Registry

Christopher Hoyte, Jeffrey Brent

Introduction: Medications associated with QT interval prolongation are commonly prescribed. There is fear of significant adverse events among the public and healthcare providers due to these medications. Our objective is to describe the cohort of cases of QT interval prolongation reported to the ToxIC (Toxicology Investigators Consortium) Registry in order to better characterize the clinical effects in these patients.
Methods: All cases of QT interval prolongation reported to the ToxIC registry between January1st, 2011 and February 1st, 2013 were extracted using the field specific search function. Only cases involving a single agent exposures were analyzed. Descriptive statistics were generated for demographic data, products involved, signs, treatments, and medical outcomes, as defined by the ToxIC registry.
Results: Over the 25-month study period there were 831 cases of QT interval prolongation. 346 of these cases were single agent exposures. The most common age range was 19–65 years (79.8%,n = 276). Most cases were reported in females (62.7%, n = 217). The most common agent identified was diphenhydramine (8.7%, n = 30). The vast majority of cases were intentional abuse or misuse (96.2%, n = 333). The most common associated clinical effects were CNS depression (55.2%, n = 191), tachycardia (24.2%, n = 84), respiratory depression (22.5%, n = 78), and hypotension (20.5%, n = 71). 85 (24.6%) received benzodiazepines, 62 (18.2%) received intravenous fluids, 50 (14.5%) received sodium bicarbonate, 12 (3.5%) received magnesium and 10 (2.9%) received antiarrhtyhmics. There was 1 death reported as a result of cardiac arrest.
Conclusions: Cases of QT interval prolongation reported to the ToxIC Registry are common. The majority of cases were in females intentionally abusing or misusing an agent. Most cases did not require treatment and the rate of significant morbidity or mortality was low. Further study is necessary to determine if these findings are generalizable to cohorts different from the kinds of patients reported to the ToxIC Registry.
Keywords: Cardiac toxicity, Arrhythmia, Abuse

181. Clinical features of patients with and without adverse dysrhythmic events after suspected exposure to QT-prolonging drugs

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Background: Identifying patients at risk for dysrhythmia after exposure to QT-prolonging drugs is challenging. QTc > 500 ms and electrolyte abnormalities are traditionally associated with increased dysrhythmia risk; however, their discriminatory value in drug overdose has not been validated. Using a case-control design, we compared electrolyte values and electrocardiogram (EKG) indices in patients with and without adverse dysrhythmic events (ADE) after suspected exposure to QT-prolonging drugs. We previously reported that Tpeak-Tend (TpTe) in lead V6, a measure of transmural repolarization heterogeneity, is significantly longer in patients with ADE and that TpTe indices have better sensitivity and specificity than QTc > 500ms for identifying these patients. We present the odds ratios of various clinical features given ADE from suspected QT-prolonging drug exposure in our sample.
Methods: Using poison center records, we identified patients exposed to QT-prolonging drugs complicated by ADE - defined as cardiac arrest, asystole, or ventricular dysrhythmia - managed at three medical centers between October 1, 2000 and October 1, 2012. Inclusion criteria were age ≥ 16, ADE occurred within 36 hours of presentation, and no cyclic antidepressant co-exposure. We matched controls without ADE to cases 5:1 on age, gender, and primary suspected QT-prolonging drug exposure. Patient serum

Table. Data for abstract number 181.

	V6 QTc > 500ms	K < 3.3 mEq/L	V6 TpTe > 120 ms
Odds Ratio	13.5	30.0	87.5
95% CI	1.4–130	2.03–441	6.65–1151

potassium (K), magnesium (Mg), and calcium (Ca) values were abstracted and EKGs were copied. An electrophysiologist blinded to patient outcome evaluated the EKG indices. Results were compared using the Student's t-test or Pearson's chi-square test where appropriate; a p-value < 0.05 was considered significant.

Results: We identified 5 cases and 25 controls with 6 and 37 EKGs, respectively. Cases had a lower mean serum K value (3.28 vs. 3.83 mEq/L, $p = 0.032$), a longer mean V6 QTc interval (556 vs. 470 ms, $p = 0.032$), and a longer mean V6 TpTe measurement (mean = 162 vs. 93 ms, $p = 0.005$). Serum Mg and Ca values did not differ significantly. Odds ratios for selected clinical features are presented in Table 1.

Conclusion: Our small sample size limits conclusions that can be deduced from this study. However, our data suggest that ADE from suspected QT-prolonging drug exposure is more strongly associated with TpTe > 120 ms in lead V6 than with QTc > 500 ms in lead V6 or K < 3.3 mEq/L. These findings require prospective validation.

Keywords: Arrhythmia, Adverse drug event, Cardiac toxicity

182. An assessment of the potential toxicity of DPP-4 Inhibitors

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Background: DPP-4 inhibitors, including sitagliptin, saxagliptin, and linagliptin, are FDA approved for the treatment of DM type II. They are considered safe medications due to their hyperglycemia-dependent mechanism of action. However no published studies assess the effects of DPP-4 exposure/overdose and threshold toxic dose has not been established.

Objectives: Our goal was to examine all isolated exposures to DPP-4 inhibitors reported to the National Poison Database System (NPDS) since their introduction in 2006 to determine if significant toxicity occurs after overdose or exposure and to construct a dose-response curve to guide treatment decisions.

Methods: NPDS was queried for data regarding cases of DPP-4 ingestions in all age groups between January 2006 and March 2013. Cases were reviewed and the following inclusion criteria applied: (1) reported ingestion of a DPP-4 inhibitor (2) known clinical outcome. Exclusion criteria included: (1) exposure to more than a single substance (2) no known outcome (3) clinical outcome judged to be unrelated to the exposure. Included cases were assessed for known exposure dose.

Results: A total of 2,173 cases were reviewed. 1,501 were excluded. Of the 672 cases that met inclusion criteria, 560 exposures developed no clinical effects. Mild effects were noted in 76. There were no deaths. Complete charts were requested on 36 cases with 'moderate/major' clinical effects for further assessment of those effects and to determine if the cases met inclusion criteria. Twenty-six were returned. Nineteen were subsequently excluded. Three cases were down-coded in severity. Two patients were accidental exposures in medication-naive non-diabetic individuals. Each developed clinically significant hypoglycemia requiring treatment.

Two cases involved diabetic patients on DPP-4 inhibitors therapeutically. Both developed hypoglycemia - one was managed at home with supplemental oral glucose; the second was managed in the ED with a single dose of IV dextrose.

Conclusion: Of 653 included exposures to DPP-4 inhibitors 639 (97.8%) had either no or minor clinical effects. Four cases resulted in clinically significant hypoglycemia requiring intervention. None of the moderate or major clinical outcomes were the result of intentional overdoses for the purpose of self-injury. Due to the lack of demographic data no dose/response curve could be generated. Based on this data exposure to DPP-4 inhibitors may result in clinically significant hypoglycemia.

Keywords: Hypoglycemic, National Poison Data System, Adverse drug event

183. Voriconazole overdose causes acute kidney injury and severe drug interaction with tacrolimus

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Background: The sole reported case of voriconazole overdose described acute liver injury and rhabdomyolysis-associated acute kidney injury (AKI). Elevated voriconazole concentrations can also adversely affect other hepatically metabolized medications.

Case report: A 5 month-old (former 34 week premature), 6.4 kg infant, who received a liver transplant for idiopathic fulminant hepatic failure, was admitted for respiratory distress and fever. Voriconazole and amphotericin B were given for presumed aspergillosis. His tacrolimus and mycophenolate mofetil were dosed by concentration. His pre-discharge voriconazole concentration was 0.7 mcg/mL [desired trough, 1–5.5 mcg/mL]. The day after discharge, the patient's home nurse administered voriconazle 600 mg orally, a 15-fold overdose, confusing it for another medication. The patient vomited and was brought to the ED. His vital signs were: blood pressure, 116/80 mmHg; pulse, 184/minute. A tacrolimus concentration was 19.7 ng/mL [desired trough, 5–20 ng/mL]. He vomited twice more and was transferred to his transplant center. 17 hours postingestion, his serum creatinine doubled to 0.82 mg/dL. Serum voriconazole and tacrolimus concentrations were 42.4 mcg/mL and 16.6 ng/mL, respectively. His liver function tests and ECG were unremarkable. His creatinine peaked on hospital day (HD) #2 at 0.9 mg/dL. Given his AKI, his tacrolimus dose was held once and then decreased by 70%. Concentrations trended down. The serum creatinine improved to 0.32 mg/dL by HD#3. Serial ECGs were normal. His voriconazole concentration on HD#6 was < 0.1 mcg/mL, and he was discharged.

Case discussion: Voriconazole inhibits CYP3A4, 2C9, and 2C19 and can inhibit its own metabolism, as well as that of many medications including tacrolimus. A prior report of voriconazole overdose manifested as delayed hepatotoxicity. In our case, AKI was predominant. Inhibition of CYP3A4, increasing the concentration of tacrolimus, was potentially the inciting factor of the patient's AKI. Tacrolimus causes prerenal vasoconstriction and can reduce renal function. While AKI might be attributable to amphotericin B, which can present in a delayed fashion despite discontinuation, the temporal relationship between the increase in serum creatinine and voriconazole overdose make this less likely.
Conclusion: Voriconazole overdose is rare, although there is potential for significant medication interactions due to its inhibitory effects of CYP450 isozymes. In this case a 15-fold voriconazole overdose resulted in AKI and a relative elevation of tacrolimus concentrations that resolved with supportive care and therapeutic drug monitoring over several days.
Keywords: Drug interaction, Renal toxicity, Overdose

184. Aconite poisoning from issyk kul – a russian root

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Background: Aconite toxicity is rare in the medical literature. It occurs in China and Southeast Asia from use of aconite as an herbal medication and in the United States from accidental ingestion of native aconite plants. We describe a unique case of aconite toxicity from a Russian herbal medication (Issyk Kul root) in the United States.
Case report: A seventy-four year old Russian-speaking woman became confused and agitated. She accidentally drank from a bottle containing vodka and Issyk Kul root.

She was anxious and diaphoretic with a heart rate of 146 beats per minute and blood pressure 143/99 mm Hg. An electrocardiogram showed a wide-complex regular tachycardia, with a rate of 150 beats per minute and prolonged QRS duration of 134 milliseconds. She was thought to be in ventricular tachycardia. An infusion of amiodarone was started. Her QRS complex widened and she lost pulses. Resuscitation was initiated and she developed a return of spontaneous circulation.
She developed acidosis, acute kidney injury, pulmonary injury, and was discharged to home after 20 days.
Case discussion: Issyk Kul root is described in the medical literature as mandrake, containing podophyllin-like compounds. Hospital personnel acquired the bottle the patient drank from. It was labeled "Aconitum."

Aconitum plants are common in Northern Asia and North America. Poisoning has occurred after mistaking *Aconitum napellus* (monkshood, wolfsbane, or devil's helmet) for an edible plant. Aconite root is processed into oral and topical forms for use as an analgesic, anti-inflammatory, and cardiac agent in traditional Chinese medicine. Severe toxicity results when topical aconite preparations are mistakenly ingested.

Toxicity results from aconitine blockade of sodium channels in heart, nerve, and muscle tissues, producing gastrointestinal distress, neurotoxicity, cardiac conduction blockade, and ventricular dysrhythmias. Onset is rapid and often fatal. Symptoms can last for 2 to 3 days.

The use of sodium bicarbonate as an antidote is logical and recommended. Magnesium sulfate and lipid emulsion may also be useful.
Conclusions: We describe a unique case of aconite poisoning from accidental ingestion of a Russian traditional medication – tincture of Issyk Kul root suspended in vodka.

Aconite toxicity is almost exclusively reported in China, Taiwan, Japan, and India. With the wide availability and increasing popularity of herbal medicines, aconite poisoning can occur anywhere in the world.

Providers need to recognize and manage sodium channel blockade from aconite poisoning. Public health officials may need to investigate the availability of Aconitum as an herbal agent and provide information on risk and prevention of toxicity in certain populations.
Keywords: Alternative medicine, Cardiac toxicity, Herbals

185. Ventricular tachycardia following zoledronic acid Infusion

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Background: Zoledronic acid (ZA), a bisphosphonate (BiP), is administered as an intravenous infusion over 15 minutes for osteoporosis. ZA-related atrial fibrillation (AF) has been reported and a FDA safety review of BiP is ongoing. We present a case of ventricular tachycardia (VT) following ZA infusion that to our knowledge is the first reported case.
Case report: A 64 year-old woman presented to the emergency department (ED) with symptoms of generalized body aches, palpitations, dyspnea and fever. Symptoms started 6 hours after receiving 5 mg ZA. Past history included DM, HTN, osteoporosis and frequent syncopal episodes; previous Holter revealed asymptomatic premature ventricular contractions (PVCs). Medications included bisoprolol, perindopril, and hydrochlorothiazide. Vital signs were T 39.1°C, HR 152/min, RR 28/min, BP 138/89 mmHg, SpO2 96% RA. She felt presyncopal and the cardiac monitor recorded non sustained VT. Electrocardiogram (ECG) showed sinus tachycardia. Laboratory values were potassium (K+) 3.8 mmol/L, calcium (Ca + 2) 1.09 mmol/L, magnesium (Mg + 2) 0.76 mmol/L, phosphate (PO4-3) 0.57 mmol/L, and serum creatinine (Cr) 62 micromol/L. Diltiazem and NaCl were administered. A second presyncopal episode 30 minutes later showed another run of non sustained VT. Amiodarone, metoprolol, MgSO4, Ca gluconate, phosphate, NaCl, metoprolol, piperacillin/tazobactam, diphenhydramine, and acetaminophen were given. Septic work up was negative. No further episodes of VT were recorded. Repeat ECG showed sinus rhythm with QTc 480 msec. Repeated laboratory values were K + 3.7 mmol/L, Ca + 2 1.94 mmol/L, Mg + 2 1.05 mmol/L, PO4-3 0.72 mmol/L and Cr 59 micromol/L. She was discharged 36 hours later. Follow up with her cardiologist was negative.
Case discussion: Increased risk of arrhythmias in ZA-treated postmenopausal women was first identified in the Health Outcomes and Reduced Incidence with Zoledronic Acid Once Yearly (HORIZON)

Pivotal Fracture Trial. Risk of serious AF with ZA was more than double compared to placebo. The subsequent HORIZON Recurrent Fracture Trial however failed to duplicate these findings and evidence for a dose or class related effects are lacking. Our patient experienced an acute phase reaction and subsequent VT following ZA infusion. Electrolyte disturbances and cardiac history may have contributed. The acute onset of symptoms suggests a ZA-related event; the Naranjo score for VT associated with ZA is 3 (possible adverse drug reaction).
Conclusion: We report a case of VT following ZA infusion in an elderly female patient with underlying electrolyte abnormalities experiencing an acute phase reaction. Prior electrolyte screening and ECG may be necessary before ZA infusion.
Keywords: Adverse drug event, Arrhythmia, Cardiac toxicity

186. Progressive myelopathy associated with elevated erythrocyte selenium levels

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Background: Selenium is an essential trace metal. Selenosis (chronic elemental selenium toxicity) is well described to affect multiple organ systems, including causing neurological symptoms such as hyperreflexia, peripheral paresthesias, anesthesia, and hemiplegia. We present a case here of a progressive myelopathy associated with elevated erythrocyte (ERC) selenium levels.
Case report: A 51 year old female first presented to the emergency department with multiple symptoms, including rash, urinary incontinence, and paresthesias and anesthesia in all extremities. She was referred to an internist and subsequently to a neurologist secondary to her progressive myelopathy. Peripheral nerve conduction studies and investigations for paraneoplastic, nutritional (vitamin B12 and other metals), and autoimmune etiologies were unremarkable. An initial brain and spine MRI revealed dorsal and lateral column signal abnormalities concerning for sub acute combined degeneration. These lesions appeared symmetric and longitudinally extensive. On review of medications, it was revealed that her GP had previously prescribed her selenium supplementation. Initial ERC selenium levels were found elevated at 580 µg/L and subsequent levels drawn 5 months later peaked at 727 µg/L. The patient has since stopped selenium supplementation and her ERC selenium levels have declined, though still above the reference range. The patient perceives that she had progressive worsening of her symptoms with both motor and sensory complaints but the patient's neurological exam has appeared stable. A trial of steroids failed to improve her symptoms.
Discussion: Selenosis has been well described in multiple populations, with manifestations including nail and hair abnormalities. Though neuropsychiatric findings have been reported in the past with selenosis, this is the first case where a documented myelopathy in the setting of elevated ERC selenium levels with abnormal MRI findings.
Conclusion: We report here a case of a progressive myelopathy with abnormal MRI findings in associated with elevated ERC selenium levels. Other investigations for causes for this myelopathy have been negative, and MRI studies in patients with documented selenosis may find similar findings.
Keywords: Dietary supplement, Neuropathy, Selenosis

187. Evaluation of emergency department visits for coagulopathy, hypoglycemia and bradycardia

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Purpose: This review evaluated emergency department (ED) visits for the three most common adverse drug event (ADE) presentations - coagulopathy, hypoglycemia and bradycardia, to determine the most common causative agents and the percentage of ED visits that were drug-related.
Methods: Reports generated from electronic medical record for a period of 22 months were used to randomly select patients who presented to the institution's EDs with coagulopathy, hypoglycemia and bradycardia. 100 patient charts were reviewed for each symptomatology. Patients with intentional overdoses, self-inflicted injuries, and illicit substance use were excluded. Between-group comparisons were made using Fisher's exact test or Student's t-test where appropriate. An alpha of 0.05 was considered significant.
Results: 78% of ED visits for coagulopathy, 89% of ED visits for hypoglycemia and 28% of ED visits for bradycardia were drug-related. The most common agents related to the ADEs were warfarin (89.7%), insulin (56%) and beta blockers (64%). The median age for patients with coagulopathy, hypoglycemia and bradycardia was 80 years (48.7% male), 78 years (56% male) and 80 years (57% male) respectively. Patients with drug-related coagulopathy were significantly more symptomatic (OR: 3.9, $p = 0.039$) than patients with non-drug-related coagulopathy; however the same trend was not noted for hypoglycemia and bradycardia groups. Symptomatic coagulopathy patients (38.4%) were not significantly younger or older than those without symptoms (61.5%). There was no difference in length of stay (average 5 ± 2 days) between drug-related versus non-drug related patients for all three symptomatologies. However, drug-related hypoglycemic patients discharged from the ED (mean age = 63.7 years) were significantly younger than those admitted to the hospital (mean age = 77.6 years, $p < 0.001$). For symptomatic coagulopathy, 17% patients required emergent reversal treatment (with phytonadione or fresh frozen plasma). 41.5% of patients with hypoglycemia needed intervention with intravenous dextrose, and 14% of patients with bradycardia required emergent reversal with multiple agents.
Conclusion: The most common agents related to ADE visits to the ED for coagulopathy, hypoglycemia and bradycardia, were warfarin, insulin and beta blockers respectively. Our findings suggest that ADEs relatable to these symptoms were usually elderly in nature and the clinical course was similar to non-drug related counterparts. In addition, a significant number of hypoglycemic cases required emergent intervention while most of the coagulopathy and bradycardia cases required non-emergent interventions.
Keywords: Adverse drug event, Anticoagulant, Hypoglycemic

188. Lithium-induced diabetes insipidus causing acute renal failure and lithium toxicity in a pediatric patient

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Background: Lithium is a commonly used psychiatric medication in adults. Its use in children however is less common. We present the first documented case of pediatric lithium-induced nephrogenic diabetes insipidus causing acute renal failure and lithium toxicity.
Case report: A 27 kg, 8-year-old male, chronically on lithium 600mg QAM and 900mg QPM for oppositional defiant disorder, presented after 2 days of ataxia, confusion, increased urination, and thirst to his psychiatrist's office. After an outpatient lithium level of 6.2 mEq/L, he was emergently sent to the emergency department. Evaluation revealed ataxia and nystagmus. His initial sodium level was 168 mEq/L, BUN 73mg/dL, and creatinine 2.66 mg/dL. He emergently received two hours of hemodialysis with a post dialysis lithium level of 3.07 mEq/L and then was placed on CVVH for maintenance. On CVVH, his lithium level trended down to 0.98 mEq/L, BUN resolved to 6 mg/dL, and creatinine returned to baseline at 0.6 mg/dL. He recovered his baseline neurologic status and was discharged to home with discontinuation of lithium therapy after 7 days.
Case discussion: Lithium-induced nephrogenic diabetes insipidus (DI) has been estimated to occur in 20 to 40% of patients on chronic lithium therapy. Patients with chronic overdosage of lithium have increased risk for nephrogenic DI. Recommended pediatric dosing for lithium is 15–40 mg/kg/day divided TID. Our patient was receiving 55mg/kg/day. Lower patient weight, combined with relative infrequency of use in pediatric patients, places this population at much higher risk for complications of lithium therapy. Unrecognized lithium-induced nephrogenic DI in our patient led to acute dehydration causing acute renal failure, and resulted in lithium toxicity.
Conclusion: Pediatric patients on chronic lithium therapy may be at higher risk for lithium-induced complications, due to provider unfamiliarity with its use in this population. Our patient demonstrates the importance of better pediatric pharmacokinetic data on drugs less frequently used in children, vigilance for development of acute complications of lithium therapy, and swift treatment of complications when they develop.
Keywords: Lithium, Pediatric, Chronic overdose

189. How often do i to take this? methotrexate's atypical dosing is confusing

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Background: Adherence to medication is improved by the routine of daily dosing. Routine is interrupted with atypical dosing.

Methotrexate (MTX) is a dihydrofolate-reducatase inhibitor. As an immunosuppressant it has unique dosing instructions. Patients unfamiliar with this type of schedule may unknowingly overdose.

MTX's dose is reduced when managing diseases such as rheumatoid arthritis, vasculitides, and psoriasis, as compared with cancers. Oral MTX is not without toxicity and deaths have been reported. Its pharmacodynamics may limit its toxicity.
Methods: A retrospective study of poison center (PC) data from 2004–2011 was done to determine the incidence, severity, and circumstances contributing to accidental MTX ingestion. Intentional MTX exposures were excluded.

Results: Thirty-eight patients were studied. The mean age was 53.6 years (5–87 years). There were 27 females. Complete information was not available for all patients.

Nineteen patients had arthritis, 2 had psoriasis, 1 multiple sclerosis, and 1 Crohn's Disease. Four had symptoms of MTX toxicity (stomatitis, gastrointestinal complaints and fatigue). Thirty-two were managed at home, 4 were evaluated in a hospital (1 was admitted), and 2 in a physician's office. None received leucovorin. MTX levels in 2 patients were below detectable limits.

Circumstances of MTX misadventure were: 2 patients repeated their dose in error; 11 ingested MTX on consecutive days; 9 were MTX naïve and unfamiliar with the dosing; 5 misunderstood the directions; 6 were confused; 1 did not read the label; and label instructions were incorrect in 1.
Discussion: Dosing errors occur because of oral MTX's unusual dosing regimen. The frequency of unintentional MTX ingestion at our PC was consistent for our study period. Limited morbidity occurred. It is imperative to change the process with which MTX is dispensed to limit these errors.

The key element lacking in this scenario is communication. MTX should only be prescribed by physicians who are familiar with it. Physicians must discuss MTX's unique dosing and listen to the patients' comprehension of instructions. A limited amount of tablets should be dispensed, especially at the start of therapy. A pharmacist should go over dosing instructions with patients. Unit dose packs would obviate some patients' confusion.
Conclusion: MTX misadventures occur as indications for its use increase. Minor morbidity results from accidental exposure although deaths have occurred. Improving communication, restricting MTX prescribing, the quantity dispensed, and instituting unit dose packaging may limit untoward situations, morbidity, and mortality.
Keywords: Adverse drug event, Education, Overdose

190. Non-ST elevation myocardial infarction after baclofen withdrawal

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Introduction: Baclofen withdrawal syndrome (BWS) is a potentially life-threatening condition characterized by spasticity, hyperthermia and autonomic instability. Cardiac complications, such as reversible cardiomyopathy, have been reported following intrathecal but not oral discontinuation. We report a case of non-ST elevation myocardial infarction (NSTEMI) complicating oral baclofen withdrawal.
Case report: A 71 year-old female with a history of hypertension and restless legs, but no history of heart disease, was admitted with lethargy and confusion. A urinary tract infection was diagnosed. She was hemodynamically stable at the time and afebrile. Over the first several days progressive improvement was noted. On hospital day 4 agitation and confusion developed and was treated with lorazepam and haloperidol. Despite this there was further decline with increasing confusion, agitation, hyperthermia to 41.7° C, rigidity, tremor and clonus. Other management included cooling blankets and dantrolene. Intubation was performed for profound lethargy and norepinephrine infusion for hypotension. An electrocardiogram

was without acute ischemic changes but a troponin was elevated at 28.9 mcg/L. At this time baclofen, a home medication inadvertently discontinued on hospital admission, was resumed. Temporal improvement in her symptoms seemed to correlate with reintroduction of this medication. Her mental status improved, she was extubated and norepinephrine discontinued. Her motor exam also returned to baseline within the next 24 hours. Follow up echocardiogram showed an ejection fraction of 45-50% and mild global hypokinesis of the left ventricle.

Case discussion: Hyperthermia, increased spasticity and autonomic instability are consistent with BWS. Reversible cardiomyopathy with troponin elevation has been reported with intrathecal but not oral BWS. Increased sympathetic activity is thought to be the cause of these complications and theoretically should occur regardless of the route of administration. Although the patient received haloperidol we feel that the timing and rapid progression of her symptoms in relation to haloperidol is inconsistent with neuroleptic malignant syndrome, as were the neuromuscular findings of spasticity and clonus.

Conclusions: Oral BWS is a severe life-threatening syndrome that can result in a variety of complications. Though not widely reported cardiac complications can occur and should be monitored. Abrupt discontinuation of oral baclofen can result in life threatening withdrawal.

Keywords: Baclofen, Withdrawal, Myocardial infarction

191. Volume overload from institution of high dose insulin therapy for calcium channel-blocker poisoning

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Background: High dose insulin-euglycemia (HIE) therapy has recently emerged as an effective therapy for poisoning by calcium channel blockers (CCB). Although the optimal dose of insulin for CCB poisoning is not known, bolus dosing ranges from 1-10 U/kg IV and is followed by a continuous infusion of 1-10 U/kg/hr. Infusions up to 22 U/kg/hr have been reported. Side effects include hypoglycemia and hypokalemia. Typical insulin drip concentrations range between 1:1 to 1:10 U normal saline:insulin. As this is a new therapy, pharmacists may not appropriately concentrate insulin drips which can lead to volume overload.

Case report: This is a case report of a 58–year-old woman who presented to the hospital after ingesting 30–40 pills of diltiazem. Her initial vital signs were: heart rate 60 beats/min, blood pressure 66/40 mmHg, respiratory rate 12 breaths/min, pulse oximeter 96% on 15L nonrebreather. Initial laboratories were significant for: pH 7.19, serum lactate 10.5 mMol/L, glucose 256 mMol/L, bicarbonate 15 mMol/L, creatinine 2.1 mg/dL. Diltiazem level was 1400 ng/mL (ref: 50–200 ng/mL). Metformin level was within the therapeutic range. Gas chromatography/mass spectrometry urine drug screen found caffeine, nicotine, and citalopram. Electrocardiogram demonstrated 1st degree block with intervals: PR 344 ms, QRS 148 ms, QTc 366 ms. HIE therapy was started with an insulin concentration of 1 U/mL at a rate of 1 U/kg/hr and titrated to a maximum of 6 U/kg/hr. She received a total of 11.2 L of fluid over the first 24 hours and developed pulmonary edema and anasarca due to volume overload. She was later intubated for respiratory failure and dialyzed to enhance fluid removal. She made a full recovery and was discharged on hospital day 15.

Case discussion: This case represents the importance of appropriately concentrating insulin drips when using HIE therapy. Institutions not familiar high dose insulin therapy may utilize inappropriately dilute concentrations (1U/mL) and thus cause volume overload. Treating physicians should anticipate this and talk with their pharmacists to create drips with concentrations of 10 U/mL or higher, taking care to carefully label and administer this uncommon antidote appropriately.

Conclusion: Volume overload should be an anticipated and avoidable complication of HIE therapy.

Keywords: Antidote, Calcium channel blocker, Insulin

192. Hemodialysis as a treatment for severe phenytoin toxicity

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Background: Phenytoin (PHT) is a commonly prescribed antiepileptic and can cause severe neurotoxicity in overdose, in part, because of its Michaelis-Menton kinetics. Although it has a low volume of distribution (0.5–0.8 L/kg) it is highly protein-bound. Toxicity is generally not considered amenable to hemodialysis. We present a case of the highest reported serum phenytoin level leading to coma with the subsequent use of hemodialysis.

Case report: 23-year-old woman with history of seizures presented to an outside hospital in status epilepticus. The treating physicians ordered phenobarbital 30 mg IV q8h and fosphenytoin (fPHT) 1000 mg IV q8h. She remained unresponsive and had an MRI of the brain that was unrevealing. On hospital day (HD) 7, she had recurrent seizure activity and the fPHT dose was decreased to 800 mg q12h. On HD 8, she was transferred to the tertiary care referral center at the family's request. Upon arrival, the adjusted PHT level was 193.06 ug/mL. A repeat adjusted level was 200.74 ug/mL (free level 23.6 ug/mL) on HD 9 (see Table). She was unresponsive, not withdrawing to painful stimuli, and with no brainstem reflexes. Due to persistently evated levels and 20% unbound, hemodialysis was initiated on HD 14. Prior to dialysis, her level was 97.8 ug/mL. After 4 hours of hemodialysis (400BF, 800DF, Rex25S) her level fell to 58.18 ug/mL and she began spontaneously moving extremities and required sedation. On HD 16 she received a second 4 hour dialysis session with levels improving from 48.03 to 25.76 ug/mL. Afterwards, she was extubated secondary to improved mental status. Unfortunately, she

Table. Data for abstract number 192.

Hospital day	Adjusted PHT level (ug/mL)
8	193
9	201
10	173
11	151
12	130
14	98 (before HD)
14	58 (after HD)
16	48 (before HD)
16	26 (after

was re-intubated for respiratory insufficiency and received a tracheostomy. Magnetic resonance imaging performed HD (17 and 25) demonstrated two punctate foci in the periventricular white matter and without signs of anoxic injury. She was discharged to a skilled nursing facility on HD 32 with continued unresponsiveness and hypotonia.

Case discussion: Toxic doses of PHT have been well established in causing serious neurologic sequelae including coma, seizures, ataxia and cerebellar degeneration. This is the highest reported level in clinical practice. At the levels in this case report PHT clearance followed zero order kinetics leading to a prolonged exposure. The rate of elimination was 0.66 ug/mL/hr with supportive care alone and 7.75 ug/mL/hr with hemodialysis.

Conclusion: This report suggests that newer high-flux large surface area polysuphone dialysis cartridges significantly enhance clearance of highly protein-bound xenobiotics and should be considered in cases of severe toxicity.

Keywords: Adverse drug event, Anticonvulsant, Hemodialysis

193. Gargantuan ibuprofen overdose in a toddler treated successfully with supportive care

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Background: Exposures to ibuprofen and other NSAIDs are common and are rarely clinically significant. We report a pediatric case with the highest reported serum ibuprofen concentration in the literature.

Case report: A 16 month-old female was found playing with a large bottle (500 count) of ibuprofen at 11:30. Two half-chewed tablets were found nearby. Patient had no nausea or vomiting but became drowsy and was taken to an ED at 12:15. Upon arrival to ED, patient was sleepy but arousable. Vital signs were stable. Patient was promptly transferred to the ED of a tertiary care center at 14:45. Patient was intubated for worsening mental status and failure to protect her airway (GCS = 7) shortly after arrival. Initial vital signs at receiving hospital were: T = 36.5, BP = 81/33, HR = 144, RR = 26, and O2 = 99%RA. Initial CBC, BMP, LFTs, lipase, UA, ASA, APAP, and EtOH were unremarkable except for a HCO3 of 21. Patient became progressively acidemic. HCO3 and potassium acetate infusions were started. Despite HCO3 and acetate infusions, patient's HCO3 decreased to 10 mEq/L about 24 hours after ingestion. Serum measurements of ethylene glycol, methanol, iron, and initial lactate were unremarkable. A GC/MS comprehensive UDS (>350 substances) was positive for ibuprofen. Serum ibuprofen concentration was 1,233mcg/mL at 4 hours post-ingestion. Repeat ibuprofen concentrations were: 682mcg/mL at 25 hours, 197mcg/mL at 39 hours, 70mcg/mL at 63 hours, and 26mcg/mL at 87 hours. An EGD performed on hospital day #2 revealed no pharmacobezoar and only mild gastritis. Patient required dopamine and epinephrine infusions for approximately 48 hours. Patient's course was complicated by aspiration pneumonia, Strep pneumoniae bacteremia, and a catheter-associated urinary tract infection. She made a full recovery after a 10-day hospitalization. Her serum creatinine was 0.4mg/dL on discharge.

Table.

Time post-ingestion (hrs)	4	25	39	63	87
Serum ibuprofen concentration (mcg/mL)	1,233	682	197	70	26

Discussion: We report a gargantuan ibuprofen ingestion successfully treated with supportive care. To the best of our knowledge, this is the highest reported serum ibuprofen concentration in the literature. The previously highest reported concentration was 776mcg/mL in a 14 year-old male who required ECMO. Our case also had a paucity of GI symptoms. Although the patient was given HCO3 and acetate infusions for a worsening metabolic acidosis, alkalinization may have enhanced the elimination of ibuprofen, which is a weak acid.

Conclusions: Massive ibuprofen ingestions in toddlers may have a paucity of gastrointestinal symptoms. Urinary alkalinization may be of some benefit in these particularly large ingestions. Further study is warranted.

Keywords: NSAID, Overdose, Acidosis

194. Para-methoxymethamphetamine (PMMA) fatalities in Alberta and British Columbia, Canada

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Background: Para-methoxymethamphetamine (PMMA) is a synthetic amphetamine similar in structure to methylenedioxymethamphetamine (MDMA). Street names for PMMA include 'Death' and 'Killer'. Fatalities have been reported in Europe, Asia, and Israel but not in North America. From June 2011–April 2012, 27 PMMA fatalities were confirmed in Alberta and British Columbia (BC). Given the limited information available on PMMA, we describe the clinical presentation of these fatalities and the associated public health response.

Methods: A retrospective case series was conducted on Alberta and BC patients who died between June 2011–April 2012, where forensic toxicological analysis was positive for PMMA, and PMMA was deemed to be the primary drug responsible. Chart reviews were conducted at the Office of the Chief Medical Examiner in Alberta and Coroners office in BC. Data collected included patient demographics, exposure history, clinical features, investigations, therapy provided, and hospital course.

Results: Over 11 months, there were 27 PMMA fatalities (20 in Alberta, 7 in BC). The median age was 24 years (range 14–52 years); 22 were male. 17 presented to hospital, and 10 were pronounced dead on scene. Median time from exposure to hospital presentation was 8 hours (range 1.5-16.5 hours), and from exposure to death was 17 hours (range 6-264 hours). Median first recorded vital signs were: Temperature 42.1°C, HR 160 BPM, BP

89/43 mm Hg, and RR 40/min. 16 patients presented with clinical features of serotonin syndrome. Indicators of end organ dysfunction included median creatinine of 214 mmol/L, creatinine kinase of 82000 mmol/L, AST of 2944 IU/L, and glucose of 1.85 mmol/L. Interventions included intubation, sedation, paralysis, and cooling methods, which consisted of ice packs, cooled intravenous fluids, cyproheptadine, cooling blankets, and cooling catheters. In addition to PMMA, MDMA (n = 27), MDA (n = 26), PMA (n = 25), amphetamine (n = 15), cocaine (n = 13), and methamphetamine (n = 11) were also identified. Collaboration between poison centers, public health, and law enforcement resulted in media interviews, advisories to physicians and school boards, multimedia abstinence and harm reduction advertising campaigns, and arrests of suspected traffickers. The last confirmed PMMA fatality was October 2012 in Alberta.

Conclusions: In this cluster of PMMA fatalities, patients presented with severe hyperthermia, serotonin syndrome, multiorgan dysfunction and shock. A coordinated response between poison centers, public health, law enforcement, and the media was followed by the decline and eventual disappearance of PMMA from our respective provinces.

Keywords: Paramethoxymethamphetamine, Designer drug, Overdose

195. Is there evidence of misuse of Baclofen, Gabapentin and Pregabalin in the United Kingdom (UK)?

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Background: There are anecdotal reports on Internet discussion fora regarding the misuse Baclofen, Gabapentin and Pregabalin. The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) highlighted in its 2010 Annual Report evidence from four countries regarding the misuse of Pregabalin. In addition, there is concern that dependent users of recreational drug may purchase these drugs in an attempt to prevent or treat withdrawal symptoms (e.g. Baclofen to prevent GHB withdrawal). There is currently no data on the frequency of misuse of these substances in the UK.

Methods: Using an existing market research consumer survey we undertook an Internet questionnaire survey of individuals aged 16-59 resident in the UK. Basic demographic data (age and sex) were collected together with data on the lifetime prevalence of misuse of Baclofen, Gabapentin and Pregabalin. Those individuals who indicated that they had misused one or more of these drugs were asked to identify the source(s) of the misused drug using predetermined categories. To validate the study population lifetime prevalence of use of cocaine, cannabis and MDMA was compared to the 2011/2012 British Crime Survey.

Results: The online survey was completed by 1,500 individuals (male: 737 (49.1%); female: 763 (50.9%)); 9.1%, 40.5%, 21.1% and 29.3% were aged 16–20, 21–39, 40–49 and 50–59 respectively. Life-time prevalence of use of recreational drugs was comparable to national data from the 2011/12 British Crime Survey (8.1%-vs-9.5% for cocaine, 28.1%-vs-31.0% for cannabis and 8.2%-vs-8.6% for MDMA). The life-time prevalence of misuse of the three drugs was: Baclofen 19 (1.3%); Gabapentin 17 (1.1%); and Pregabalin 8 (0.5%). The source(s) of drugs misused is shown in Table; most individuals obtained the drug(s) from more than one source. Misuse of legitimately prescribed medication for the individual was the only source for 2 (10.5%), 3 (17.6%) and 0 (0%) for Baclofen, Gabapentin and Pregabalin respectively.

Table. Sources of misused Baclofen, Gabapentin and Pregabalin (n = number reporting misuse).

	Baclofen (n = 19)	Gabapentin (n = 17)	Pregabalin (n = 8)
Prescribed medication	3	8	1
High street pharmacy/shop	5	5	2
Friends or family	3	7	3
Street-level drug dealer	3	5	2
On-line pharmacy	6	3	2
Non-pharmacy Internet supplier	5	0	1
Purchased outisde of UK	1	2	0
Other	0	1	0

Conclusion: This study suggests that there is misuse of Baclofen, Gabapentin and Pregabalin in the UK, and that the majority of the misuse is from sources other than legitimately prescribed medication. Further work is needed to understand the reasons for this misuse, to enable appropriately targeted harm reduction activity.

Keywords: Substance abuse, Drug of abuse, Surveillance

196. Was controlling methoxetamine under the UK temporary class drug order legislation effective in reducing its use in a high-drug using population?

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Background: Methoxetamine is a ketamine analogue that has been marketed to drug users as a "bladder-friendly" alternative to ketamine. Due to concern regarding the acute and chronic harm associated with the use of methoxetamine, it was controlled in the UK under the Temporary Class Drug Order (TCDO) legislation in March 2012. The aim of this study was to investigate, in a high drug-using population, the awareness of methoxetamine, the frequency of its use compared to ketamine and the impact of its control under the TCDO legislation.

Methods: A questionnaire survey was undertaken in gay-friendly nightclubs in South East London, UK over four separate nights in July 2011 (four clubs) and again in July 2012 (three clubs). Previous studies have shown that drug use is high in these nightclubs. Verbal consent was obtained by the study investigators. Participants were asked basic demographic questions (age, sex and self-identified sexual orientation) and about their self-reported frequency of use of both ketamine and methoxetamine. In the 2012 survey, they were also asked whether they had heard of ketamine and methoxetamine. The study was approved by Lancaster University Research Ethics Committee.

Results: 315 and 330 individuals completed the survey in 2011 and 2012 respectively. In 2012, 97% of those surveyed had heard

of ketamine compared to only 33.1% for methoxetamine. Although there was no significant change in life-time (2011: 60.3% vs 2012: 67.1%, $p = 0.07$) and last year (2011: 48.7% vs 2012: 43.6%, $p = 0.19$) use of ketamine, there was a significant reduction in last month use (2011: 34.9% vs 2012: 24.4%, $p = 0.003$). Life-time, last year and last month use of methoxetamine significantly increased from 2011 to 2012 (Life-time 2011: 6.1% vs 2012: 21.0%, $p < 0.001$; Last year 2011: 4.8% vs 2012: 19.2%, $p < 0.001$; Last month 2011: 1.9% vs 2012 10.1%, $p < 0.0001$).

Conclusions: There was less awareness and use of methoxetamine compared to ketamine; despite this there was a significant increase in self-reported use of methoxetamine over the one year period between the two studies. There was a self-reported reduction in ketamine use, suggesting the potential that there had been displacement from ketamine to methoxetamine. Finally, it appears from this study that control under the TCDO had no impact on the self-reported use of methoxetamine.

Keywords: Bath salt, Designer drug, Drug of abuse

197. Pattern of nitrous oxide use in a men who have sex with men, high-drug using population: how does this compare to the 2011/2012 global drugs survey?

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Background: Nitrous oxide has legitimate use in medicine as an analgesic and anaesthetic and in the food industry as an aerosol propellant, particularly for the production of whipped cream. It is also used as a recreational drug for its euphoric effects. The 2011/2012 Global Drug Survey reported a life-time prevalence of use of 49.6%. There is limited information on the pattern of use in other high-drug using populations, such as the men who have sex with men (MSM, gay) community.

Methods: The study was undertaken in three gay-friendly night-clubs in South London, UK on four separate nights in July 2012. Verbal consent was by the investigator, who then completed the questionnaire. The following information was then obtained from study participants: i) basic demographic questions (age, sex and self-identified sexual orientation); ii) awareness of nitrous oxide; and iii) self-reported life-time and last year use of nitrous oxide. Data was then compared to that reported in the 2011/2012 Global Drugs Survey. The study was approved by Lancaster University Research Ethics Committee.

Results: 330 individuals completed the survey; the mean age was 31.5 ± 8.5 years and 92% were male. 85% self-identified themselves as gay, 9% as straight and 6% as bisexual. 56.3% of participants were aware of nitrous oxide. Life-time self-reported use (28.1%) of nitrous oxide was lower than that reported in the 2011/2012 Global Drug Survey (49.6%). Similarly last year use (11.9%) was much lower than UK respondents (27.2%) and UK regular clubbers (43%) in the 2011/12 Global Drug Survey, but appeared to be comparable to last year use in the US Global Drug Survey 2011/12 respondents (10%).

Conclusions: The pattern of use of nitrous oxide in this high-drug using population appears to differ from that reported in the 2011/2012 Global Drugs Survey. It is important that when collating information on the patterns of use of recreational drugs, that a variety of information sources are utilised to ensure that the data produced is robust and reliable.

Keywords: Drug of abuse, Substance abuse, nitrous oxide

198. Anonymous pooled urine samples from festival urinals to detect classical recreational drug and novel psychoactive substance use: Is it possible in when it's freezing outside?

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Background: There have been several studies reporting the analysis of anonymous pooled urine samples from standalone "pissoirs" (urinals) from city-centre streets and music festivals in the UK. We report here a study using similar methodology to determine the feasibility of using this technique at a winter festival outside of the UK.

Methods: Anonymous pooled urine samples were collected from four stand-alone urinals from different locations at a winter "house music" festival attended by 22,000 people in Oslo, Norway in December 2012. Samples were subsequently analysed using full-scan accurate mass high resolution liquid-chromatography coupled to tandem mass-spectrometry, processed against compound databases containing > 1700 drug compounds/metabolites.

Results: Urine collection was only possible from two of the four urinals; the other two had frozen due to the cold weather. Caffeine and nicotine/metabolites were detected in both samples validating the sample collection. The classical recreational drugs and novel psychoactive substances detected are shown in Table 1 (hordenine is likely to be from beer rather than psychedelic cacti use as no mescaline was detected). The following substances commonly reported to used around Europe and/or detected in UK festival urinals by our group were not detected: 4-methylmethcathinone (mephedrone), 1-benzylpiperazine, 5-(2-aminopropyl)benzofuran (5-APB), methoxetamine, ketamine and methiopropamine.

Conclusion: This study highlights the difficulty of collecting pooled urine samples during outdoor festivals in cold environments, where the urine may have frozen. The range of drugs detected from

Table 1. Frequency of detection of classical recreational drugs and potential novel psychoactive substances from the two festival urinals.

Compound detected	Urinal 1	Urinal 2
Classical recreational drug		
Amphetamine and metabolites	Detected	Detected
Cannabis metabolites	Detected	Detected
Cocaine and metabolites	Detected	Detected
MDMA	Detected	Detected
Methamphetamine	Detected	Detected
Potential novel psychoactive substance		
Cathine	Detected	Detected
Hordeine	Detected	Detected
Methylhexaneamine	Detected	Detected

this festival in Norway differs from that detected using the same methodology in a UK based music festival [Wood DM 2013]. This technique will be useful to monitor geographical (country and regional) patterns of use of classical recreational drugs and novel psychoactive substances.

Keywords: Drug of abuse, Designer drug, Bath salt

199. Which reality is this? A novel PCP analog combined with 2C-NBOMe causes a dissociative serotonin syndrome

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Background: The 2,5-dimethoxyphenyl-N-[(2-methoxyphenyl) methyl]ethanamine (2C-NBOMe) series of designer phenethylamines is an increasing trend in the abuse of hallucinogens. In addition to describing the clinical course of this patient with such an overdose, we present spectrographic analysis of a novel phencyclidine (PCP) analog not previously reported in a live patient.

Case report: A 19-year-old male college student was found unconscious in the snow by campus police and was brought to an urban ER with extreme agitation and confusion. An unmarked eyedropper with a small amount of clear liquid was found amongst his belongings, which he later said contained "2C-T-2 or 2C-T-7." On exam he demonstrated sustained clonus and hyperreflexia without rigidity. Tachycardia, hypertension, mydriasis, flushing and diaphoresis were also noted. He was admitted to the Intensive Care Unit where rhabdomyolysis, hyperthermia, and progressive dissociation developed over the next 36 hours. After treatment, he was discharged home with complete resolution of his symptoms.

Case discussion: Analysis by gas chromatography/mass spectrometry of the eyedropper contents revealed 3 substances not found in standard and expanded mass-spectral libraries – 2 were confirmed to be variants of 2C-NBOMe, matched to spectra found in a monograph published by the Drug Enforcement Agency. The third was thought to represent a PCP analog which has not had a published spectrum to date. This unknown was later confirmed by comparison with a sample of the suspected substance obtained by a chemical research company.

Conclusions: This case represents the first report of recreational use in Michigan of this PCP analog, the mass spectrum of which has not been previously reported. In addition, the clinical presentation and course of a patient's combined hallucinogen overdose is discussed.

Keywords: Phencyclidine, Hallucinogen, Amphetamine

200. Severe ethanol intoxication in twin toddlers

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Background: More than 12,435 cases of ethanol (ETOH) exposure involving children less than five years of age were reported to poison control centers in the US during 2011. Although the toxic effects of ETOH ingestion are known, limited data exists on the correlation between blood alcohol content (BAC) and toxicity in children. We present the cases of twin siblings who developed sedation, hypothermia, and respiratory depression after ingesting ETOH.

Case report: 24-month old twin siblings, a brother (Patient 1) and sister (Patient 2), were found by their mother to be obtunded after she had left them under a friend's supervision. Upon presentation to the outside hospital (OSH), Patient 1 had the following exam: Temperature (T) was 34.4oC, heart rate (HR) 63/min, blood pressure (BP) 81/36 mm Hg. Also noted were GCS of 3, irregular breathing, sluggish pupils, flaccid extremities, and absent reflexes. BMP, CBC and head CT were normal. Patient 2 was discovered in the home an hour later. On arrival to OSH, she was unresponsive and breathing irregularly. Her T was 36.2oC, HR 114/min, BP 99/72 mm Hg, pupils were sluggish, extremities were flaccid, and reflexes were absent. BMP, CBC and head CT were normal.

Both patients were given midazolam and fentanyl and intubated at the OSH and were airlifted to our tertiary-care center. Initial BAC were 723 mg/dl in the male child and 485 mg/dl in the female child. Both patients had comprehensive urine drug screens with no evidence of any co-ingestion. Neither patient developed hypoglycemia. A history of alcohol mixed with chocolate milk ingested 4 hours prior to presentation was obtained.

Both patients remained unresponsive for six hours. BACs were drawn approximately every 6 hours until negative (Table). Patient 2 awoke 8 hours after presentation; Patient 1 awoke 12 hours after presentation. Ventilation was continued for 24 and 20 hours, respectively, while BACs remained high and then both patients were extubated with complete recovery. Ethanol elimination rates calculated by linear regression were 36.6 mg/dl/hr ($r2 = 0.99$) for Patient 1 and 35.5 mg/dl/hr ($r2 = 0.99$) for Patient 2 (graph available). Peak BACs were estimated to be 814 mg/dL and 591 mg/dL at 1.5 hours post ingestion.

Discussion: To our knowledge, these are 2 of the highest BAC survivals to be reported in the pediatric population. We provide additional evidence that the elimination rate for ETOH is more rapid in young children than adults.

Conclusion: If the respiratory depression of ETOH intoxication is promptly and adequately supported, extremely high levels of BAC can be tolerated without sequelae in the pediatric population.

Keywords: Alcohol, Pediatric, Pharmacokinetics

Table.

	ETOH level (mg/dl)	
Time since ingestion (hours)	Patient 1	Patient 2
4.0	723	–
4.5	–	485
9.6	501	269
15.6	253	90
21.6	87	<10
36.0	<10	–

201. Trend analysis of novel psychoactive substances detected in pooled urine samples from street urinals over six months

John R. Archer[1], Paul I. Dargan[1], Wui Ling Chan[1], Andrew Hitchings[2], Simon Hudson[3], David M. Wood[1]

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Background: Previous studies have shown that anonymised pooled urine samples collected from street urinals can detect both classical recreational drugs and novel psychoactive substances (NPS). This study aimed to determine changes in patterns of drugs detected using the same street urinals over a 6 month period.
Methods: Anonymised pooled urine samples were collected using 12 stand-alone four-person urinals in central London on the first Saturday night each month from July to December 2012. Urinals were placed in the same geographic locations for each collection. Samples were analysed using full-scan accurate mass high-resolution liquid chromatography coupled to tandem mass spectrometry, processed against compound databases containing more than 1700 drug compounds/metabolites.
Results: The frequency of detection of recreational drugs and NPS is shown in Table. Nicotine, its cotinine metabolite and caffeine were detected in all samples, validating the urine collection. There was consistency in the classical recreational drugs detected. A total of 13 NPS were detected with significant variability in the frequency of detected from a month-to-month basis. Some key findings were: lack of methoxetamine (detected in no samples), mephedrone (1 sample in six months) and short-term detection of TFMPP (14 samples in a 2 month period).
Conclusion: This study demonstrates that this technique can be used to monitor trends in the use of recreational drugs in a geographical area over time. There was continued stability of classical recreational drug trends but diversity in NPS detected over time. It also suggests that control of NPS may be associated with a decrease in the use of some drugs (methoxetamine (Temporary Class Drug Order, March 2012) was not detected in any urinals); however, control of mephedrone (April 2010) has had a more limited impact.
Keywords: Bath salt, Drug of abuse, Substance abuse

Table. Frequency (number of urinals out of 12) of drug detection.

Group	Drug	Jul	Aug	Sept	Oct	Nov	Dec
NPS	Cathine	12	12	7	7	7	5
	Mephedrone	5	8	8	5	4	2
	Methylhexaneamine	3	7	8	12	4	3
	Methcathinone*	5	0	0	0	0	0
	Ethylmethcathinone	3	0	0	0	0	0
	Methiopropamine	1	2	1	1	0	2
	Pipradrol	1	4	1	2	0	0
	Cathinone	3	2	2	3	0	0
	5-(2-aminopropyl) benzofuran	1	0	0	0	1	1
	1,4-trifluoromethylphenylpiperazine	0	0	0	1	2	0
	4-methylbuphedrone	0	1	4	0	0	0
	4-methylethcathinone	0	1	1	0	1	0
	1,4-methoxyphenylpiperazine	0	0	0	0	1	0
	4-fluoroephedrine	0	0	1	0	0	0
	Methoxetamine	0	0	0	0	0	0
Classical	Cocaine*	12	12	12	12	8	12
	Morphine	12	12	12	12	12	12
	MDMA*	9	11	12	9	11	12
	Methadone*	5	11	11	7	7	7
	Amphetamine*	7	9	9	5	2	9
	Ketamine*	5	7	5	8	4	5
	3,4-methylenedioxyamphetamine	3	2	5	6	5	2
	Cannabis*	8	12	12	12	2	1
	Methamphetamine*	4	2	1	1	3	6

(*metabolite detected)

202. Clinical course of 4-bromo-2, 5-dimethoxyphenylamine (2C-B) intoxication with laboratory confirmation

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Background: 2C-B is a designer drug of abuse belonging to the 2C series of phenethylamine derivatives. Recreational use of phenethylamine derivatives for their entactogenic effect has significantly increased over the last decade. Seizures and deaths have been reported following exposure to 2C drugs. We present the first case of lab confirmed 2C-B ingestion with repeated seizures, severe lactic acidosis, and rhabdomyolysis.
Case report: A 19-year-old man with a history of depression, anxiety, and poly-substance abuse was found confused and hallucinating by family approximately 1 hour after a witnessed ingestion of 2C-B pills purchased from the internet. He became unresponsive and developed a 1-minute generalized tonic-clonic (GTC) seizure with urinary incontinence. EMS was summoned and while enroute to the ED, he developed another GTC seizure. On arrival in the ED he was given lorazepam. His GCS was 4 (E1, V2, M1), skin was flushed and diaphoretic, jaw was clenched, extremities were rigid, and he had mydriatic pupils. Initial vital signs: T 36.4 C°, BP 175/75 mmHg, HR 120/min, RR 38/min, O2 saturation 94% on 15L/min oxygen. His oxygenation declined. He was intubated for airway protection. Propofol was started for sedation and seizure prophylaxis. Chest radiography and CT of the head were unremarkable. ECG was significant for sinus tachycardia. Urine toxicology screen for drugs of abuse was negative. Remarkable lab findings included: WBC 14,000/mm3, serum lactate 19 mmol/L. ABG: pH 6.87, PCO2 70, PO2 60, HCO3 12. Serum chemistry: sodium 139 mEq/L, potassium 4.2 mEq/L, chloride 104 mEq/L, bicarbonate 10 mEq/L, BUN 12 mg/dL, creatinine 1.1 mg/dL, glucose 123 mg/dL. He was given intravenous fluids and sodium bicarbonate; then admitted to the ICU. His creatine kinase peaked at 1452 U/L. All symptoms resolved after 24 hours of hospitalization and he was discharged home. Serum analysis using liquid chromatography/time-of-flight mass spectrometry (LC/TOF-MS) confirmed the presence of 2C-B at 342 ng/mL. No other drugs including synthetic cathinones and cannabinoids were detected.
Case discussion: Our case, with lab confirmation of 2C-B, highlights the serious risk of major neurological toxicity following the use of phenethylamine derivatives. Our patient responded well to

a benzodiazepine and propofol, which supports the use of GABA agonists for treatment of seizure activity. LC/TOF-MS is a useful method for detecting 2C derivatives.
Conclusions: Exposures to phenethylamine derivatives such as 2C-B are associated with severe neurological adverse events including seizures. This is the first reported case of 2C-B exposure with lab confirmation.
Keywords: 2C-B, Phenethylamine, Seizure

203. Signs of synthetic cannabinoid vs. marijuana intoxication as determined by police drug recognition experts

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Background: Synthetic cannabinoid ("spice") abuse is becoming more common, but little data is available regarding its effects on driving or whether physical exam findings of "spice" intoxication are similar to marijuana intoxication as determined by Drug Recognition Experts (DREs). The objective of this study is to summarize DRE data at the time of arrest from impaired drivers who admitted to "spice" use or who possessed "spice" and to compare this to similar data from arrested, impaired marijuana users or possessors.
Methods: This is a retrospective study of a convenience sample of de-identified arrest reports of impaired drivers suspected of using or possessing "spice" (n = 100) or marijuana (n = 33) in one state from Mar. 2010–July 2012. Inclusion criteria were arrested drivers who admitted to using either "spice" or marijuana, or who possessed either "spice" or marijuana; had a DRE evaluation; and had negative drug and alcohol blood screens for other intoxicants checked by the State Crime Lab. Exclusion criteria were any impaired drivers arrested with other intoxicants found in drug or alcohol blood screens. Twenty popular synthetic cannabinoids were tested for in blood samples using liquid chromatography tandem mass spectrometry after single step liquid/liquid extraction. Tetrahydrocannabinol (THC) and COOH-THC (a THC metabolite) were quantified by gas chromatography-mass spectrometry. Statistical significance was determined by Fisher's exact test.
Results: 100 "spice" and 33 marijuana arrest records were screened; 13 "spice" and 25 marijuana records met inclusion criteria. All marijuana users (mean age 22 + 5 years) tested positive with levels available for 21 of 25: THC (10.7 + 5 ng/mL) and COOH-THC (57.8 + 28 ng/mL). Blood tests were available for 7/13 "spice" suspects; synthetic cannabinoids were detected in 6 of these 7 "spice" suspects. 38% (5/13) of "spice" suspects and 4% (1/25) of marijuana suspects were involved in motor vehicle crashes ($p = 0.01$). DREs documented more confusion (6/10) or disorientation (5/10) in the "spice" group versus those in the marijuana group (0/25) ($p < 0.003$). More marijuana users had tremors (25/25) versus those in the "spice" group (8/13) ($p = 0.003$).
Conclusion: Synthetic cannabinoid suspects were more confused and disoriented, and were involved in more motor vehicle crashes than marijuana suspects in this population evaluated by DREs.
Keywords: Drug of abuse, Intoxication, Marijuana

204. Seizure and acute kidney injury associated with synthetic cannabinoid use

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Background: The chemical structures of synthetic cannabinoids (SC) have been evolving since their introduction in the U.S. in the early 2000s, and their clinical effects profiles are poorly characterized and changing. Seizures and deaths have been reported in association with these agents. More recently, the use of at least one compound, XLR-11 ((1-(5-fluoropentyl)-1H-indol-3-yl)(2,2,3,3-tetramethylcyclopropyl)methanone), has been associated with acute kidney injury (AKI). We report a case of chronic SC use, including XLR-11, associated with seizure and AKI.
Case report: The patient was an 18 year-old male who had a witnessed seizure. His initial SCr was 1.8 mg/dL. He was treated with Keppra with no further seizures. He developed mild rhabdomyolysis (initial CK 513; peak CK 2,789). Peak SCr was 6.8 mg/dL, he did not require hemodialysis and he recovered over a six-day period with baseline CNS function and SCr 3.9 mg/dL at discharge. He disclosed that he had been smoking a SC product daily for six weeks, purchased at a local "head shop." The purported, most recent package of use had no identifiers of brand, origin or contents. Analysis of the product by GC-MS demonstrated XLR-11. The patient's urine, however, was found to contain 4-OH JWH-018, 5-OH JWH-018, and Carboxy UR-144 and 5-OH UR-144 (chloropentyl analogs and likely metabolites of XLR-11). Two additional SC products were purchased in another city in the same state four months later and also analyzed by GC-MS. Both contained XLR-11, as well as 5-OH UR-144.
Case discussion: Synthetic cannabinoids pose serious health risks. They undergo no testing and are marketed as "not for human consumption" as a means to avoid regulatory oversight. New structures are introduced as regulatory prohibitions are applied. Associating clinical effects with specific compounds is difficult in part because there are no commercial laboratory tests for these agents. AKI was first reported in association with SC use in a cluster of cases in 2011 – 2012 in which XLR-11 was identified. This patient likely had exposure to XLR-11, and other SC. It is unknown whether use of the chloropentyl analog of XLR-11 is also associated with AKI and/or seizure. Exposure to JWH-018, a Schedule I compound, occurred at some unknown time and its contribution to these effects is unknown. XLR-11 has started to come under regulatory prohibition, but the compound is still being marketed in the U.S. and related compounds have been developed and combined with it. Patients may have no knowledge of their multiple SC exposures and use histories may be inaccurate.
Conclusions: The ongoing development and marketing of designer drugs, such as XLR-11 and UR-144 pose significant and unpredictable health threats.
Keywords: Cannabinoid, synthetic, Renal toxicity, Public health

205. Urinary and biliary tract inflammation associated with ketamine use

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Background: The association between heavy ketamine use and inflammation of the urinary bladder and gall bladder has been described in Asia and Europe, where ketamine use is relatively higher than in North America. We report the first North American case with both urinary and biliary tract inflammation associated with chronic ketamine use visualized on CT.
Case report: An 18 year-old woman with a history of cocaine and ketamine abuse presented to the emergency department (ED) complaining of right-sided abdominal pain and hematuria. She was recently prescribed an antibiotic for a urinary tract infection, but there was no improvement in her symptoms. On examination she had normal vital signs, white powder was noted in her hair, and she had suprapubic tenderness without rebound or guarding. Liver function tests were normal. Urinalysis showed: large blood; small leukocyte esterase; white blood cells, 10-15/high powered field (HPF); red blood cells, 30-50/HPF; and no bacteria. During her ED stay a plastic bag of white powder fell from her bag. On confrontation she noted that it was ketamine, which she used chronically. She underwent a CT of the abdomen and pelvis following oral and IV contrast which revealed marked distension of the gall bladder and common bile duct (CBD) with a CBD diameter of 8 mm. There was also irregularity and signs of inflammation of the mucosal surface of the urinary bladder with normal kidneys and ureters. She was admitted for pain control and eventually discharged to substance abuse treatment with urology followup.
Case discussion: Ketamine cystitis is described in heavy ketamine users in Asia. The pathophysiology is unclear but ketamine is primarily excreted in the urine and inflammation may be caused by metabolites that are directly tissue toxic. Of note, methoxetamine is marketed as a ketamine-like substance without bladder effects, though mouse data suggests a similar inflammatory reaction. Biliary inflammation is believed to result from a similar interaction between the metabolite and the mucosa as a small portion of ketamine undergoes biliary excretion. It is unclear whether the inflammatory changes are permanent.
Conclusion: Chronic ketamine abuse can result in direct tissue injury as the drug and its metabolites are excreted. This is more commonly manifested as bladder inflammation likely because excretion is primarily renal, though mild biliary excretion may cause similar pathology in the gall bladder and common bile duct. We report the first American patient with chronic ketamine use-associated inflammation of both the bladder and biliary system viewed on CT. Clinicians in North America should consider this disorder in their management of patients with chronic pelvic and abdominal pain.
Keywords: Adverse drug event, Substance abuse, Ketamine

206. Antidepressants as drugs of abuse

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Background: Prescription drug abuse is increasing in the US. While not as common as other drugs, the abuse of antidepressants (ADs) is reported. There is little information on AD abuse. This study assesses the frequency of AD abuse and the health impact associated with it.
Methods: All AD exposures coded as "intentional abuse" reported to a statewide poison center system during 2000-2012 were identified. Multiple-agent exposures were included in the demographic and circumstance factors data. However, only single agent exposures were used to calculate the clinical outcomes and management data.
Results: There were 1,512 cases of AD abuse of which 48% involved selective serotonin reuptake inhibitors, 32% mixed amine effects, 15% cyclic ADs, and 10% bupropion. Among the 557 single agent exposure cases, 44% involved selective serotonin reuptake inhibitors, 27% mixed amine effects, 17% cyclic Ads, and 11% bupropion; similar to the mixed agent abuse situation. There was no change in abuse frequency over the study period. 57% of patients were 20 years or more in age and 52% were male. 96% involved ingestion, 8% inhalation, and 1% injection with multiple routes in some exposures. Of the 557 cases taking only a single AD, 49% were already at/en route to a healthcare facility, 28% were referred to a healthcare facility, and 20% were managed on site. The medical outcome was 23% no effect, 19% minor effect, 16% moderate effect, 3% major effect, 1% not followed-judged nontoxic, 16% not followed-minimal effects, 20% unable to follow-potentially toxic, and 2% unrelated effect. The most common clinical effects were drowsiness (24%), tachycardia (12%), vomiting (10%), agitation (5%), and nausea (5%). The most frequent treatments were activated charcoal (23%), IV fluids (17%), cathartic (15%), dilution (7%), and benzodiazepines (6%).
Conclusion: ADs are used as drugs as abuse and physicians and public health providers should be aware of this. Abusers tend to be adult and male. AD abuse is commonly associated with other drugs. Patients tended to be managed at healthcare facilities. AD abuse can lead to major effects.
Keywords: Antidepressant, Abuse, Prescription drug

207. Antipsychotics as drugs of abuse

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Background: Prescription drug abuse is increasing in the US. While not as common as other drugs, the abuse of antipsychotics (APs) is reported. There is little information on AP abuse. This study assesses the frequency of AP abuse and the health impact associated with it.
Methods: All AP exposures coded as "intentional abuse" reported to a statewide poison center system during 2000-2012 were identified. Multiple-agent exposures were included in the demographic and circumstance factors data. However, only single agent exposures were used to calculate the clinical outcomes and management data. Comparisons were made between atypical antipsychotics (AAPs) and typical antipsychotics (TAPs).
Results: There were 1,343 cases of AP abuse of which 981 involved AAPs and 380 TAPs. The annual number peaked at 185

cases in 2010 and then declined to 106 cases in 2012. Patient age was 51% (49% AAP, 56% TAP) 20 years or more and sex was 62% (61% AAP, 63% TAP) male. 97% (97% AAP, 94% TAP) involved ingestion, 7% (8% AAP, 7% TAP) inhalation, and 2% (1% AAP, 4% TAP) injection with multiple routes in some exposures. Of the 590 single-agent cases (436 AAP, 154 TAP), 64% (68% AAP, 51% TAP) were already at/en route to a healthcare facility, 21% (19% AAP, 29% TAP) were referred to a healthcare facility, and 12% (11% AAP, 17% TAP) were managed on site. The medical outcome was 15% (17% AAP, 10% TAP) no effect, 25% (28% AAP, 14% TAP) minor effect, 27% (26% AAP, 29% TAP) moderate effect, 3% (3% AAP, 3% TAP) major effect, $<1\%$ ($<1\%$ AAP, 0% TAP) not followed-judged nontoxic, 11% (9% AAP, 19% TAP) not followed-minimal effects, 17% (15% AAP, 25% TAP) unable to follow-potentially toxic, and 2% (2% AAP, 1% TAP) unrelated effect. The most common clinical effects were drowsiness (41%; 46% AAP, 26% TAP), tachycardia (15%; 16% AAP, 12% TAP), dystonia (10%; 6% AAP, 21% TAP), slurred speech (7%; 7% AAP, 6% TAP), and agitation (6%; 6% AAP, 6% TAP). The most frequent treatments were IV fluids (27%; 28% AAP, 26% TAP), activated charcoal (17%; 21% AAP, 7% TAP), antihistamines (12%; 8% AAP, 26% TAP), cathartics (12%; 15% AAP, 3% TAP), and benzodiazepines (5%; 3% AAP, 11% TAP).

Conclusion: APs are used as drugs as abuse. Physicians and public health providers should be aware of this. Abusers tend to be male. AP abuse frequently involves other drugs. AAP patients were more likely to be managed at a healthcare facility while TAP patients were more likely to have major effects. AAP abuse was more likely to result in drowsiness and tachycardia while TAP abuse was more likely to result in dystonia. AAP abuse was more likely to be treated with activated charcoal and cathartics while TAP abuse was more likely to be treated with antihistamines and benzodiazepines.

Keywords: Antipsychotic, Abuse, Prescription drug

208. Oil production worker exposures reported to poison centers

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Background: Oil production in the United States is increasing. This study describes exposures reported among oil production workers to poison centers.

Methods: This study used data collected by a statewide poison center system during 2003-2012. All records with any of the following terms in their notes fields were identified: oil field, oil rig, oil drill, oil work. These records then were reviewed to identify those that appeared to relate to exposures that occurred to workers while they were involved in oil production. Exposures to animals, medications or drugs, and infectious diseases were excluded from further analysis. The distribution of the remaining exposures was determined for various factors.

Results: Of 408 total exposures, 20 involved exposures to animals, 10 medications or drugs, and 1 infectious disease. Of the remaining 377 exposures, the annual number of exposures increased from 15 in 2003 to 88 in 2012. The mean patient age was 34 years (range 17–77 years); 98% were male. The most commonly reported exposure routes were inhalation (46%), dermal (38%), ocular (19%), and ingestion (14%). The exposure was unintentional in 99% of the cases. The caller site was a healthcare facility (70%), own residence (20%), workplace (6%), and other/unknown (5%). The patient was already at/en route to a healthcare facility in 73% of the cases, managed on site in 14%, and referred to a healthcare facility in 12%. The distribution by medical outcome was no effect (11%), minor effect (26%), moderate effect (28%), major effect (5%), not followed-minimal effects possible (15%), unable to follow-potentially toxic (10%), unrelated effect (5%), and death (0.5%). The rate per 1,000,000 population was 7.9 in urban counties and 63.7 in rural counties. The most frequently reported specific substances were hydrogen sulfide (28%), sodium hydroxide (10%), hydrochloric acid (5%), crude oil (4%), and fuel (3%).

Conclusion: Reported oil production exposures have increased. Comparatively few of the exposures were reported from the workplace, suggesting that there was often some delay between the exposure and contacting the poison center. Poison centers might attempt to educate the oil production industry that they are available should any potentially adverse exposures occur, thereby possibly making patient management more timely. Most of the exposures involved healthcare facility management although the majority of exposures were not considered serious. Higher rates of exposures were reported from rural counties, probably because that is where oil production is more likely to occur. A major limitation of this study is that it depended on the circumstances of the exposure being recorded in the notes.

Keywords: Poison center, Occupational, Oil production

209. Adolescent 2C Series phenethylamine derivative exposures reported to poison centers

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Background: Among the designer drugs that have increased in popularity in recent years are 2C series phenethylamine derivatives. These include such substances as 2CB, 2C-D, 2CE, 2C-I, 2C-P, 2CT2, 2CT7, 2C-T-21, and 25-I. Individuals use these drugs to induce hallucinations, euphoria, and empathic and emotional behavior. Since many of the reported adverse exposures involved adolescents, the intent of this investigation was to describe adolescent 2C series phenethylamine derivative exposures reported to poison centers.

Methods: All 2C series phenethylamine exposures among patients age 13–19 years reported to a statewide poison center system during 2000–2012 were identified. (No patients less than 13 years were reported.) Exposures involving other substances in addition to these drugs and those not followed to a final medical outcome were included. The distribution of exposures by selected factors was determined.

Results: Of 31 adolescent exposures, 32% involved 2C-E, 23% 2C-I, and 23% 2C-P. No exposures were reported prior to 2005 and 77% during 2011–2012. The mean patient age was 17 years (range 14–19 years); 77% of the patients were male. The exposure route was ingestion alone (71%), ingestion and inhalation (10%), inhalation alone (6%), injection (3%), and unknown (10%). Forty-eight percent of the exposures occurred at the patient's own residence,

16% in a public area, 3% at another residence, 3% at school, and 29% at an unknown location. Seventy-four percent of the patients were already at or en route to a healthcare facility and 26% were referred to a healthcare facility. The medical outcome was minor effect (16%), moderate effect (48%), major effect (16%), unable to follow-potentially toxic (16%), and unrelated effect (3%). The most commonly reported adverse effects were tachycardia (58%), hallucinations (39%), mydriasis (29%), hypertension (26%), agitation (26%), drowsiness (16%), confusion (13%), electrolyte abnormality (13%), and seizure (13%). The most common treatments were IV fluids (68%), benzodiazepines (45%), intubation (13%), oxygen (13%), other sedation (10%), and ventilation (10%).
Conclusion: Adolescent 2C series phenethylamine exposures increased during the last several years. The majority of the patients were males and most of the drugs were ingested. Although the highest proportion of exposures occurred at the patient's home, the next highest proportion occurred in public areas. Most of the exposures resulted in potentially serious outcomes, and management at a healthcare facility occurred or was recommended for all of the cases. One limitation of the study was that exposure was not always confirmed clinically.
Keywords: Adolescent, Poison center, 2C series phenethylamine derivative

210. Guaifenesin and kidney stones: the painful truth

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Background: Guaifenesin is an expectorant medication found in many over the counter cough and cold preparations. Although guaifenesin itself has no intoxicating properties, it is often found in combination with dextromethorphan and/or antihistamines, which are commonly abused for their euphoric and hallucinatory effects. While guaifenesin is typically considered non-toxic, we present two cases of patients with histories of chronic dextromethorphan abuse presenting with acute kidney stone formation, thought to be attributed to excess guaifenesin ingestions.
Case 1: A 17 year old boy was admitted to a psychiatric unit after being medically cleared following an ingestion of 28 tablets of guaifenesin 1,200 mg/dextromethorphan 60 mg (Mucinex DM®). Hours later he developed tachycardia, diaphoresis, vomiting and lower back pain. He was returned to the Emergency Department (ED) where it was discovered he had 2 large kidney stones. He reports abusing similar products over the past several years.
Case 2: A 22 year old man presented to an ED after ingesting 10 Mucinex DM® tablets in an effort to get high. 9.5 hours later he was found to have a SCr of 1.5. He was transferred to a larger facility and found to have 2 large kidney stones that were obstructing his ureters.
Discussion: Guaifenesin acts as an expectorant by increasing the volume and reducing the viscosity of secretions in the trachea and bronchi. It also stimulates the flow of respiratory tract secretions, allowing ciliary movement to carry the loosened secretions upward toward the pharynx. Thus, it may increase the efficiency of the cough reflex and facilitate removal of the secretions. Recently guaifenesin has been linked to the formation of kidney stones in chronic abusers. Guaifenesin is excreted as unchanged drug and metabolites in the urine, the major urinary metabolite being ß-(2-methoxyphenoxy)-lactic acid. Urinary calculi examined from the kidneys of patients that admitted to chronically taking large doses of guaifenesin-containing medications were found to be composed of the calcium salt of this metabolite. A study of 56,000 urinary calculi showed that 0.05% of the stones were composed of this calcium salt metabolite.
Conclusion: Although guaifenesin ingestions are typically considered nontoxic, these cases demonstrate the potential for adverse effects with chronic guaifenesin abuse. It is important for clinicians to recognize the potential for this compound to cause nephrolithiasis.
Keywords: Abuse, guaifenesin, nephrolithiasis

211. Effect of an Alcohol Withdrawal Protocol on Patient Care

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Background: The treatment of alcohol withdrawal (AW) often requires inpatient pharmacological intervention. Numerous medications are used therapeutically, although clinician preferences vary. Benzodiazepines (BZD) are considered first-line agents, while other therapies include beta-adrenergic antagonists, clonidine, dexmedetomidine, anticonvulsants, and neuroleptics. On October 1, 2010, the Department of Internal Medicine of a suburban, academic tertiary care hospital implemented a new clinical protocol to treat and manage patients with AW. Prior to this there were no defined algorithms or protocols in place. The new protocol stratifies patients into low- and high-risk categories and correlates a clinical assessment with BZD dose and frequency.
Objectives: The primary objective was to investigate the impact of a treatment protocol on outcomes of patients admitted medically for AW. Primary objectives included length of stay (LOS), number of intensive care unit (ICU) admissions, number of patients leaving against medical advice (AMAs), and alcohol-related readmissions within 30 days of discharge.
Methods: This was a retrospective chart review of all patients admitted to a tertiary care facility medicine service in suburban New York, during a 6 month period before the implementation of the protocol (03/01/2010 – 08/31/2010) and those admitted during the 6 month period after implementation of the protocol (12/01/2010 – 05/31/2011). Medical records were identified by ICD-9 codes (alcohol withdrawal, alcohol related disorders, etc) and pharmacy records. All patients that were admitted to Medicine and treated for alcohol withdrawal were included and reviewed. Records of patients admitted from 09/01/2010 – 11/30/2010 during which the protocol was being introduced were excluded. Data were representated as either means and standard deviations or medians and interquartile ranges for continuous variables; Chi squares or Fisher's Exact tests were performed for dichotomous variables.
Results: The control group (prior to implementation) consisted of 138 patients (67.4% male, mean age = 46.2 years). The experimental group (after implementation) consisted of 129 patients (69% male, mean age = 45.6 years). There was no statistically significant difference in LOS, ICU admissions ($p = 0.06$), or alcohol-related readmissions ($p = 0.3$) between the two groups. There were fewer AMAs post-implementation of the protocol ($p = 0.03$).

Conclusions: Implementing an AW protocol did not show a statistically significant difference in patient outcomes as measured by LOS, ICU admissions, or alcohol-related readmissions. However, there were fewer AMAs after the protocol was implemented.
Keywords: Alcohol, Withdrawal, Protocol

212. Successful suicide by non-pharmaceutical toxins over a 12-year period

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Background: In 2010, 6,599 poisoning suicides were reported in the United States (US). While medications remain the primary substances involved in completed poisoning suicides, successful fatal poisonings with non-pharmaceutical substances occur with some regularity. The goal of this study was to identify successful suicides caused by non-pharmaceutical self-poisoning in a large US county over the last 12 years.
Methods: A large US county medical examiner's database was queried for all suicides in which exposure to non-pharmaceuticals was listed as cause death from 2000-2012. Substances were categorized by specific toxin when available and by product type when unavailable. Decedent age, sex and circumstances surrounding each case were also reviewed.
Results: Ages ranged from 18-95 (median 48) years. There were 160 (77%) males and 48 females. Discussion: Carbon monoxide inhalation (vehicle exhaust, burning charcoal; 49%) was the most common method of suicide and remained relatively constant over the study period. Ethylene glycol (antifreeze ingestion; 7%) and cyanide (ingested, used in chemistry, photography; 4%) were employed in a relatively constant manner as well. There has been an increasing number of helium inhalation (plastic bag over head attached to helium tank; 31%) deaths in recent years.
Conclusion: Inhaled toxins are the most popular (81%) in non-pharmaceutical suicides, likely due to their rapidity of death. Although much less frequently, individuals successfully employ a broad spectrum of other toxins to commit suicide.
Keywords: Suicide, Non-pharmaceutical, Fatal

213. Metformin overdose-induced recurrent hypoglycemia

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Background: Metformin inhibits gluconeogenesis and glycogen breakdown, decreases glucose absorption and improves peripheral insulin sensitivity. Metformin is generally thought not to cause hypoglycemia. We report a case of metformin overdose who presented with severe lactic acidosis and recurrent hypoglycemia, along with serial serum metformin levels.
Case report: A 31 year old male presented 10 hours after suicidal ingestion of 50 grams metformin. In the field he was drowsy and fingerstick glucose was 13 mg/dl. He was given oral glucose after which his glucose rose to 156 mg/dl. In the ED he was awake, tachypneic with RRof 20, HR 80, BP134/45, SpO2 100 % T36.8. His fingerstick glucose was 40mg/dl and he received 50% dextrose. The patient had HIV for which he was taking Atripla. Chemistry studies were remarkable for bicarbonate 11.3 mEq/L, BUN 24 mg/dl, creatinine 1.9 mg/dl

Despite 5% dextrose infusion, he developed another episode of hypoglycemia to 57 mg /dl, then received a 10% dextrose infusion, and sodium bicarbonate for lactic acidosis. He was hemodialyzed for 6 hours on the day of admission and 6 hours on the following day for persistent lactic acidosis in the context of worsening renal function, with a peak creatinine of 2.6 mg/dl.

The table shows serial plasma metformin levels with corresponding lactate and blood glucose concentrations. The peak metformin level was 98 mcg/ml. The insulin level was low and no sulfonlyureas were detected . The patient glucose and lactate normalized by day 2. He was transferred for psychiatric care.
Discussion: Our patient presented with severe hypoglycemia in the context of an acute metformin overdose with a peak level of 98 mg/l. Prior reports indicate that a metformin level above 50 mg/L is a predictor of mortality. Our patient had recurrent hypoglycemia episodes over the first 24 hours despite a marked decline in metformin levels but associated with a persistently high lactate level. Also despite 6 hours of dialysis with a substantial

Table. Results for abstract number 212.

Toxin	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Carbon monoxide	14	6	4	7	10	8	6	15	9	8	6	7	3	103
Helium		2	4	2	4	2	3	4	4	8	12	6	13	64
Ethylene glycol	1				2	2	1	1	2	1	1	2	1	14
Cyanide		2		1			1	1	1	1			1	9
Caustic/corrosive	1	1										1	2	5
AChE inhibitor	1					1	1		1					4
Hydrogen sulfide											2		1	3
Strychnine	1		1											2
Herbicide/fungicide													1	1
Furniture stripper													1	1
Zinc phosphide						1								1
Gasoline	1													1
Water												1		1
Total	19	11	9	10	16	14	12	21	17	18	21	17	23	209

Table. Lab results, abstract number 213.

Hrs	Metformin mcg/ml	Lactate mmol/l	Glucose mg/dl
9			13
9.1			156
11	98	11.2	40
13	84	15	57
14	50	15	207
20	19	11.4	89
25	19	7.4	45
29	22	6.8	76
33	13	1.8	78
42	11		122

decline and plateau in metformin levels, lactate remained high, for which another 6 hours round of dialysis was performed. Hypoglycemia has been reported in previous metformin overdose cases but its time course in association with serial metformin levels have not been reported.

Conclusion: Metformin overdose can cause severe and recurrent hypoglycemia over 24 hours in the context of lactic acidosis, even when metformin levels have declined. Blood glucose should be monitored, particularly in metformin ingestions resulting in lactic acidosis.

Keywords: Metformin , Hypoglycemia , Lactic acidosis

214. Duloxetine: An uncommon cause of fatal ventricular arrhythmia

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Background: Duloxetine (Cymbalta) is a serotonin norepinephrine reuptake inhibitor (SNRI) used to treat depression, diabetic neuropathic pain, fibromyalgia, and stress urinary incontinence. Duloxetine overdose is associated with vomiting, tachycardia, CNS depression, hypotension, serotonin syndrome, and seizures. Ventricular arrhythmia in overdose is not described and reports of fatal ingestions are scant. We present an ultimately fatal case of recurrent ventricular tachycardia (VT) and torsade de pointes (TdP) secondary to duloxetine overdose.

Case report: A 44-year-old woman, last seen one hour prior, was found next to bottles of duloxetine and oxycodone. Paramedics diagnosed pulseless VT. After cardiopulmonary resuscitation, 100mg of lidocaine, 5mg of epinephrine, 50mEq of sodium bicarbonate (bicarb) and 5 episodes of defibrillation, she regained a pulse and sinus rhythm. She arrived to the hospital intubated with a pulse of 135 beats per minute with many premature ventricular complexes, blood pressure 147/111 mmHg, and oxygen saturations of 95%. ECG revealed QRS duration of 166ms, QTc of 520 ms, and a 4 mm R wave in aVR. She recieved 50mEq of bicarb and then an isotonic infusion. She then suffered TdP with successful defibrillation, followed by 30 episodes of TdP and VT with successful defibrillation. During that time, 250mEq of bicarb, 450mg of amiodarone, and 4 g of magnesium were given. Labs were notable for sodium of 137 mMol/L, potassium of 3.2 mMol/L, CO2 of 19 mMol/L, and magnesium of 2.5 mg/dL. Serum et hanol, acetaminophen, salicylate, amitriptyline and nortiptyline levels were negative. A urine drug screen was positive only for benzodiazepines. A serum duloxetine level was 102ng/mL (therapeutic 20-80ng/mL). Coronary angiography found no obstructive disease. No further arrhythmia occurred; she was declared brain dead on hospital day 6.

Case discussion: SNRI's are a relatively new class of structurally heterogeneous antidepressants including duloxetine and venlafaxine. Duloxetine is a potent SNRI with equal reuptake inhibition on both norepinephrine and serotonin without known active metabolites. Therapeutic use is not known to cause QTc prolongation. Three cases of sinus tachycardia are described due to therapeutic dosing. Fatalities attributed to duloxetine are limited to one case of fatal hepatotoxicity from therapeutic dosing and one case of pulmonary embolism after acute duloxetine ingestion. Unlike venlafaxine, overdose of duloxetine leading to QTc prolgation and fatal ventricular arrhythmia is undescribed.

Conclusion: Clinicians should be aware of the potential for QTc prolgation and fatal ventricular arrhythmia in the setting of duloxetine toxicity.

Keywords: Antidepressant, Arrhythmia, Ingestion

215. Complications of intentional denture cleanser tablet ingestion

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Background: Denture cleansers are common household products; adverse effects related to ingestion of these products are infrequently reported. We present a case of denture cleanser tablet (DCT) ingestion resulting in pulmonary, oropharyngeal and esophageal complications.

Case report: A 68 year-old female with a past medical history significant for depression and deep venous thromboses had a witnessed ingestion of Polident® Overnight Whitening DCT's; she chewed and swallowed six tablets after an altercation with a relative. Although initially asymptomatic, the patient developed coughing and "gurgling" respirations three hours after the ingestion and was brought to the Emergency Department (ED). In the ED, she was noted to have a hoarse voice and was spitting up saliva. She did not complain of abdominal pain. She was tachypneic (RR 28/min) and hypoxic (oxygen saturations 84% on a non-rebreather mask). The patient was admitted to the Intensive Care Unit and treated with high-flow oxygen. Although her initial chest radiograph was normal, results of chest radiography performed twelve hours after the ingestion were consistent with aspiration pneumonitis. The patient was treated with albuterol/ipratropium nebulizers, intravenous and nebulized corticosteroids, and intravenous antibiotics. Her oxygen saturations and dysphonia improved within the first twenty-four hours after the ingestion. Vocal cord erythema and edema of the hypopharyngeal and supraglottic areas were noted on flexible nasopharyngoscopy performed one day after the ingestion. Esophagogastroduodenoscopy was performed two days after the ingestion, and revealed Grade II non-reflux esophagitis in the proximal third of the esophagus as well as an ulceration in the vestibule. The patient was treated with omeprazole, and her diet was advanced slowly.

She was transferred to the psychiatric service nine days after the ingestion.
Case discussion: Polident® Overnight Whitening contains sodium perborate, which forms an alkaline peroxide solution when dissolved in water or oral secretions. Liberation of peroxide in the esophagus can cause corrosive tissue injury. One previously published canine model of DCT ingestion reported the presence of localized erosions in the proximal third of the esophagus after DCT's were fed to anesthetized dogs. In the same study, denture cleansing powders were found to cause diffuse esophagitis as well as massive coagulation necrosis of the gastric mucosa.
Conclusions: DCT ingestion may result in oropharyngeal and esophageal injury as well as aspiration pneumonitis. Patients who ingest denture cleansing products should be monitored closely in a hospital setting for these complications.
Keywords: Caustic, Overdose, Denture Cleanser

216. Use of percutaneous left ventricular assist device (impella) in vasodilatory poison-induced shock

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Background: The Impella is a relatively new left ventricular assist device (LVAD) that can be inserted percutaneously. Current approved uses include severe left sided systolic heart failure and cardiogenic shock. There are few if any published cases on use of percutaneous LVADs in poison-induced cardiogenic or vasodilatory shock. We report such a case.
Case report: A 58-year-old woman presented to an emergency department after an overdose of zolpidem and amlodipine in unknown amounts. Her presenting vital signs were initially normal, but deteriorated after arrival— systolic blood pressure (SBP) dropped from 140mmHg to 85mmHg, and pulse dropped from 70 beats per minute (bpm) to 50 bmp. The patient was started on high dose insulin titrated to 10 units/kg/hr within 2 hours. She received at least seven grams of IV calcium gluconate. Due to continued hypotension, she required dopamine (later switched to epinephrine due to episodes of atrial fibrillation), vasopressin, norepinephrine, and phenylephrine. Despite maximum catecholamine doses, her blood pressure was 60/35 mmHg and her pulse was 40-50 bpm. Labs revealed a serum lactate of 8.4mmol/L. Echocardiogram revealed an ejection fraction of greater than 90% and she was reported to have peripheral vasodilation. Due to continued deterioration, a percutaneous LVAD (Impella) device was inserted and remained in place for 11 hours. During this period catecholamines were weaned and mean arterial pressure improved to 74 mmHg within 2 hours. While removing the Impella device, there was a minor arterial tear and the patient underwent successful surgical repair. Following removal, high dose insulin and vasopressors were weaned and discontinued over the next 12 hours, and the patient recovered neurologically intact.
Discussion: Percutaneous LVADs in poison-induced shock is infrequently reported and use of the device for this indication has not undergone scientific study. This case may have experienced benefit from the percutaneous LVAD, but also experienced a complication. Further studies are indicated to understand the risks and benefits of this procedure, but due to limited treatment options for refractory poison-induced shock, this device may be considered in certain clinical situations. Other options for mechanical cardiac support also have risks and benefits. Intra-aortic balloon pumps require adequate heart rate and blood pressure to function properly and extracorporeal membrane oxygenation (ECMO) is invasive and is often not available at many centers.
Conclusion: Percutaneous left ventricular assist device may help in poison-induced vasodilatory shock refractory to vasopressors.
Keywords: Cardiac toxicity, Calcium channel blocker, Mechanical Cardiac Support

217. Assessment of pediatric intentional exposures as reported to US poison control centers, 2003–2012

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Background: The majority of calls received by US Poison Control Centers (US PCCs) occur in the pediatric population. As children age, the reason for their exposure shifts from unintentional to intentional exposures. The AAPCC designates pediatric age groups as those under the age of 6 years, 6–12, and 13–19. However, recent PCC data found that of deaths in children over the age of 6 years, 46.4% were the result of suicide with another 14.8% from substance abuse including children under 12 years with intentional abuse. While data suggests children between the ages of 6 and 12 exposures are a combination of unintentional and intentional exposures, PCC data has not be evaluated to determine if there are changes in the intent of exposures in this age group.
Methods: A retrospective review of aggregate data regarding exposures reported to US PCCs for children 1-18 years of age for the years of 2003 – 2012 was performed to assess changes in rates for intentional exposures across age groups and over time. All human intentional cases were obtained with analysis of intentional abuse and total intentional cases with respect to total number of human exposures for each year of age as calculated by intentional case per 1000 total cases per age (years).
Results: The highest number of total human exposures for each pediatric age category occurred in the years 2008 or 2009 with the nadir occurring in 2012 in most age groups. The number of total intentional exposures per 1000 total pediatric exposures per year of age was higher in 2012 compared to 2003. A increase was noted in children over the age of 6 years between 2003 and 2012 (22 cases/1000 total and 38 cases/1000 total, respectively). This trend continued through children 18 years of age. The number of intentional exposures more than tripled between children 5 years and 6 years of age (11.4 cases/1000 total and 38 cases/1000 total, respectively) in 2012. There was an increasing trend until 12 years of age when the incidence increased to 127 cases/1000 total. The highest incidence occurred in 17 year olds with a rate of 593 cases/1000 total. Similar trends were seen within the intentional abuse category at lower incidence rates overall.
Conclusions: Current age categories set by the AAPCC are appropriate with children 6-12 years increasing intentional exposures but to a lesser extent than those older than 13 years. However, there is an increasing trend during this age category. Increased intentional exposures were seen in 2012 compared to 2003. Further

elucidation of the data is needed to ascertain full intent (e.g., abuse versus suicide) of the cases.
Keywords: Pediatric, Poison center, Intentional Exposures

218. Advanced hemodynamic monitoring in doxazosin and propranolol induced cardiovascular collapse

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Background: Few reports exists of doxazosin overdose and to our knowledge no reports exist documenting hemodynamic parameters following doxazosin and propranolol induced cardiovascular collapse.
Case report: 34 yo M with a history of hypertension was found lethargic at prison following a reported ingestion of over 100 tablets of Doxazosin 4 mg and Propranolol 10 mg. His initial vital signs were HR 48 and BP 66/42 and he was intubated, started on levophed, glucagon, and epinephrine, and transferred to our institution. On arrival, he remained bradycardic and hypotensive despite high dose pressors. Insulin and intralipid were initiated at 7 hours post ingestion and CVVH was started due to oliguric renal failure. Due to persistent hypotension, vasopressin and isoproterenol were added. Cardiology was consulted and placed a temporary pacemaker. By 24 hours post ingestion, the patient was on epinephrine at 30 mcg/min, isoproterenol at 12 mcg/min, vasopressin at 0.04 U/min, glucagon at 5 mg/hr, insulin at 2 U/kg/hr, and Norepinephrine at 30 mcg/min to maintain a systolic blood pressure over 80 mm Hg. Hemodynamic monitoring was performed with a FloTrac© device and indicated vasodilatory shock, indicating a relatively greater degree of alpha blockade than beta blockade (see table). The patient was started on phenylephrine titrated up to 120 mcg/min. By hospital day (HD) 2, his hemodynamics improved and his pressors were weaned. He was off all pressors by 60 hours post ingestion and off insulin and glucagon shortly afterwards. By HD 5 he was extubated. He was discharged on HD 7 neurologically intact. Serum doxazosin level sent 50 hours post ingestion was 83 ng/mL (reference; peak levels of 8 ng/mL 2-3 hours following 1 mg dose).
Discussion: Few reports of doxazosin overdose exist. In this case of cardiovascular collapse following a mixed ingestion of doxazosin and propranolol, advanced hemodynamic monitoring suggested a severe vasodilatory shock and his doxazosin level indicates a large exposure. Hemodynamic parameters were used in real time to assist with vasoactive medication management and the patient ultimately did well.
Conclusion: We report a case of neurologically intact survival following doxazosin and propranolol induced cardiovascular collapse with results of hemodynamic monitoring during the acute phase.
Keywords: Cardiac toxicity, Shock, Overdose

219. Non-expected metaxalone symptoms

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Background: Metaxalone is a centrally acting muscle relaxant with an unclear mechanism of action; it causes central nervous system depression and may affect polysynaptic spinal reflexes. In the literature, overdose is primarily characterized by sedation. Limited case reports describe serious toxicity. We report three cases of isolated metaxalone overdose characterized by muscular rigidity, tachycardia, and altered mental status (AMS). Seizures were reported in the pediatric ingestion and one adult patient exhibited hyperthermia.
Case reports: Case One: A 61-year-old female presented to the emergency department (ED) 3 hours after ingesting 56 grams of metaxalone. She was hypertensive, (blood pressure (BP) 189/97), tachycardic, tachypneic, and had excess secretions. She was then intubated and sedated with a midazolam infusion, with a maximum rate of 12 mg/hr. Her body temperature (T) was 101° Fahrenheit (F) and muscle rigidity was noted. Her T peaked at 104° F. 13 hours post-ingestion her muscle rigidity had abated, her heart rate (HR) was improved to 80, and T decreased to 100.7° F. 24 hours post-ingestion she was extubated and admitted to taking only metaxalone.
Case Two: A 14-month-old male was brought to the ED after ingesting 1600mg metaxalone. 2 hours post-ingestion the child was ataxic and acting strangely. At 4 hours post-ingestion the child had mydriasis, trismus, stiff legs, and a seizure, so was given a dose of lorazepam. He was hypertensive and tachycardic (HR 160). He had a second seizure and was again given lorazepam. Muscle rigidity resolved at 8 hours post-ingestion, however, he remained drowsy, and ataxic with mydriasis. He was discharged on hospital day 2.
Case Three: A 41-year-old female presented to the ED 1 hour post-ingestion of 16 grams metaxalone. 6 hours post-ingestion she developed AMS, muscle rigidity, clonus, mydriasis, tachycardia (HR 120). She became hypotensive, requiring fluid resuscitation. Due to altered mental status she was intubated and sedated with midazolam. Muscle rigidity, AMS and diaphoresis persisted until 36 hours post-ingestion. Electroencephalogram was normal. Creatinine kinase peaked at 13,571 units/liter. She was medically cleared 60 hours post ingestion.

Table. Data for abstract number 218.

	HD 1	HD 2	HD 3	HD 4
CVP (Central Venous Pressure)	18	12	14	24
CI (Cardiac Index)	2.2	4.3	4.0	4.4
SVV (Stroke Volume Variation)	23		17	6
SVR (Systemic Vascular Resistance)	568	408	426	1081
Infusions	Levophed, Epi, Vaso, Glucagon, Insulin, Isoproterenol	Levophed, Epi, Vaso, Glucagon, Insulin, Isoproterenol, Phenylephrine, transvenous pacer	Glucagon, Insulin	None

Discussion: Metaxalone overdoses are generally well tolerated and respond to supportive care. However, the above cases demonstrate that metaxalone overdose may have significant neuromuscular and autonomic symptoms, which may mimic neuroleptic malignant syndrome or serotonin syndrome.
Conclusion: Health care providers should be cognizant of the potential effects of metaxalone and ensure patients are monitored for an adequate period of time following overdose.
Keywords: metaxalone, Overdose, neuromuscular

220. Overdoses managed in an observation unit

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Background: Observation Units (OU) are a new but increasing aspect of hospitals. OU provide more efficient use of resources in an increasingly taxed healthcare system. The majority of poisoned patients' medical issues resolve in 24 hours, making them ideal canididates for an OU. The purpose of this study is to examine the types and safety of overdoses placed in our OU. We hypothesize the majority of patients admitted to the OU did not require further medical intervention or upgrading to a higher level of care.
Methods: We performed a retrospective chart review of patients with ICD-9 codes associated with overdose or poisoning admitted to our OU between 7/1/10 and 12/31/12. A total of 137 patients were identified, 112 were included. Exclusions were: admission to hospital (17); transfer to psychiatry (4); miscoded (2); and seen at other site (2). Research associates, blinded to research goals, reviewed medical charts using a structured data collection form. We collected pertinent information detailed below, medical interventions, and any upgrades in disposition.
Results: Between 7/1/10 and 12/31/12 there were 112 patients admitted to the OU versus 454 patients admitted to the hospital with selected ICD-9 codes. Overall 566 patients had these ICD-9 codes, 20% were managed in the OU.

Patients' ages ranged from 17 to 76 years old (mean 38), with 41% male (46) and 59% female (66). Ethnicity was: African American 65% (73); Caucasian 19% (21); Hispanic 12% (13); and Asian 4% (4). A total of 230 different substances were recorded with 61 patients taking more than one intoxicant. The most common overdoses were: sedative- hypnotics (66); antipsychotics (22); non-opioid analgesics (21); opioid analgesics (20); anticholinergic (18); illicit substances (18); antidepressants (14); ethanol (13), and cardiovascular drugs (12).

Initial OU mental status recorded was: 54% alert and oriented to person, place and time (60); 41% sedated (46) and 5% confused (6).

The most common medical interventions in the ED were: sedatives (18); naloxone (12); activated charcoal (9); dextrose (5), and N-acetylcysteine (4) The most common medical interventions in the OU were: sedatives (24); oxygen (10); and naloxone (5). No intubations or cardiac arrests occurred in the ED or OU. No patients were upgraded to a higher level of care.
Conclusions: Patients with varying poisonings who do not show significant deterioration during our customary practice of ED observation for 4-6 hours post exposure would likely be safe for an OU. Understanding the types of overdoses that are safe to be managed in an OU can assist in appropriate disposition, patient flow, efficient use of resources, and provide the best level of care for the patient.
Keywords: Overdose, Surveillance, Observation

221. A patient administered prehospital ketamine on 20 separate episodes

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Background: Ketamine is often used for in-hospital analgesia and procedural sedation. It has also been used to control prehospital agitation but is not widely accepted for this purpose. We report outcomes from 20 prehospital ketamine administrations to a single patient with recurrent agitation.
Case report: A 100 kilogram 53-year old male with video EEG-confirmed pseudoseizures was transported 25 times over 12 months for "seizures" and severe agitation. He was known to have violent "post-ictal" states during which he had injured multiple first responders. Due to the dangers of frequent transports to the emergency department (ED), emergency medical service (EMS) elected ketamine sedation for the patient's agitation and "post-ictal" states.

Over 25 transports, he received prehospital intramuscular ketamine 20 times, 4 times with benzodiazepines (BZDs). He received BZDs alone 4 times. Total ketamine doses ranged from 200-700mg. "Improved" patient status occurred in 20/20 ketamine cases compared to 2/4 BZD cases. Mean time to ketamine from EMS arrival was 14 minutes (range 7–28). ED data were available in 24/25 transports. Mean prehospital systolic blood pressure (SBP) was 181mmHg; mean initial hospital SBP was 176mmHg. Mean prehospital heart rate (HR) was 113; mean initial hospital HR was 97. 9 of 9 urine cocaine screens were positive.

No significant prehospital complications occurred; one episode of respiratory depression was treated with oxygen. There were six airway interventions, including suctioning (2), nasopharyngeal airways (3), and one oropharyngeal airway. In the ED, secretions were managed with suctioning and atropine twice. He was intubated twice, both at the same institution. In the remaining 18 instances, the patient was observed without an advanced airway. No laryngospasm or emergence reactions occurred.
Case discussion: Prehospital ketamine was administered to the same patient on 20 occasions. Increased oropharyngeal secretions, a commonly known side effect of ketamine, resulted. Several minimal interventions including suctioning and atropine were undertaken, and no significant prehospital complications occurred. ED endotracheal intubation occurred twice at the same institution; urine cocaines returned positive in both instances.
Conclusions: In this unusual case of a patient with agitation following recurrent pseudoseizures, prehospital ketamine resulted in improved patient status by prehospital provider assessment compared to BZDs alone. Ketamine's known side effect of increased secretions was commonly encountered. In agitated patients at risk of harming themselves or their caregivers, prehospital ketamine is a viable sedating agent.
Keywords: Sedation, Agitation, Prehospital

222. Poison Center information provides colchicine poisoned patient with compassionate end of life care

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Background: Colchicine is an alkaloid drug derived from plants Colchicum autumnale, and Gloriosa superba. It is used to treat gout as well as many other disorders including pericarditis. Death has been reported from as little as 7 mg, with 0.8 mg/kg the well accepted fatal dose. We report a case where the poison center (PC) provided insight into the severity of the exposure and improved end of life care.
Case report: A 31 year old, 68 kg, male presented to an ED after an overdose of 160 tablets of his 0.6 mg colchicine, and 30 tablets of his 20 mg Prilosec. Past medical history includes asthma, psychosis, and pericarditis. The patient told the staff that he took the ingestion in an attempt to seek psychiatric care and denied any real intent to harm himself. On arrival to the ED, the patient was awake and alert. Gastrointestinal toxicity with nausea and vomiting rapidly ensued. Supportive care was initiated and multiple dose activated charcoal was attempted. By history, the patient ingested 1.4 mg/kg colchicine. With the history of ingestion, the predicted outcome was discussed with the health care providers. With that information, the health care providers were able to attempt to locate the patient's family and discussed the severity of the ingestion with the patient. As the patient deteriorated over the next 48 hours, supportive care was continued and the healthcare providers were able to provide end of life care to the patient. The patient expired from multi-system organ failure 69 hours post exposure.
Discussion: Many times poison centers are consulted on cases where death is the expected outcome. In only a few cases are we able to predict fatality when a patient is initially awake, alert and oriented. In this case we provided the information to hospital staff early during the course of illness. This allowed the staff to organize care around a supportive approach, and frank discussion with the patient concerning his prognosis. The staff reported they felt more compassionate towards the patient knowing he was most likely going to die, and wanted to take extra steps to provide him with comfort care according to his requests.
Conclusion: Compassionate care of poisoned patients can be enhanced when staff and patient are provided early information of potential of severe toxicity by the PC.
Keywords: Death, Colchicine, Overdose

223. Canopy bed may decrease sedation requirements in agitated patients

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Background: Toxicology patients present frequently with agitation due to overdose or withdrawal states. Pharmacologic management can require extensive use of resources, expose patients to medication side effects, and prolong hospitalization. Physical restraints are often necessary and can also contribute to agitation and injury.
Case report: A 45 year old man with a history of alcohol abuse presented to an outside hospital with carbon monoxide toxicity after a suicide attempt. His initial CO level was 49%, and he was intubated prior to transfer for hyperbaric oxygen therapy. His hospital course was complicated by aspiration, alcohol withdrawal, and agitation. While intubated, he required propofol and benzodiazepines for sedation. He was extubated on hospital day 6 and transferred to the floor, but continued to require large amounts of diazepam due to agitation. Restraints were discontinued and replaced with a canopy bed on hospital day 8. Sedatives were discontinued the following day. The canopy bed was discontinued on hospital day 10. He was discharged on hospital day 12. MRI to evaluate for hypoxic encephalopathy as a contributor to his agitation did not demonstrate abnormalities. Total daily diazepam and haloperidol doses after extubation and initiation of the canopy bed are depicted in Table.
Case discussion: Mechanical restraints can oftentimes worsen a patient's agitation. Chemical restraints may lead to prolonged delirium. In this case, high dose sedative requirement for control of agitation was completely eliminated within 1 day of replacement of soft restraints with a canopy bed.
Conclusion: In medically appropriate patients, a canopy bed as a physical restraint method may decrease the need for sedative use.
Keywords: Delirium, Carbon monoxide, Non-pharmacologic treatment

Table. Data for abstract number 223.

	HD 6 (Extubated)	HD 7	HD 8 (Canopy Initiated)	HD 9	HD 10 (Canopy Discontinued)	HD 11	HD 12 (Discharge)
Diazepam (mg)	160	180	150	0	0	0	0
Haloperidol (mg)	5	5	5	0	0	0	0

224. Bradycardia and respiratory depression from suicidal overdose of veterinary products

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Background: Drugs used for veterinary euthanasia and sedation have been used in suicide attempts, and fatal outcomes have occurred. A case of attempted suicide with multiple veterinary products resulting in life-threatening bradycardia and respiratory depression is reported.
Case report: A 39 year-old veterinarian was brought to the emergency department (ED) 9 hours after a suicide attempt in which he ingested and injected intramuscularly (IM) several veterinary medications intended for equine sedation. His exposure included propranolol 250 mg po, detomidine gel 91 mg po, detomidine 600 mg IM, romifidine 200 mg IM, pentobarbital 32 g IM, and unknown quantities of acepromazine. Upon arrival to the ED he was cold and pale with slurred speech and pinpoint pupils. He initial vitals were T 30°C, HR 32 beats/min, and BP 110/50 mmHg, which dropped to 90/60 mmHg. His mental status declined and he was intubated for respiratory depression. An ECG showed a narrow

QRS with a prominent Osborn wave. He was treated with external rewarming, glucagon, calcium gluconate, high dose insulin, sodium bicarbonate, naloxone, and intravenous fat emulsion (IFE). His heart rate remained in the 30's, but his systolic BP improved to 130-150 mmHg. Laboratory results were significant for: potassium 7.2 mEq/L, CK 17,000 U/L, AST 289 U/L, and lactate 1.5 mEq/L. Acetaminophen, salicylates, ethanol and digoxin were undetectable. His heart rate, temperature, and mental status slowly improved over the course of several hours, and he was extubated the following day with no apparent sequelae.

Discussion: Detomidine and romifidine are centrally-acting α2-adrenoceptor agonists, used primarily for veterinary sedation. In animals, both cause CNS depression, bradycardia, and transient hypertension followed by hypotension. Intentional human exposures have not been previously reported. This patient developed life-threatening bradycardia and respiratory depression consistent with central α2 agonism following a combined intentional self-administration of detomidine and romifidine, along with pentobarbital, acepromazine, and propranolol. His moderate hypothermia was likely contributory. Following aggressive therapy he maintained adequate tissue perfusion and a mean arterial pressure > 100. This may represent therapeutic success or prolonged peripheral α1 agonism.

Conclusion: Centrally-acting α2-adrenoceptor agonists intended for veterinary use may cause life-threatening bradycardia and respiratory depression in human overdose when combined with other veterinary agents. Aggressive therapy, including use of naloxone and IFE, may be beneficial.

Keywords: Overdose, Veterinary, Central alpha-2 agonist

225. Those salicylate cases; how sweet are they?

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Background: Medical toxicology and emergency medicine texts submit contradictory expectations regarding glucose concentrations in the context of salicylate poisoning. The aim of this study is to characterize the relationship between glucose and salicylate concentrations in patients after significant exposure.

Methods: Utilizing Crystal Reports (Version 11.0), all salicylate cases reported to our regional poison center (RPC) over a 5 year period (2008–2012) were retrospectively queried. Those cases where a salicylate concentration was reported >/ = 30 mg/dL, and a serum glucose concentration was recorded, were included. Abnormalities in glucose concentration were defined according to standard Endocrine Society Guidelines. Hypoglycemia was defined as a concentration less than 55 mg/dL, and hyperglycemia as a concentration greater than 140 mg/dL.

Results: A total of 1418 salicylate exposures were managed during the 5 year period. Cases of interest included 160 patients where a documented salicylate concenteration >/ = 30 mg/dL and a glucose concentration were reported. Within this group, salicylate concentrations ranged from 30 – 118 mg/dL (average 54 mg/dL) and serum glucose concentrations ranged from 63–674 mg/dL (average 122 mg/dL). Zero patients (0%) were classified as hypoglycemic. For the rest of the included patients, 130 (81%) were normoglycemic, and 30 patients (19%) were defined as hyperglycemic. The highest salicylate concentration was 118 mg/dL and had a corresponding glucose concentration of 140 mg/dL. Additionally, the lowest salicylate concentration was 30 mg/dL with a corresponding glucose concentration of 100 mg/dL.

Conclusion: While the relationship of glucose concentrations in salicylate poisoned patients may vary (according to texts), these data reveal a propensity toward normoglycemia followed by hyperglycemia. None of our patients were hypoglycemic. We highlight, however, a slight trend of increased salicylate concentrations corresponding with higher glucose concentrations. These data are limited in several ways. Not all salicylate poisoned patients had glucose concentrations reported in the RPC record. Also, the timing and correlation of these laboratory values in each particular patient was problematic. Finally, separating patients into groups based on acute vs. chronic poisoning was challenging in this cohort. A prospective study may help better define the relationship between salicylate poisonings and corresponding glucose concentrations.

Keywords: Salicylate, Hypoglycemic, Poison center

226. How long to observe? undetectable 8 hour salicylate level resulting in delayed enteric coated aspirin poisoning

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Background: Delayed absorption after overdose of enteric coated aspirin (EC-ASA) is well documented. We report a case in which the salicylate (ASA) level was non-detectable (< 2 mg/dL) for over 8 hours before the development of significant salicylate toxicity.

Case report: 14-year-old female presented to a community ED 45 minutes after ingestion of #123 EC-ASA 325 mg. She received 50gm activated charcoal, started whole bowel irrigation (WBI) with polyethylene glycol (PEG) 3L over 12 h, and was transferred to a secondary hospital. She was afebrile with a normal physical exam on admission. ASA level at 45 min, 4 h, and 8 h post-ingestion were non-detectable (< 2 mg/dL), with a normal ABG 7.36/46.5/103.4/25.5 on RA and one charcoal-laden stool 7.5 h post-ingestion. At 12 h, she developed tinnitus, flushing, bloating, and respiratory rate 22. ASA level was 37.9 mg/dL at 13 h, with ABG 7.4/33.5/111.3/22.7. She was started on IV D5W + 150 mEq/L NaHCO3 + 20 mEq/L KCl at 200 mL/hr. PEG WBI via NGT was titrated to 1 L/hr. ASA level was 66.9 mg/dL at 17 h. She was transferred to a tertiary pediatric intensive care unit for further monitoring and possible dialysis. Salicylate level declined steadily, and she developed significant hypokalemia, which resolved with

Time, hr	4	8	13	17	24	27	37	48	69	82
ASA, mg/dL	< 2	< 2	37.9	66.9	55	57	39	20	4	< 1
K			3.8		2.6	2.5	2.1	2.7	3.5	4.0
Anion Gap			7		16	15	15	11	11	9

IV K+ replacement and supportive care (See Table). By 82h, she was asymptomatic with normal K+ and non-detectable ASA, after which she was transferred to a psychiatric facility.

Discussion: Time of observation for both detectable drug levels and symptoms of toxicity after overdose is critical, especially with EC-ASA. Patients often present to the ED with history as aspirin ingestion but no container to verify formulation. Delayed or erratic salicylate absorption has been reported after both enteric and non-enteric-coated salicylate overdoses, with detectable ASA levels consistently reported within 8 h post-ingestion. One previously reported EC-ASA case reported ASA levels 0.1 mmol/L (1.4 mg/dL) for 7 h, increased to 6.9 mg/dL at 24 h, was discharged home, and returned with symptoms and ASA 70 mg/dL at 32 h prompting dialysis (Drummond R, 2001). Our patient was asymptomatic for 12 h, with non-detectable ASA until 13h and developed symptoms and ASA level requiring intensive care.

Conclusion: A non-detectable ASA level in an asymptomatic patient after a standard period of observation of 8 hours is insufficient for medical clearance after history of EC-ASA overdose.

Keywords: Aspirin, Overdose, Pediatric

227. Prevalence of rhabdomyolysis in sympathomimetic toxicity: A comparison of stimulants

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Background: "Bath salts," or synthetic cathinones have emerged as popular drugs of abuse and produce sympathomimetic toxicity. It is unknown if rhabdomyolysis (rhabdo) occurs more frequently in patients with synthetic cathinone toxicity compared with other stimulants. The purpose of this study was to determine the prevalence of rhabdo in patients with sympathomimetic toxicity and to evaluate its prevalence among specific agents.

Methods: This retrospective study identified all patients treated by toxicologists at a single tertiary-care medical center with sympathomimetic toxicity over 3 years. Inclusion criteria were patients >14 years of age with a diagnosis of a stimulant toxicity confirmed by comprehensive urine drug screen (CUDS) and a measured creatine kinase (CK). Subjects were excluded if neither CK nor CUDS were performed, or if the CUDS failed to confirm presence of a stimulant. Rhabdo and "severe rhabdo" were defined as a CK >1000 and >10,000 IU/L, respectively. Descriptive statistical analysis, followed by logistic regression analysis, were performed. Occurrence of renal failure (creatinine >1.6 mg/dL), mechanical ventilation, and death were determined.

Results: 102 subjects met inclusion criteria. Sympathomimetic toxicity from amphetamine/methamphetamine (AMP/METH) n = 55, synthetic cathinone n = 19, METH and cocaine n = 11, cocaine n = 9, other sympathomimetic drugs n = 6, METH and synthetic cathinone n = 1, and METH and other stimulant n = 1. The mean (+/−SD) age was 33.8 (+/−11.5) years, range 14-65 years; 74% were male. Rhabdo occurred in 32 of 102 (31%) subjects. For all subjects, the median initial and maximal CK (range) were 421 (55-64,578) and 713 (61->350,000) IU/L, respectively. In subjects who developed toxicity from a single stimulant, rhabdo occurred in 12/19 (63%) synthetic cathinones, 33/55 (60%) AMP/METH, and 3/9 (33%) cocaine. The median maximal CK (range) among subjects exposed to synthetic cathinone was 2,638 (62->350,000) IU/L, AMP/METH 665 (61–50,233), and cocaine 276 (87–25,614) (p = 0.014 for differences among groups). Severe rhabdo occurred in 5 synthetic cathinones, 2 AMP/METH, and 1 cocaine. After performing logistic regression, the synthetic cathinones had a 3.75 greater odds of developing rhabdo compared with other stimulants (95% CI 1.23–11.5), and a 4.04 greater odds of developing severe rhabdo (95% CI 1.06–15.4) IU/L. Renal failure occurred in 23%, mechanical ventilation was required in 21%, and death occurred in 1.

Conclusion: In this cohort, 31% of patients with stimulant toxicity developed rhabdo. Synthetic cathinones were associated with a greater risk of developing rhabdo compared with other sympathomimetics.

Keywords: Drug of abuse, Bath salt, Stimulant

228. "Bath Salts" abuse: A poison center study of the clinical effects and outcomes

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Background: In 2010, certain regions of the United States began reporting abuse of a new street drug called "bath salts". Analysis of "bath salts" abused in our region of the Midwest, showed they contained the β-keto phenylalkylamines: 4-methylmethcathinone (mephedrone), 3,4-methylenedioxypyrovalerone (MDPV), and methylone. Though "bath salts" have now made their way into most parts of the country, there are still a paucity of studies describing clinical effects and outcomes associated with "bath salts" abuse. Our catchment area had a significant number of "bath salts" cases reported from the beginning of 2010 to the end of 2011. Our study describes the clinical effects and outcomes seen with "bath salts" abuse reported to our poison center, which serves a population of approximately 4 million people in a third of our state.

Methods: A retrospective chart review of our poison center's electronic database for all "bath salts" cases reported to our poison center from January 1, 2010 to December 31, 2011 was performed.

Results: During this time, there were a total of 297 cases reported to our poison center concerning exposure to "bath salts". Of these cases, 69% (n = 205) were male and 31% (n = 92) were female. The age of the patients ranged from a newborn up to 62 years of age (mean = 29.9 years of age). Of these cases, 53 (18%) were lost to follow-up, or the clinical effects were not reported. For the remaining 244 patients, the clinical effects most commonly reported were agitation (79%, n = 193), tachycardia (60%, n = 146), hallucinations (41%, n = 99), and hypertension (38%, n = 93). The most common therapies used for treatment were intravenous fluids (61%, n = 149), benzodiazepines (59%, n = 143), sedation (17%, n = 41),

and intubation (6%, n = 15). All patients presented to a hospital for evaluation. Most patients (n = 165; 68%) had "moderate effects" as defined by the AAPCC. However, there were serious complications or major effects reported in 37 cases (15%) including rhabdomyolysis (n = 8), renal failure (n = 7), cardiac arrest (n = 4), cerebral vascular accident (n = 2), disseminated intravascular coagulation (n = 1), persistent vegetative state (n = 1), hepatotoxicity (n = 1) and myocardial infarction (n = 1). Two of these 37 cases resulted in death.

Conclusion: Bath salts abuse in our region peaked in mid-2011. In our study, serious clinical effects and death occurred in a significant portion of patients abusing the drugs called "bath salts".

Keywords: Bath salt, Poison center, Drug of abuse

229. "Bath Salts" toxicity and withdrawal in a newborn

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Background: We report the first case of a pre-term infant born to a mother intoxicated from "bath salts".

Case report: A newborn female, 34 weeks small-for-gestational-age infant (birth weight 1631 g), was born to a 24 y/o mother with Graves disease and a history of marijuana, opiate and "bath salts" abuse. The mother was found unconscious on the sidewalk after a reported "bath salts" overdose and was transported into the ED where she was intubated and stabilized. Non-reassuring fetal heart tracings led to an emergent C-section delivery. Meconium stained fluids were noted. Apgar scores were 2 at 1 minute, 5 at 5 minutes, and the infant required a short period of resuscitation and transfer to the NICU. Initial labs were notable for a glucose = 44 mg/dL and lactic acid = 7.4 mmol/L. Maternal urine immunoassay was positive for THC, PCP and opiates. Opiates and THC were detected in the infant's urine and meconium was positive for THC. Infant blood, urine, and cord blood were positive for MDPV (100 ng/mL, 270 ng/mL, 41 ng/mL) and negative for mephedrone. In the NICU the infant was vigorous, hypertonic and jittery. Within the first 24 hours of life, the infant became progressively more agitated with increasing scores on the Finnegan scale (range 6–16) in an exaggerated onset of drug withdrawal, scoring almost exclusively for neurologic symptoms (crying, decreased sleeping, tremors and myoclonic jerks). The infant also had feeding intolerance that resolved after a few days. Per the NICU protocol for management of neonatal abstinence syndrome, she was started on IV morphine and required multiple titrations of her dosing over 48 hours to control her symptoms. Finnegan scores stabilized (range 2–7) by day 3. Morphine was converted to enteral dosing. Morphine dosing was weaned and discontinued on day 13. The infant showed no rebound withdrawal and was discharged on day 24.

Case discussion: This is the first report documenting transplacental exposure of an infant to maternally abused "bath salts" and the resulting withdrawal symptoms from this exposure. This case posed a unique diagnostic dilemma to her caregivers, as there was no precedent to help predict the effects and withdrawal symptoms of bath salts in the neonate, as well as the confounding effects of both her prematurity and her mother's polysubstance abuse. Of note, maternal urine toxicology was also positive for phencyclidine (PCP), which we believe is a false positive caused by MDPV.

Conclusions: The effects of bath salts on the unborn fetus/neonate are unknown and withdrawal symptoms are likely under recognized by clinicians. We hope this case report will educate clinicians about "bath salts" abuse, and increase awareness for withdrawal symptoms in infants born to intoxicated mothers.

Keywords: Bath salt, Withdrawal, Neonate

230. Survival despite severe hyperthermia and multi-organ system dysfunction following week-long use of an MDPV containing "stain remover"

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Background: Amphetamine and cathinone analogs have become popular drugs of abuse in the United States in recent years. One example, White Girl, is marketed as a "super pure stain remover". We present a case of White Girl ingestion by a 29 y/o male who exhibited bizarre behavior and sympathomimetic effects, and severe multi-organ system toxicity including a temperature of 109.2 F.

Case report: A 29 y/o male was found digging holes under his house, looking for wires that he believed were shocking him. He was extremely agitated, resisting police and EMS. On ED arrival he had diaphoresis, mydriasis, tachycardia (190 bpm), hypotension (SBP 50 mmHg) and hyperthermia (temperature of 103 F - unknown route). Initial treatment included naloxone (no response to unknown dose), 3L of normal saline and unassisted tracheal intubation. Within one hour of arrival, the patient's temperature increased to 109.2 F. Additional complications in the ED included status epilepticus, metabolic acidosis (pH 7.26), hypoglycemia (blood glucose 46 mg%) and intracranial hemorrhages. Toxic effects during hospitalization included myocardial infarction (troponin 38.6 ng/ml), rhabdomyolysis (CK 347,800 U/L), hepatotoxicity (AST 11,970 IU/L), acute kidney injury (serum creatinine 6.3 mg%) and coagulopathy (INR 7.7). Treatment included aggressive cooling and hydration, benzodiazepines for seizures, and phenylephrine infusion on days 2 and 3. Hemodialysis was initiated on hospital day 6 and continued through discharge. He fully recovered from all other complications by the end of his 2 week hospital course.

The patient's container of White Girl was obtained from his sister, who was a local police officer. A sample analyzed by the toxicology laboratory at our institution identified the contents as methylenedioxypyrovalerone (MDPV).

Case discussion: MDPV is a synthetic cathinone commonly found in abused products marketed as commercial bath salts, cleaners, insect repellants or attractants and others. These products are typically labeled as "not for human consumption". Reported toxic effects of MDPV include agitation, tachycardia, mydriasis, rhabdomyolysis and other sympathomimetic effects similar to amphetamines and synthetic congeners. Hyperthermia associated with sympathomimetic drugs is associated with poor outcome.

Conclusion: This patient with severe MDPV toxicity survived with good outcome despite suffering severe multi-organ dysfunction syndrome (MODS), including a core temperature of 109.2 F. Despite a very high mortality rate, this case suggests that patients

with toxin-induced MODS may substantially recover with early, aggressive care.

Keywords: Abuse, Bath salt, Stimulant

231. 3,4 Dimethoxyamphetamine: Hallucinogen and CYP2D6 inhibitor? A case report

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Background: Methylenedioxymethamphetamine (MDMA) is a common recreational drug. We present a case of a 19 year old for whom subsequent serum and urine analysis revealed MDMA and a psychedelic (3,4 dimethoxyamphetamine [DMA]) with potential cytochrome P450 inhibitory effects.

Case report: A 19 year-old presented to an emergency department (ED) following a witnessed tonic-clonic seizure. The patient was minimally responsive to verbal and physical stimuli. Initial vital signs were normal. Laboratories were normal with the exception of sodium of 127 mEq/L and urine drugs of abuse screen positive for amphetamines. Twelve hours later, serum sodium was 114 mEq. After receiving hypertonic saline (3%), the patient had gradual improvement in her mental status and admitted to taking "Ecstasy" at a rave approximately 2hours prior to her initial presentation to the ED.

Liquid chromatography-time-of-flight mass spectrometry (LC-TOF/MS) of serum and urine revealed MDMA and MDMA metabolites (3,4-methylendioxyamphetamine [MDA] and 4-hydroxy 3-methoxyamphetamine [HMA]) as well as DMA. The first tested serum was obtained ~14 hours from ingestion. See Table.

Discussion: MDMA undergoes two metabolic pathways. The major pathway involves O-demethylation (CYP2D6) to 3,4-dihydromethamphetamine (HHMA), and O-methylation to 4-hydroxy-3-methoxymethamphetamine (HMMA). A secondary pathway involves N-demethylation to MDA (CYP2B6) and subsequent O-methylation to HMA. The absence of HHMA and HMMA suggests inhibition of the CYP2D6 major pathway. DMA metabolism is not well described in the published literature however CYP2D6 metabolism may be involved due to demonstrated CYP2D6 metabolism in other dimethoxyamphetamines. MDMA and 3,4-DMA levels did not change significantly over the sampled interval also arguing for inhibition of CYP2D6 metabolism. Designer amines (e.g. 2C compounds) have been previously described as synergistic and additive to the effects of MDMA. The exact reason for DMA addition to this product is unknown.

Table. Data for abstract number 231.

	ng/mL					
Drug	Serum 1 1220	Serum 2 1523	Serum 3 1715	Urine 1 0910	Urine 2 1221	Urine 3 1753
MDMA	148	130	132	4051	3726	3341
MDA	12	10	10	634	263	84
HMA	221	170	144	1949	905	151
3,4-DMA	150	125	121	2532	2245	1825

Conclusion: A psychedelic, 3,4-DMA with minimal reported stimulant and hallucinatory properties was detected on LC-TOF/MS of serum and urine in a patient with "Ecstasy" ingestion. We propose the addition of DMA as a CYP2D6 inhibitor in an attempt to prolong or intensify the effects of MDMA. Health care providers should be aware of this potential adulterant.

Keywords: Amphetamine, Abuse, Laboratory

232. Is there a continental divide? Geographic distribution of sympathomimetic drug toxicity

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Background: Anecdotally, many health care providers believe cocaine is predominantly an "East Coast" drug of abuse while methamphetamine and amphetamine represent "West Coast" drugs of abuse. We sought to determine whether this observation is accurate and to determine whether additional demographic features are associated with an increased use of one drug of abuse versus the other.

Methods: National Poison Database System (NPDS) data was obtained and querried by state for the years 2005–2011 for exposures to cocaine, methamphetamine, and amphetamine. An average case exposure rate (number of cases/100,000 persons) by state was calculated for each drug of abuse over the study period. States were then categorized as either east or west of the Mississippi River. A two sample T-test assuming unequal variance was performed. Linear regression was performed to determine if additional demographic factors were predictive of a reported drug exposure.

Results: A statistically significant difference was observed in the reported case exposures for cocaine ($p < 0.001$) and methamphetamine ($p < 0.001$) but not for amphetamines ($p = 0.58$). Cocaine exposures are more commonly reported to NPDS from states east of the Mississippi River while methamphetamine exposures are more common in states west of the Mississsippi River. Additional demographic factors such as state average yearly income, unemployment rates, # of violent crimes/1000 persons, and percentage of state population that is caucasian were not predictive of case exposure rates ($p > 0.05$) for cocaine, methamphetamine or amphetamine.

Conclusion: Over a six year period of time, more cases of exposure to cocaine were reported from states east of the Mississippi River while more cases of exposure to methamphetamine were reported from states west of the Missisippi River. This was not observed with amphetamines. Additional demographic features were not predictive of sympathomimetic drug exposure.

Keywords: Abuse, Amphetamine, Cocaine

233. Who uses bath salts? Urban vs. rural distribution of PCC cases

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Background: Cathinone derivatives, which are structurally related to amphetamines and sold as "bath salts" and "plant food",

Statewide bath salt cases stratified by population density.

Geographic Area	# of cases	Population	Population/100,000
Large Metropolitan	46	5,194,675	0.89
Medium Metropolitan	50	3,936,816	1.27
Small Metropolitan	51	1,922,605	2.65
Micropolitan/Rural	75	866,051	8.66
Large + Medium	96	9,131,491	1.05
Small + Micro + Rural	126	2,788,656	4.52

recently emerged as a synthetic drug of abuse. These substances were easily available for purchase in retail outlets such as gas stations and convenience stores in 2010; calls to poison centers peaked nationally in 2011. These substances can be insufflated, smoked or injected to produce the desired effect and often times can lead to adverse effects such as hypertension, tachycardia, agitation, hallucinations, seizures, paranoia, homicidal, suicidal activity, and can potentially be fatal. The goal of our study was to correlate population density (by county) with reports of bath salts to a regional poison center.

Methods: The regional PCC received 237 cases associated with bath salts in 2011. Fifteen calls were excluded for having an unidentified origin. The remaining 222 cases were then divided according to population density of the originating county based on the following U.S. census data: Large metropolitan (> 1,000,000); medium metropolitan (> 250,000–999,000); small metropolitan (50,000–249,000); and micropolitan/rural (< 50,000). The number of calls were divided by 100,000 inhabitants to adjust for population base.

Results: Data collected are tabulated below:

The rate of cases reported per 100,000 population originating from micro/rural, small metro and medium metro areas were 9.7×, 3.0× and 1.4× greater respectively than the population corrected rate for large metro areas.

Conclusions: There were significantly more cases from rural areas when corrected by population than from urban areas during the period reviewed. It is unknown why this discrepancy exists. Law enforcement data has shown urban vs. rural differences in the use of some drugs especially for methamphetamine. From PCC data, it appears a distribution similar to methamphetamine can be seen with bath salts. Some factors leading to this observed distribution of reports to the regional PCC may include: 1) Rural populations may have a higher rate of bath salt abuse compared to urban areas. 2) Rural populations may be more likely to seek care for drug related issues. 3) Rural hospital staff may be more likely to seek assistance from PCC's for these exposures due to limited onsite resources. Further research may be needed to confirm the cause of the higher rural rate of reporting cathinone exposures.

Keywords: Designer drug, Bath salt, Surveillance

234. Comprehensive urine drug of abuse screens in emergency psychiatric patients

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Background: Urine toxicology screens are often ordered in medical screening of patients who present with psychiatric complaints for medical clearance. In-house drugs of abuse screens typically test for nine classes of drugs. More comprehensive mass spectrophotometry analysis has the potential to provide more data. The purpose of this study was to examine the pattern of drug use as revealed by comprehensive screening in patients presenting to an ED requiring medical clearance for psychiatric evaluation and treatment.

Methods: We collected urine from 427 different patients at time of ED presentation for medical clearance. The samples were subjected to immunoassay (IA) and mass spectrophotometry (LC-MS/MS) for individual identification of a variety of drugs and their metabolites (n = number screened): opiates (21), benzodiazepines (6), barbiturates (3), tricyclic antidepressants (5), SRIs (6), stimulants (5), other (14), cocaine (2), cannabinoids (5), bath salts (3), and phencyclidine.

Results: For the 422 patients, mean age was 43 (range 18 to 83) with 42% male gender. Initial complaint was: 54% suicidal ideation; psychosis 36%; and altered mental status 29%. Sixty four (15.2%) samples were negative for all drugs; an additional 43 (10.2%) tested only positive for ethanol and metabolites. The remaining 315 (74.6%) samples were positive for one or more drugs of potential abuse or psychotropic nature. The table shows cases for which frequency was > 1%:

Table. Results for abstract number 234.

CLASS	DRUG	Cutoff (ng/ml)	N tested	N positive	% positive
Opiates	Morphine	50	422	25	5.9
	Norhydrocodone	50	422	36	8.5
	Noroxycodone	50	422	19	8.5
	Norfentanyl	8	422	7	1.7
	Methadone	100	422	12	2.8
	Tramadol	100	422	18	4.3
Benzodiazepines	Lorazepam	40	422	80	19.0
	Oxazepam	40	422	55	13.0
Barbiturates	Phenobarbital	200	284	5	1.8
Tricyclics	General	500	281	10	3.6
SRIs	Norfluoxetine	25	284	21	7.4
Stimulants	Amphetamine	100	422	52	12.3
Others	Meprobamate	100	422	12	2.8
	Carboxy-zolpidem	10	284	18	6.3
Cannabinoids	Carboxy-THC	15	422	92	21.8
	JWH compounds	15	365	4	1.1

Besides ethanol and its metabolites in 173 (41%) patients, the most common drugs detected were benzodiazepines, cannabinoids and amphetamines. Of interest was the presence of carisprodol and some JWH compounds. None of the following drugs or their metabolites was detected: meperidine, methylphenidate, ketamine, phencyclidine, methylene dioxypyrovalerone, and mephredone.
Conclusions: Comprehensive drug of abuse screens with IA and MS detect a variety of drugs and their metabolites usually not seen in typical hospital ED drug of abuse screens. The impact of such additional data, especially if timely, on ED treatment and disposition of patients remains to be determined.
Keywords: Drug of abuse, Laboratory, Medical clearance

235. Abuse and misue of anabolic steroids

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Introduction: The purpose of this study is to identify the number of individuals that have abused or misused anabolic steroids resulting in an adverse event or hepatic damage in the last 10 years. There are many case reports in the literature and anecdotal information from health web sites regarding the abuse and misuse of anabolic steroids and the development of hepatic dysfunction. There is little data on what routes of administration, oral or parenteral, that resulted in poor outcomes. This is the first use of the National Poison Data System to escribe adverse events related to anabolic steroid use.
Methods: Data was collected from the National Poison Data System (NPDS) data base. Inclusion criteria were: substance coded as anabolic steroids, human, age 13 to > 90, dates 01/01/2003 - 12/31/2012. This data was analyzed for the number of cases of intentional abuse and misuse then reduced down to only include moderate and major effects. Moderate and major effects were further divided into oral or parenteral use of anabolic steroids and liver damage was determined from LFT and billirubin in these individuals.
Results: There were 2508 cases in the 10 year period that were related to anabolic steroids. Of those cases 498 (19.9%) were classified as intentional abuse or misuse. Of the intentional abuse and misuse cases 94 (3.7%) had a moderate or major effect. Oral ingestions accounted for 26 of the major and moderate effects with 4 cases involving hepatic injury, defined as LFT increase > 100 and increased billirubin. Parenteral use of steroids accounted for 60 of the moderate or major effect cases with 8 cases resulting in hepatic injury. Eight major effect cases were reported with 5 in the parenteral use group and 3 in the oral group. The average age with intentional abuse and misuse for oral steroid use was 25.9 (SD = 10.6) years and for parenteral was 28.8 (SD = 8.5) years ($p = 0.18$). Females accounted for none of the cases in the oral group and two cases in the parenteral group.The only age group with different usage was the 20-24 age group that was more likely to use parenteral steroids ($p = 0.01$). There was a relatively consistent call rate for intentional abuse and misuse during the study period with an average of 50 calls per year.
Conclusion: Major effects secondary to anabolic steroid abuse or misuse were more likely to occur following parenteral use. Hepatic injury was also more likely to result from parenteral use. The National Poison Data System provides an additional data source for the analysis of medication abuse and misuse. Additional study need to be performed to further define the rate and severity of hepatic injury.
Keywords: Abuse, Drug of abuse, Adverse drug event

236. Cholestatic jaundice and acute kidney injury following use of over-the-counter anabolic steroids

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Case 1: A 30 YO man was admitted with low back and abdominal pain, nausea, vomiting, jaundice, malaise and 13.6 kg weight loss over 6 weeks.

Vital signs were normal. Creatinine (Cr) was 1.6 mg/dL. AST and ALT were 57 and 54 IU/L, respectively. Total bilirubin (Tbili) was 46.6. mg/dL; direct 34.6 mg/dL. CBC and PT were normal. EBV serologies suggested remote infection. Hepatitis, anti-nuclear, anti-mitochondrial, and smooth muscle antibodies, HIV, and leptospira testing were negative. Ceruloplasmin was slightly elevated at 36 mg/dL. Abdominal U/S was normal.

HD#2 he admitted using "EP-Stane", a supplement with 15 mg/capsule of 2-α, 3-α, epithio-17-α-methyl-5-α-androstan-17-β-ol, daily until becoming ill. Cr peaked at 2.28 on HD#6; bilirubin peaked at 38.2 on HD#7. Both were declining at discharge. Renal biopsy showed bile staining and was consistent with acute tubular injury. Two months later Tbili was 4.7 mg/dL and Cr was 1.03.
Case 2: A 41 YO man was transferred for hyperbilirubinemia. He had been using over-the-counter steroids containing 2-α-17-α-dimethyl-etiocholan-3-1-17-β-ol, 13 FO-3-methoxy-gona-2,5-(10)-diene-17-one, and 17-β-hydroxy-2-α-17-β-dimethyl-5-α-androstan-3-onazine. He had 2 weeks of progressive malaise and nausea.

Vital signs were normal; exam was notable for icterus. BUN was 18 mg/dL, Cr 1.8 mg/dL, AST/ALT 50/194 IU/L, TBili 17 mg/dL, and Alk Phos 126 IU/L. PT was normal.. Ceruloplasmin was slightly elevated at 35 mg/dL. Anti-nuclear, anti-mitochondrial, and smooth muscle antibodies were all negative. He had an unremarkable abdominal U/S.

Two weeks later, Cr increased to 2.83 mg/dL and then to 5.42 mg/dL, when he was readmitted. His bilirubin was 37.2 mg/dL. Renal biopsy revealed bile staining and findings consistent with ATN. Cr peaked at 9.22 mg/dL and patient was started on HD. He was on dialysis for 7 weeks. At 4-month follow up, Cr was 1.51 and Tbili was 0.6 mg/dL.
Discussion: Anabolic steroid use has been linked to cholestatic jaundice, toxic hepatitis, and peliosis hepatis. ATN related to prolonged cholestasis and hyperbilirubinemia, as well as directly associated with anabolic steroid use has been described. In both cases, patients used 17 α-methylated steroids sold as dietary supplements. These compounds are hepatically metabolized to anabolic steroids and also associated with cholestasis and liver injury.
Conclusion: Clinicians should be aware of the potential hepatic and renal toxicity of anabolic supplements and question patients regarding their use in the appropriate clinical setting.
Keywords: Hepatotoxicity, Dietary supplement, Abuse

237. Steroids, growth hormone, and the poison center

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Background: Anabolic Androgenic Steroids (AAS) and human Growth Hormone (GH) have received extensive media coverage over the past decade for their reported abuse in professional athletics. Additional reports have placed steroid use in the general population, including high school students, between 2–6%. The purpose of this study is to characterize calls to the Illinois Poison Control Center (IPC) regarding AAS and GH over a period of ten years.
Methods: All calls to the IPC related to anabolic steroids or hormones were evaluated from January 1, 2002 to December 31, 2011. A total of 456 cases were identified. Each case was then carefully evaluated and determined if the concern for AAS or GH prompted the call to the IPC and narrowed to 122 cases. Each of these was characterized by patient age, gender, reason for use, route of exposure, clinical effects, recommendations by poison specialists (i.e. decontamination, treatment, etc.), and any additional unique characteristics of each case.
Results: Of the 122 cases thoroughly evaluated, 112 cases (91.8%) were related to AAS, 9 cases (7.4%) related to GH alone, and 1 case (0.8%) was a combined AAS and GH issue. 50 (40.9%) of these calls occurred in the pediatric age range (0–18) with 32 (26.2%) in the 0–5 year-old age demographic. 80 (65.6%) were male and 43 (38.4%) were female. 61 cases (50%) were accidental exposures, 53 (43%) were intentional use, and the remaining cases were unclear based on the documented information. 9 cases involved accidental ocular exposure from injectable AAS for which all were treated with eye irrigation. Additional reported effects with AAS included acne (2), weight gain (2), psychosis (5), aggression (5), skin irritation (3), GI upset (4), hypoglycemia (1), jaundice (1), and insomnia (1). 64 cases (52.4%) had no reported effects. 13 cases (10.6%) involved suicide attempts. 19 cases (16.8%) were using AAS for bodybuilding. 8 (88.8%) of GH alone cases were accidental overdose due to auto-injector malfunction or misreading dosing instructions with no clinical effects observed. The one case with combined GH and AAS involved a 28 year-old male bodybuilder that developed acute psychosis and agitation and required psychiatric admission.
Conclusion: Poison center consultation for AAS and GH use is a relatively rare event averaging roughly 1 case per month over ten years despite the large amount of media coverage on this topic. A large amount of calls to the IPC however did involve accidental exposures with minimal to no clinical effects. Interestingly, 10.6% of calls involving AAS and GH were in suicide attempts. Despite the unique occurrence, the poison center provides a valuable source of information for AAS and GH education and guidance.
Keywords: Poison center, Steroids, Growth hormone

238. Fatal intravenous injection of electronic cigarette "eLiquid" solution

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Introduction: The use of electronic cigarette devices is increasing with a growing concern about possible adverse effects from these currently unregulated devices. We report a fatality associated with the intentional injection of "eLiquid", a nicotine containing solution used to refill certain types of electronic cigarettes.
Case report: A 29 year old man was found by emergency medical services in cardiopulmonary arrest with a suicide note indicating that he had intravenously injected himself with "eLiquid." In the emergency department (ED) he developed seizures resistant to lorazepam, phenobarbital, phenytoin, and leviteracetam. Labs were notable for a leukocystosis of 21.8 K/mm^3, a potassium of 2.4 mmol/L, blood sugar of 401 mg/dL, creatinine of 2.0 mg/dL, creatine kinase of 977 unit/L, and a troponin of 0.34 ng/mL. A urine drug immunoassay was positive for amphetamines. A head CT was unremarkable. He was transferred to a tertiary care hospital where the seizures were controlled with the addition of propofol. Therapeutic hypothermia was initiated but he never regained consciousness. He was diagnosed with anoxic encephalopathy and declared brain dead on hospital days 5. An autopsy was not performed as he was an organ donor. Comprehensive serum drug testing on specimens obtained on arrival to the ED detected only lidocaine, which he received during his resuscitation, nicotine, and nicotine's primary metabolite, cotinine. No amphetamines were detected. His serum nicotine and cotinine was 2000 ng/ml and 2100 ng/ml, respectively. These levels are consistent with other fatalities attributed to nicotine.
Discussion: Electronic cigarettes are currently unregulated and many are refillable with nicotine containing solutions such as the "eLiquid" solution in this case. A recent study found some of these solutions to contain as much as 25 mg/ml of nicotine. Even higher concentrations are purported on internet websites. Thus, a 10 ml bottle of "eLiquid" may contain enough nicotine to be fatal to an average sized adult. Children would be at even more risk. Health care providers should be aware that as the use of electronic cigarettes increase, toxicity from both intentional and unintentional exposure to these nicotine containing liquids may become more prevalent.
Keywords: Intoxication, Cardiac toxicity, Seizure

239. Nicotine poisoning following ingestion of e-Liquid

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Background: Electronic cigarettes (e-cigarettes), initially marketed as smoking cessation aids, are increasingly popular among tobacco users. These devices utilize a cartridge filled with 'e-Liquid', a solution of dissolved nicotine concentrate, connected to an atomizer. The user can purchase bottles of replacement e-Liquid for future use. We present a case of nicotine poisoning following intentional ingestion of e-Liquid.
Case report: A 22 year-old male presented to the emergency department (ED) shortly after intentional ingestion of approximately 30 ml of e-Liquid (nicotine content: 24 mg/ml). 20 minutes after ingestion, he developed nausea and vomiting. He then rubbed an additional 30 ml over his skin. His family contacted emergency medical services (EMS), who performed skin decontamination prior to arrival in the ED. In the ED, the patient complained of

dizziness and nausea, with a heart rate ranging from 51-58 bpm. A mild tremor was noted on physical exam. Initial laboratory testing showed hypokalemia of 3.3 mEq/L. The patient was admitted to the intensive care unit (ICU). Though bradycardia and nausea persisted for several hours, the patient completely recovered with supportive measures.

Case discussion: The prevalence of e-cigarette use is increasing in the United States; a Center for Disease Control (CDC) report showed a doubling of adult use between 2010 and 2011. Many models require the user to refill the device using e-Liquid, a concentrated nicotine formulation. Nicotine's toxic potential is well known. Ingestion of less than 10 mg can produce symptoms of toxicity in children and nonhabituated adults. E-Liquid formulations are available with nicotine concentrations as high as 48 mg/ml. The increased market and household presence of e-Liquid represents a new hazard for accidental and intentional ingestion. Nicotine is well absorbed through the gastrointestinal tract and the skin. Our patient was exposed to both routes, and subsequently developed toxic effects.

Conclusions: We present a case of nicotine poisoning following intentional ingestion and dermal exposure to e-Liquid. As e-cigarettes are growing in popularity, healthcare providers should be aware of this e-Liquid's potential toxicity, even at low doses.

Keywords: Nicotine, Overdose, e-Liquid

240. Nicotine content of liquid for electronic cigarettes

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Background: Electronic cigarettes (ecigs) and other smokeless nicotine products are increasingly popular. Ecigs use a heating coil to vaporize nicotine solution. Refill liquid is sold in stores and via the internet in various concentrations and flavors. These may pose a risk of nicotine toxicity if ingested by children. The National Poison Data System began tracking ecigs in September 2010. Exposure calls (age ≤ 5) to US Poison Centers rose from 7 in 2010 to 171 in 2012 and 88 in the 1st quarter of 2013. The aim of this study was to quantify nicotine concentration in 6 refill liquid samples and compare with declared content.

Methods: Ecig liquid was obtained in a smoke shop and on the internet. Each fluid was dissolved in methanol, diluted and reconstituted in 10% methanol, and analyzed with liquid chromatograph- time-of-flight mass spectrometer (Agilent LC1200-TOF 6230) using electrospray ionization in negative and positive polarities. The chromatograms and spectra obtained were analyzed through Mass Hunter Qualitative Analysis (Agilent) using a comprehensive drug panel database (383 drugs) that includes 65 stimulants. Quantification was done by isotope dilution method using a six point calibration curve. Each product was analyzed in triplicate. The pH of each was measured using an Accumet pH meter with a microprobe electrode.

Results: Bottles ranged in volume from 5 to 30 mL. All liquids contained nicotine, though measured and declared concentrations differed. Measured pH range was 7.0–8.5. To date no specific undeclared ingredients have been identified.

Conclusions: Liquids tested contained between 14.8 and 87.2 mg/mL of nicotine. Measured concentration differed from declared by up to 50%. Most had alkaline pH, which enhances mucosal nicotine absorption. Ecig liquids are sold in a variety of flavors that, along with aromas and packaging, may appeal to small children. Some come with instructions to keep away from children. None of the 6 samples tested were provided in child resistant containers.

Keywords: Nicotine, Electronic cigarette, Pediatric

241. E-cigarette exposures- nothing to get choked up about

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Background: Both tobacco and nicotine-containing pharmaceuticals have long been recognized as a potential source of poisoning both with normal use and accidental exposure. In 2007, a new source of nicotine exposure was introduced to the US market, the electronic cigarette (ECIG) or "e-cigarette". Since then, the US ECIG market has been doubling annually and has become the largest worldwide. Despite their widespread popularity, there is a paucity of existing data regarding ECIG toxicity. We report the experience of a statewide poison system.

Methods: The database of a statewide poison system was queried for human ECIG exposures from 2010 (when Poisindex code first generated) through 2012. Year, age, manner and route of exposure, estimate exposure amount, product concentration, if evaluated at healthcare facility and symptoms were recorded.

Results: A total of 35 cases were identified- 4 in 2010, 12 in 2011, 19 in 2012. Children 8-years old or younger- 14 cases; 9 ingestion,

Table. Results for abstract number 240.

Sample	Description	Declared Concentration (mg/mL)	Measured Concentration (mg/mL)	Total Amount in bottle (mg)	pH
PG Base (Ecig Express)	Odorless, clear, viscous liquid	100	87.2 ± 2.7	2617 ± 81	8.5
Titan Fluid (Coffee)	Viscous orange liquid with coffee odor	36	18.1 ± 0.3	181 ± 3	8.0
Titan Tornado Fluid (Red Bull)	Viscous orange with candy-like odor	36	50.4 ± 0.5	504 ± 5	8.5
Provape Premium e-juice (Lot 3010D)	Viscous orange liquid with nutty & mild tobacco odor	24	18.6 ± 0.2	93 ± 1	7.25
Provape Premium e-juice (Lot 3027D)	Viscous orange liquid with nutty & mild tobacco odor	24	17.1 ± 0.2	85.5 ± 1	7.0
Hangsen Desert Ship	Viscous yellow liquid with nutty & mild tobacco odor	18	14.8 ± 0.2	148 ± 2	7.5

5 inhalation. All were either cartridge taste exposures (1 patient experienced 3 episodes of vomiting) or a few puffs from ECIG (transient coughing in 1 patient with pre-existing viral infection). Adults (age range 19-60 years)- 21 cases. Inhalation-10 cases, all adverse effects to normal use including: gastrointestinal symptoms (9 cases), coughing, chest pain, confusion and palpitations (1 case each). Ocular:- 5 cases, all results from mistakenly instilling drops from cartridges and resulted in transient irritation. Ingestion-4 cases, 3 from leaky cartridge, 1 swallowed whole cartridge. Symptoms included: dizziness, oral irritation (2 cases each), vomiting and flushing (1 case each). Dermal- 2 cases from leaking cartridges, transient irritation in 1 patient. A total of 5 patients were evaluated in an emergency department and none were admitted. Product concentrations ranged from 4–30 mg of nicotine per ml.

Conclusions: Poison centers are likely to see an increase in exposures to ECIG given their growing popularity. Our modest results suggest that adverse effects and accidental exposures to ECIGS are unlikely to result in serious toxicity.

Keywords: Pediatric, Nicotine, E-cigarette

242. Electronic cigarette exposures reported to poison centers

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Background: Electronic cigarettes (also known as e-cigarettes) are battery-powered devices that heat a liquid solution of nicotine. The users then inhale the vapors that result from the heating. Various potential benefits include that they may be more cost-effective and socially acceptable than regular cigarettes, used in locations where smoking is restricted, and helpful in quitting smoking. These exposures may be dangerous because the nicotine solutions are highly concentrated. Little is known about the impact of these on public health. This study describes electronic cigarette exposures reported to poison centers.

Methods: All electronic cigarette exposures reported to a statewide poison center system during January 2009-March 2013 were identified. Exposures involving other substances in addition to the electronic cigarette (n = 2) and exposures not followed to a final medical outcome were included. The distributions of exposures by various demographic and clinical factors were determined.

Results: Of 79 total exposures, 2 were reported in 2009, 6 in 2010, 11 in 2011, 43 in 2012, and 17 in the first 3 months of 2013. The age distribution was 46% age 5 years or less, 3% 6-19 years, and 51% 20 years or more; 52% of the patients were male. The route of exposure was 73% ingestion, 18% inhalation, 14% dermal, and 4% ocular; 9% involved multiple routes. 80% of the exposures were unintentional, 8% intentional, and 13% adverse reactions. 68% were managed on site, 14% already at/en route to a healthcare facility and 15% referred to a healthcare facility. The medical outcomes were 25% no effect, 18% minor effect, 3% moderate effect, 6% not followed-judged nontoxic, 32% not followed-minimal effects possible, 13% unable to follow-potentially toxic, and 4% unrelated effect. The clinical effects reported most often were nausea (14%), vomiting (13%), headache (5%), dizziness (5%), throat irritation (4%), agitation (4%), ocular irritation (4%), and dyspnea (4%). The most common treatments were dilution (52%), food (10%), and activated charcoal (6%).

Conclusion: Electronic cigarette exposures reported to poison centers are increasing. Most of the patients are adults or young children and the exposures occur through ingestion. Reported exposures often do not have serious outcomes.

Keywords: Electronic cigarette, Poison center, exposure

243. Child resistant packaging for edible cannabis products: translating research to practice

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Background: Research conducted by investigators at the Rocky Mountain Poison & Drug Center (RMPDC) and Children's Hospital Colorado in 2012 documented that since 2009, an increase in Colorado medical marijuana dispensaries and medical marijuana cards was associated with a substantial increase in the number of pediatric cannabis intoxications evaluated in the emergency department. Many of these exposures involved cannabis edibles, such as baked goods and candies. Cannabis edibles were not dispensed in child-resistant packaging, nor were there requirements for such packaging in Colorado or other states that permitted the sale of medical marijuana. The passage of Amendment 64 in Colorado in 2012 legalizing the sale of recreational cannabis and cannabis edibles poses the risk of further escalation in pediatric exposures unless child-resistant packaging is required.

Methods: In an effort to advance a legal requirement for child resistant packaging, representatives of the RMPDC conducted presentations to the Governor's Task Force on Implementation of Amendment 64 and to child health advocacy groups and reported 1) the widespread sale of cannabis edibles containing THC doses ranging from 50 to 300 mg; 2) clinical studies on dronabinol (THC) demonstrating a maximum tolerated dose in pediatric patients of ≈ 4 to 12 mg; 3) the results of published RMPDC research demonstrating 14 pediatric evaluations (including two ICU admissions) at the Children's Hospital Colorado for cannabis ingestion between 2009 to 2011, compared to zero cases from 2005 to 2009, many involving edibles; 4) the historical role of medical toxicologists and poison control centers in the development and promotion of child resistant packaging for pharmaceuticals in the 1950s and 1960s; 5) evidence that the Poison Prevention Packaging Act of 1970 was associated with decline in pediatric intoxication by covered products from 40 to 95% in several studies; and 6) the current commercial availability of resealable child-resistant packaging suitable for the sale, distribution, and household storage of cannabis edibles. These RMPDC findings were the subject of media coverage in newspapers, radio and television.

Results: A legal requirement for child resistant packaging for cannabis edibles garnered support from multiple public health officials and stakeholders, and was included in legislation to implement Amendment 64 (legalization of cannabis) in Colorado.

Conclusion: Promotion of a legal requirement for child-resistant packaging of cannabis edibles in Colorado illustrates the role that poison control center research and advocacy can have in the implementation of poison prevention practices.

Keywords: Marijuana, Public health, Child-resistant packaging

244. Comparison of medical simulation to written and oral examination in the assessment of emergency medicine residents in medical toxicology

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Background: Medical simulation is a popular and common teaching tool in post-graduate education. However, limited data exists for its use as a competency tool. Simulation experiences have been suggested as an alterative to the traditional oral examinations for evaluating emergency medicine residents (EMR). The purpose of this study is to compare written vs. oral vs. simulation examination for testing EMR in medical toxicology based cases.
Methods: Knowledge based assessment tools using simulation, written, and oral examinations were developed, piloted, and revised. From July 2011 to April 2013, all consecutive EMR rotating on a month long toxicology service were eligible for participation in the study. During July 2011 to June 2012, EMR were assigned to either a written exam of an aspirin overdose case or simulation exam of a tricyclic antidepressant (TCA) overdose case. The following month, the testing modalities were reversed. From August 2012 to April 2013, the written examination was replaced by a traditional mock oral examination. For each case scenario, questions and answers were exactly the same, only the assessment tool varied (written vs. oral vs. sim). At the end of testing, EMR were asked to complete a survey. EMR were blinded to the purpose of the study, scores were not included in final rotation evaluation, and evaluators remained the same to ensure consistency.
Results: 55 EMR were enrolled in the written vs. simulation arm of the study. 20 EMR were enrolled in the oral exam vs. simulation arm of the study for a total of 75 EMR. Only 7 residents (9.3%) had been assessed with simulation in the past. The mean scores with standard deviation were as follows:

ASA sim (n = 39): 6 ± 2.25
TCA sim (n = 36): 6.53 ± 1.34
ASA written (n = 27): 7.33 ± 1.21
TCA written (n = 28): 6.04 ± 2.27
ASA oral (n = 9): 6 ± 2
TCA oral (n = 11): 6.55 ± 1.34

The written (52/55, 95%), oral (20/20, 100%), and simulation (75/75, 100%) examinations were all judged to be fair by EMR. Satisfaction rates of the simulation test (66/75, 88%) and oral test (18/20, 90%) were higher than the written examination (27/55, 49%). The majority of EMR (50/75, 66%) felt that simulation examination should replace the ABEM oral examination for certification testing.
Conclusions: In this study, simulation assessment had similar accuracy (demonstrated by similar mean scores) and precision (demonstrated by similar standard deviation) but higher satisfaction rates when compared with written examination and similar satisfaction scores compared to oral examination. Most EMR participants felt that simulation testing should replace the ABEM certifying oral examination.
Keywords: Simulation examination, Medical toxicology, Medical education

245. Use of social media to establish two-way communication during public health crisis

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Background: West Nile Virus (WNV) has been in the U.S. since 1999. The virus can cause high fevers, headaches, & disorientation. Nationwide, the WNV cases during 2012 were the highest reported to the CDC since 1999. Texas was the epicenter accounting for 49% of the deaths and 52% of the cases in the U.S. August 2012 marked the peak of the disease, especially in the hard-hit North TX area. State officials worked diligently with the CDC to help eliminate mosquitos that carry the disease, including aerial spraying of synthetic pyrethroid. Safety concerns from the public ensued after learning about the aerial spraying plans.
Methods: A press release was issued on 8/14 to inform the public that the North Texas Poison Center (NTPC), which is part of the Texas Poison Center Network (TPCN), was available for the public for any questions about the medical effects of the pesticides. Experts were available to answer questions regarding the effects on people, pets and even plants via the 1-800-222-1222 hotline. In addition to using the hotline for questions, the public was encouraged to visit the NTPC on Facebook & Twitter for more information about aerial spraying. Email newsletter was sent out to 2,000 subscribers in the region.
Results: More than 1,772 calls flooded the TPCN. Of these calls, 28 were exposures to the spray. The remainder were informational calls. During aerial spraying, the NTPC Facebook page nearly doubled in likes to the page with many questions about aerial spraying from the public & numerous information shares. Facebook updates from the NTPC about aerial spraying quickly went viral reaching thousands of people with vital safety messages regarding WNV. Followers to the Twitter page also increased during this time.
Conclusions: Social media in the midst of a public health crisis is essential. The younger generation seems to find it easier to turn to online information rather than to pick up a phone. The NTPC experienced questions from a new audience of people online that may have never called the hotline.
Even after the WNV crisis was resolved in North TX, the new social media audience that was gained from the concerned public remains on NTPC's pages. These people now receive poison prevention messages and news, where they otherwise would not receive poison education.
Keywords: Social Media, West Nile Virus, Insecticide

246. Health district mini-grant program

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Background: Our state covers over 75,000 square miles and over half of the residents live outside of the metropolitan area where the poison center is located. Outreach education in this rural state is challenging and has been sparse due to geographic barriers. The goal of this project was to develop partnerships in rural counties to broaden outreach education in these areas through provision of mini grants to rural health districts.

Methods: The number of educational materials distributed and outreach events attended by health district were reviewed and compared to the population distribution for each health district. Two rural health districts with limited outreach were identified to pilot the mini grants. A contract was drafted and approved by our institution's legal counsel. A scope of work was created and revised based on feedback from the pilot health districts. A contract was signed by health officers in both districts and by institution officials. Training was conducted with educators in both health districts in person and included a discussion of the requirements of the mini grant, and necessary tools and materials to start the program. Support materials were provided and included such things as lesson plans, press release templates, and handouts. After three years of the program, utilization patterns, costs and benefits were analyzed and compared to patterns prior to program implementation. Costs were calculated per event using state travel guidelines. Given the rural nature of the state, it was assumed that all events would require an overnight stay, per diem, and a full day of wages.
Results: The year prior to initiation of the contract (2009) the number of outreach contact hours in both health districts was 7 compared to an average 56 each year from 2010-2012. The total number of outreach events increased from 3 prior to the mini grant to 20 after. The total number of people reached via outreach education per year increased from 146 to 2,302. Media events increased from 1 prior to the program, to 3 after. The costs benefit including wages and travel (mileage, per diem and lodging) to outreach events averaged $5800.00 per district per year. The cost of the mini-grant to the UPCC was $2400.00 per year for each health district.
Conclusion: Outreach education has been limited in rural areas due to geographic barriers. After implementation of the health district mini-grant program, there has been an increase in the number of events, hours of outreach provided, number of media events, and number of people reached in these areas. Our poison center has expanded the mini-grant program and currently contracts with five health districts in the state.
Keywords: Education, Health district, Rural

247. Poison center collaboration with college of pharmacy to provide senior medication safety program

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Background: A Regional Poison Center (RPC) partnered with its host College of Pharmacy (COP) to not only provide medication safety information to seniors, but also provide a service learning experience for second year pharmacy students (P2s).
Case report: The RPC and COP successfully collaborated on a service learning project for first year pharmacy students during their community-based Introductory Pharmacy Practice Experience (IPPE). Students provided a poison prevention program for daycare children. The RPC and COP wanted to expand and include the service learning program for P2 students, utilizing the students' increased pharmacy knowledge. After completion of their second year in pharmacy school, P2s complete an IPPE in a health system setting. During their IPPE, students were grouped based on geographical location and provided a medication safety program to seniors at Senior Centers, low income housing communities, and faith based organizations within the state. The RPC initially contacted the senior organizations for consent of the program. Students were given a one hour orientation session which included information on poison center services and an overview of the presentation and associated materials. The program included a packet of materials which contained a flip chart of medication safety information and a supplemental script to enhance their presentation. Giveaways to the seniors included a medication log to document medication use for easy presentation to physicians and pharmacists, a dry erase board to display medication names and time of day taken, and Mr Yuk stickers.
Case discussion: One hundred seventy-nine students completed the service learning project in the summer of 2012 at 62 sites. Programs were conducted in 17 of 46 counties in the state. Eighty-seven percent of the students believed the seniors learned new ways to remain safe while taking medication and 78% agreed the program increased their ability to communicate with non-healthcare individuals. Additionally, 90% agreed the experience motivated them to continue community outreach as a healthcare professional.
Conclusions: The partnering of a RPC with a COP for service learning projects has increased poison prevention programs throughout the state. The P2 Senior Medication Safety project has allowed students to utilize their pharmacotherapy knowledge while also providing valuable medication safety and poison center information to an age group who have not been traditionally targeted for poison prevention. Furthermore, service learning projects may have a positive impact for these future pharmacists to become involved in additional health community outreach.
Keywords: Poison center, Senior, Education

248. Adolescent perceptions of misuse and abuse of prescription analgesics

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Background: A 27% increase in the contribution of prescription drugs to poisoning deaths in persons 15–19 years old occurred from 2000–2009. The effect of adolescent attitudes and perceptions of prescription drugs to this increase is not known. The objectives of this pilot project were to determine adolescents' scope and understanding of prescription drug misuse and test their awareness of a poison control center (PCC) as a relevant resource.
Methods: One hundred fifty-four calls were placed to recruit adolescent participants for three focus group sessions. Inclusion required proficiency with a verbal articulation exercise, minimum household income >$75K and parental consent. Focus groups were conducted by a single trained individual over one day. Two 12–13 year-old groups were segregated by gender; one 15–16 year-old group was of mixed gender. Two researchers analyzed the focus group recordings and abstracted the data into Excel. Fisher's exact test was used to compare groups. Pharmaceutical deaths aged 12–26 years reported to PCC from 2010–2012 were reviewed, and the percentage of fatalities that were Caucasian was determined.
Results: There were 30 participants; 11 male and female 12–13 year olds and eight 15–16 year olds (50% male). Participants

mostly attended public schools (83%) and their race was predominantly Caucasian (93%). This paralleled the race composition in the deaths reported to the PCC (93% Caucasian). Only 36% of 12–13 year olds reported being aware of prescription drug misuse at their schools compared to 75% of 15–16 year olds ($p = 0.10$). Of all participants who responded to the question, 82% believed that prescription drugs were safer than illegal drugs. Younger adolescents tended to be less likely to share prescription pills than older adolescents (5% vs. 25%, $p = 0.17$). There was a trend in the motivation for misusing prescription drugs based on gender, with males reporting peer pressure (33%) and females reporting curiosity (47%) to be the main reasons ($p = 0.12$). Only 42% of participants reported receiving any education on prescription drug misuse in school, and only 25% reported their parents played a role in prescription drug education. Qualitatively, the older group reported that they would not be receptive to education on prescription drug issues; only 27% of all participants reported that they would call a PCC for drug questions or concerns.

Conclusions: Students 12–13 years old reported less awareness and occurrence of prescription drug misuse than 15–16 year olds; education on the topic appears lacking. Prevention efforts may require targeting the younger adolescent populations as they report being more open to education. Due to limited sample size, further research is needed.

Keywords: Adolescent, Prescription Drug, Poison center

249. Utilization of online video to educate providers on use of gastric lavage for drug overdoses

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Background: Historically, gastric lavage was routinely utilized in the treatment of toxic ingestion patients. Since then, multiple studies have demonstrated this practice to be ineffective and potentially dangerous when applied indiscriminately to all toxicology patients. These studies have caused an appropriate decline in the frequency of gastric lavage for poisoned patients; however, this has resulted in many emergency physicians having little training and no experience in performing gastric lavage. This lack of training could result in the failure to perform gastric lavage when indicated or performing the procedure inappropriately.

Methods: We developed a 5 minute video detailing the indications and contraindications to gastric lavage. We also demonstrated how to perform gastric lavage in a stepwise fashion using a simulation mannequin and standard gastric lavage kit. The video was made publically available on YouTube.com to educate providers as to when gastric lavage is appropriately indicated, the risks and contraindications to gastric lavage, and how to perform gastric lavage.

Results: Since posting the video to YouTube.com in June 2012 the video has been viewed over 17,600 times. Over half of the views came from countries other than the United States to include the Philippines, Ethiopia, India, Egypt, Saudi Arabia, and Malaysia.

Conclusions: Due to the infrequency at which gastric lavage is performed, maintaining adequate proficiency in this procedure can be difficult. Furthermore, written text and audio only lectures are often limited in their ability to demonstrate gastric lavage adequately. Video demonstrations can be utilized for routine medical education and provide as needed training immediately prior to real-life gastric lavage and other medical procedures. Utilization of internet based toxicology education may help to advance medical toxicology in resource limited developing countries. Future studies should evaluate the effectiveness of procedure focused point-of-care education videos.

Keywords: Decontamination, Education, Internet

250. Developing, implementing and evaluating a pesticide education program for community health workers/promotores de salud (CHW/P)

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Background: Farming is one of the most important industries in the U.S., and much of the country's fruits and vegetables are grown in California. Educating people and creating awareness about the safe use of pesticides in and around farms and homes can greatly reduce the risks associated with these chemicals. Because of the unique cultural and language characteristics of farm workers, the use of CHW/P has proven successful to increasing awareness about health issues within the farm worker community.

Objectives: To develop relevant and mobile pesticide health education tools and train CHW/P how to utlize these resources.

Methods: 10 focus groups across 5 California cities were held to gain an understanding about the level of knowledge that CHW/P had about the hazards and proper use and safety of pesticides as well as to distinguish communication habits and preferences, and identify resources, opportunities and outreach methods. CHW/Promotores were recruited to 6 pesticide education trainings through community-based organizations working with farm workers in 6 California cities. Trainings were 6-hours long, held in Spanish, and presented by a promotora. The trainings utilized participatory approaches in educating the CHW/P and covered 6 major topics: Pesticides in the Community 2) Pesticide Basics, 3) Pesticides and your Health, 4) Pesticides at Work, 5) Pesticides in the Home, and 6) Resources.

Results: Farm workers share a set of unique attributes that require creative and mixed methodology education tools. Low-literacy level English and Spanish materials were created from the ground-up with the help of CHW/P, and include facilitator and participant manuals, presentations, videos, and a website and mobile-optimized site. Using SPSS Statistics Version 20, the trainings and tools were evaluated. 90.1% found the overall training excellent, and 95.2% believed that the training provided valuable information for educating farm workers. Participants highlighted the manual, videos, and resources as the most valuable pieces of the training and stated that they will use this information to provide education on pesticides to farm workers (71.6%), community members (58.9%), friends (64.2%), and family (64.2%).

Conclusions: Because CHW/P are mobile and work primarily in the field, the development and placement of all health education tools online and accessible through mobile devices, is an innovative way to provide pesticide health education. The utilization of these tools in conjunction with community based participatory education utilizing CHW/P, has proven to be a successful method to behavior modification and knowledge increase.

Keywords: Pesticide, Public health, Community Health Workers/ Promotores de Salud

251. Impact of a Carbon Monoxide Educational Flyer

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Background: As part of a campaign to reduce the incidence of unintentional carbon monoxide (CO) poisoning a CO Educational Flyer (COEF) was developed for distribution to residents in one poison center's service area. This area included two states that were identified by the Centers for Disease Control and Prevention as having the highest rate of unintentional non-fire related CO fatalities during one recent five year period. The purpose of this study was to evaluate by telephone survey whether residents who were mailed a COEF made any changes related to the number, type, or location of CO alarms in their home, or made any other changes to reduce their risk of CO poisoning after reading the flyer.
Methods: COEFs were included with poison center educational materials mailed to residences during a six month period. Flyers were also randomly offered to poison center callers during the following 13 months. A total of 456 COEFs were mailed. No sooner than two weeks after a flyer was mailed, a follow up call was attempted to complete the survey. After confirming that residents received and read the flyer they were asked about changes made regarding the number, type, and location of CO alarms in their home, as well as any other changes made since reading the flyer. Of the 456 poison center callers who were mailed a flyer, 65 (14.25%) completed the follow up telephone survey.
Results: Of the 65 completed surveys, 33 (50.77%) made no changes in their home after receiving and reading the COEF, 25 (38.46%) made at least one change, and 7 (10.77%) indicated a desire to make at least one change but had not yet done so. Some cited lack of time or money as reasons for not making the desired changes. The most frequently reported change made by 14 of the respondents was the purchase of at least one new CO alarm. Five reported relocating their CO alarms, and 11 reported other changes including replacing batteries, getting the gas furnace checked, posting the flyer in their daycare, and purchasing CO alarms for a Sudanese family.
Conclusion: Almost 50% of those surveyed in this study indicated that they had made or intended to make a change related to CO alarm use in their home or take some other action intended to reduce the risk of CO poisoning. Limitations of this study include small sample size, low response rate, and uncertainty as to whether the specific population of poison center callers surveyed is representative of the general population. Nevertheless, the results suggest that educational materials such as this COEF may be effective in raising awareness of CO poisoning, prevention strategies, and correct use of CO alarms, which may in turn reduce the overall incidence of unintentional CO poisoning.
Keywords: Carbon monoxide alarm, Carbon monoxide, Education

252. Assessment of toxicology knowledge in fourth year medical students: 3 years of data

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Background: Pharmacology and toxicology are core content knowledge for physicians. Medical students should demonstrate understanding of general pharmacology and basic treatment of poisoning. The objective of this study was to measure the knowledge of 4th year medical students (MS4) on these topics over 3 years.
Methods: A multiple-choice exam (15 questions) was administered to MS4 students in spring of 2010, 2011, and 2012. Questions were developed by medical toxicologists to evaluate basic knowledge in three areas: pharmacologic effects (PE), treatment of poisoning (TOP), and pharmacokinetics (PK). The students were grouped by intended specialties into pharmacologic intense (anesthesia, emergency medicine, internal medicine, pediatrics, and psychiatry), less pharmacologic intense specialties (dermatology, OB/GYN, ophthalmology, pathology, physical medicine and rehabilitation, radiology, and surgery) and by completion of a pharmacology or toxicology elective. Mean group scores were compared using ANOVA.
Results: 332 of 401 (83%) students completed the survey. Mean scores were stable over the three years, higher for students

Table. Results for abstract number 252.

Group	N	Mean (SD) Overall Score	Mean (SD) PE Score	Mean (SD) TOP Score	Mean (SD) PK score
All students	332	10.0 (2.4)	3.1 (1.2)	3.5 (1.0)	3.4 (1.1)
Yr 1: 2010	108	10.2 (2.2)	2.9 (1.1)	3.6 (1.0)	3.7 (1.0)
Yr 2: 2011	116	9.9 (2.3)	3.1 (1.2)	3.4 (0.9)	3.3 (1.2)
Yr 3: 2012	108	9.8 (2.7)	3.1 (1.2)	3.3 (1.1)	3.3 (1.1)
Pharmacology intense	216	10.3 (2.2)	3.2 (1.1)	3.5 (0.9)	3.5 (1.1)
Less Pharmacology Intense	95	9.4 (2.7)	2.8 (1.3)	3.3 (1.0)	3.3 (1.2)
Both	10	11.2 (1.8)	3.3 (1.3)	4.1 (0.7)	3.8 (1.0)
Toxicology	35	11.6 (2.0)	3.7 (1.2)	4.0 (0.9)	3.9 (0.9)
Clinical Pharmacology	86	10.1 (1.9)	3.0 (1.2)	3.5 (0.9)	3.5 (0.9)
Neither	201	9.6 (2.5)	3.0 (1.1)	3.3 (1.0)	3.3 (1.2)

completing a toxicology rotation and for students entering a pharmacologically intense specialty.
Conclusions: The external validity is limited to a single medical school with incomplete participation. The content was limited by the survey length and there is no gold standard for this knowledge area. Consistent results over the three year period and correlation of performance with completing a toxicology rotation and intent to enter a pharmacology intensive specialty suggest that this survey is a valid measure of toxicology knowledge. This test can be rapidly administered and may be useful for measuring the impact of toxicology educational programs. Implementation of required courses focused on toxicology may improve core content knowledge in MS4 students.
Keywords: Education, Medical students, Toxicology

253. Dial in for safety: a poison prevention awareness campaign rings in success at a multilingual pediatric clinic

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Background: Many people are unaware of the phone number for the poison center (PC). It can be especially challenging for those with limited English proficiency to access the PC. Programming cell phones with the PC number may be an important first step toward increasing awareness and penetrance.
Methods: A pediatric clinic affiliated with a large teaching hospital in a rural state, serving both English- and non-English-speaking patients, partnered with their local PC to increase awareness of the PC. Starting in March 2013, a form was attached to each patient chart for those five years and younger that included a brief statement describing PC services, along with instructions to program their cell phone with the PC number while waiting for their child's appointment. At check-in, parents were asked to take the form and return it at check-out. For those with limited English proficiency, free interpreter services were provided. To reinforce the message during the visit, a graphic-based magnet with the PC phone number was given to each patient. The form contained three boxes to be completed by the participant to indicate the participant's primary language, whether they programmed their phone and whether they received a magnet. At check out, the form was removed from the patient chart by staff and placed into a designated box. All forms were anonymous. The goal was threefold: to determine if this was an effective venue for an awareness campaign, if there was an increase in PC calls and if language was a factor in who programmed their phones. Five weeks of data were collected.
Results: There were 309 forms handed out. 47% (n = 145) were returned. Forms that were not completed were due to cancelled or rescheduled appointments, no-shows or parents opting not to participate. 66% (n = 95) of parents reported English as their primary language. Other primary languages reported were Nepali, Chinese, French, Somali, Arabic, Spanish, Karen, Kirundi, Bengali, Vietnamese, Burmese and Swahili. 100% received a magnet. 86% (n = 124) programmed their phone—89% of English speakers and 78% of non-English speakers. Feedback from staff indicated the ease of implementing this project and the desire, if successful, to make it a sustainable practice at this clinic. There was no increase in calls to the PC during the first five weeks.
Conclusion: This setting appears to be an effective venue for an awareness campaign and offers the possibility of becoming integrated into a more extensive prevention initiative; however, the small sample size made it difficult to make an accurate assessment of the project's success. To fully evaluate this proactive approach to prevention, the project will need to continue for six months.
Keywords: Poison center, Education, Pediatric

254. Physostigmine

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Objective: Physostigmine, a carbamate cholinesterase inhibitor, is used to treat antimuscarinic toxicity. Clinician comfort with physostigmine is variable due to concern for adverse events associated with its use. We present preliminary results from a survey evaluating clinician knowledge on physostigmine and its role in toxicology.

Table. Results for abstract number 254.

		Attending			Resident		
		IM n = 19	EM n = 26	Intern n = 11	2nd Year n = 7	EM 3rd Year n = 11	4th Year n = 8
Rotated on a toxicology service		0	69	9	0	73	100
Administered physostigmine		16	54	0	0	18	50
Comfortable administering physostigmine without toxicology input		11	42	9	0	27	75
Indication							
Glaucoma	Yes	35	19	18	11	15	17
Contraindications							
Asthma	Yes	44	52	41	56	8	38
Intestinal Obstruction	Yes	56	44	35	56	39	29
Urogenital Obstruction	Yes	56	48	29	33	31	14
Tricyclic Antidepressants	Yes	28	40	12	0	31	38

Methods: The authors created a survey and tested it on other physicians for completion time and clarity. After reformatting, the survey was piloted among different physicians. A printed survey and/or e-mail link to an electronic version was provided for potential participants after local Institutional Review Board approval. No ultimately surveyed physicians participated in survey development or pilot. Responses remained confidential. No identifiable information was collected. Two research team members individually entered printed survey data into the electronic survey system. Crosstab filtering provided by SurveyMonkey was used to interpret responses.
Results: The table lists selected survey results in percentages. No Internal Medicine (IM) attendings surveyed had rotated on a toxicology service, while 69% of Emergency Medicine (EM) attendings had. EM resident toxicology experience varied according to training level. Additionally, 16% of IM attendings previously administered physostigmine while only 11% felt comfortable doing so without toxicology input. EM attendings were more likely to have administered physostigmine and were more likely to feel comfortable doing so. Interestingly, 50% of 4th year EM residents administered physostigmine previously and 75% felt comfortable doing so without toxicology input. However, knowledge of indications and contraindications varied.
Conclusions: Previous physostigmine experience and individual clinician comfort with its administration varies widely between IM and EM physicians, and between EM attendings and residents. Despite a high percentage of EM attendings rotating in a toxicology service, less than half felt comfortable using physostigmine. This survey helps identify a potential knowledge gap and educational need among physicians of both specialties. This information can be used to design educational programs addressing appropriate physostigmine use for both EM and IM physicians.
Keywords: Physostigmine, Education, Anticholinergic

255. Toxicology consultation and mechanical ventilation recommendations increases survival in intubated salicylate poisoned patients

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Objective: Salicylate overdose poses a large risk for morbidity and mortality. In cases of profound lethargy or respiratory failure endotracheal intubation may be necessary. Endotracheal intubation is a high risk procedure in salicylate intoxicated patients if ventilatory management is not appropriately managed. Our hypothesis was that specific recommendations from a toxicologist regarding mechanical ventilation parameters led to a better outcome in patients requiring intubation.
Methods: This was a retrospective analysis including all salicylate poisonings to a single poison center from January 2006 to March 2013. The authors electronically searched the Toxicall® database for patients with salicylate poisoning. 1,297 cases were identified. Inclusion criteria were: salicyate toxicity (serum concentration >50 mg/dl) and mechanical ventilation (MV). 13 patients met the inclusion criteria.
Results: Of the 13 patients that were mechanically ventilated, 11 had specific toxicology recommendations for ventilator management (maintain elevated minute ventilation to approximate pre-intubation rate or hyperventilate if unable, increase/mimic tidal volume; hyperventilation during RSI and frequent blood gas assessment post-intubation). All 13 patients were receiving sodium bicarbonate prior to intubation. 2 patients without toxicology recommendations died shortly after intubation. 9 of 11 with specific medical toxicology recommendations survived. Pre and Post MV pH were available for 3 of the 9 cases. In these 3 cases, pre-intubation pH was ≤ 7.3 (range 7.14–7.30) and post intubation pH was ≥ 7.44 (range 7.44–7.55). In the same 3 cases, pre-intubation pCO_2 was ≥ 54 mmHg (range 54–67) and post-intubation pCO_2 was ≤ 31 mmHg (range 25–31). In the 2 patients that died with toxicology recommendations, one of the patients had a pre-intubation pH and pCO_2 of 7.42 and 24 mmHg, respectively, and a post-intubation pH and pCO_2 of 7.10 and 54 mmHg, respectively. These findings reflect inadequate MV management, which likely was a result of inadequate minute ventilation and tidal volume during RSI.
Conclusions: Direct toxicology consultation and MV recommendations of severe salicylate poisoned patients improved patient outcome. Both patients without specific MV recommendations died.

Inappropriate MV of severe salicylate poisoned patients is associated with respiratory acidosis, acidemia and clinical deterioration. Our small study, however, suggests that specific recommendations regarding MV by a toxicologist may improve outcome in these patients.
Keywords: Salicylate, Mechanical ventilation, Poisoning

256. Utilizing community volunteers to assist in poison center public education efforts

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Background: Our Poison Center covers a very large geographical area which makes it difficult to provide educational programs on a regular basis to all areas. In 2009, we investigated the possibility of utilizing community volunteers to provide in-house support for the education staff and to fulfill a select group of programs and health fairs, primarily to the outlying counties.
Methods: With assistance from the host institution's Volunteer Services Office, the education staff contacted various volunteer organizations to list the Poison Center as a site for volunteer opportunities. A description of the program was uploaded to the various websites listing the Poison Center's contact information and sent out via a news release to the media. Callers interested in providing poison education in their communities were encouraged to participate. Staff also recommended health care professionals who were interested in providing poison awareness.

In 2010, the Community Volunteer Program was implemented. Prospective volunteers were required to apply through the education staff. If deemed appropriate, the application is processed by our host institution's Volunteer Services Office who initiates background and reference checks. Once approved, the volunteer completes training modules on line, takes a post test and is familiarized with the Center's services and resources. When possible, they tour the Poison Center.

Upon completion of the orientation process, the volunteer is provided a "Community Volunteer Kit" that includes educational

modules, flash cards on various topics/scenarios, and materials to set up a table display (display board, brochures and other promotional products). After each event the volunteer is required to complete a form containing details of the event including number of attendees, materials used, and the type of audience served. Materials are replenished as needed to volunteers.
Results: The Center's education office currently has 10 volunteers. Volunteer backgrounds have included paramedics, nurses and pharmacists as well as students and housewives. The community volunteers have logged 155 events & in-house support to date, reaching approximately 12,000 individuals, and providing almost 670 hours of time inside and outside of the Center. They have provided programs in several outlying counties not easily accessed by the Center's education staff, which has proven to be a significant cost savings to the Poison Center.
Conclusion: Utilizing community volunteers to provide programs, participate in health fairs and other community-oriented activities, especially in outlying counties, has proven to be a great time and cost saving venture for this Poison Center.
Keywords: Volunteers, Community, Programs

257. How long does it take to get published? a description of medical toxicology fellowship graduates

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Background: The American College of Graduate Medical Education (ACGME) instituted a new method to track scholarly activity of trainees. One measure is the number of PubMed citations generated by a trainee while in training. Since there is a paucity of data describing the time to publication for graduates from residency and fellowship programs, we chose to examine the time to PubMed citation during and after training for fellows in Medical Toxicology.
Method: PubMed was searched for citations from all 2010 graduates of US Medical Toxicology Fellowship programs. Citations eligible for inclusion were from a 4-year period beginning with the time fellowship started (June 2008) until two years after graduation (July 2012). Searches were conducted by author names. For common names, additional searches were made including the name and the following: the city of the fellowship, names of program directors and senior faculty at the home institution. Once the number of citations was determined, the data were placed in a de-identified spreadsheet for analysis with descriptive statistics. Our Institutional Review Board exempted this study from review.
Results: A total of 27 fellows graduated in 2010. 15/27 (56%) fellows generated a PubMed citation during the 2-year period while in fellowship. 21/27 (78%) fellows generated a citation during the first year following fellowship, and 23/27 (85%) had a citation by the end of the second year after graduation from fellowship. The mean number of citations during fellowship was 1.2 (Median 1, Std Dev 1.4, Range 0–4), the mean number of citations the first year after fellowship was 1.4 (Median 1, Std Dev 1.9, Range 0–6), the mean number of citations during the second year after fellowship was 1.6 (Median 1, Std Dev 2.4, Range 0–9). The cumulative mean number of citations from the beginning of fellowship to two years after graduation was 4.2 (Median 2.5, Std Dev 4.6, Range 0–17).
Conclusions: Approximately half of all Medical Toxicology Fellows achieve a PubMed citation during their training. By two years after training, only 85% of graduates achieve this milestone. Since time to journal publication after completion of a project takes 6–18 months at most journals, accrediting bodies should use these data to inform appropriate standards for assessment of fellow scholarly activity. Further study should be conducted in other fellowship training specialties as well as primary residencies to determine the average and optimum times to generate a PubMed citation.
Keywords: ACGME, Medical toxicology, Research

258. Poison prevention off to a head start!

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Background: Children of Head Start age are considered high risk for poisoning. Parents/caregivers of Head Start children are identified as a crucial audience for poison prevention teaching. Two separate programs were developed, implemented and compared to identify the most effective teaching method.
Method: Two programs were implemented to identify a sustainable method to effectively teach poison prevention to parents/caregivers of Head Start children. Program A provided a PowerPoint presentation given by the poison prevention educator to the Head Start parents/caregivers. Training dates for group parent/caregiver participation were required. A pre-survey was given two weeks before the training and a post-survey was given two weeks after the training. Method B is a train-the-trainer model. Head Start Parent Advocates are trained by the poison prevention educator to provide one-on-one poison prevention training to Head Start families. Program B's tool is a reusable tabletop flipbook with graphics and key messages. Survey questions are asked of the Head Start family immediately before the training and survey questions are asked immediately after the training. In both programs, a de-identified coding system is used to match pre and post surveys for analysis. The data are submitted to the poison prevention educator for analysis.
Results: For Program A, 45 parent/caregivers attended seven trainings. Only 14 participants filled out a pre-survey before the training and only seven participants filled out a two week post-survey. Only 31 participants filled out an evaluation at a training. A de-identified coding system recognized only one pre-survey, training evaluation and post survey matched. Therefore, the data were too small to analyze program effectiveness. In Program B, eight Head Start Advocates were trained by the poison center educator and evaluations indicated a clear understanding of the program objectives and a strong commitment to the program. Trainings for the Head Start families have been scheduled and results are pending.
Conclusion: Program A presented several challenges such as a lack of participation in pre-surveys, poor attendance, timing of trainings, lack of interest, poor return on post-surveys and a significant amount of time and travel by the poison center educator. Data were too inconsistent for meaningful analysis. Program B provides a personal one-on-one training in the parent/caregiver's home environment with reliable evaluation. The train-the-trainer

method with general poison prevention messages, a strong partnership with Head Start and minimal to no travel for the poison center educator suggests a much more cost effective and sustainable training tool.
Keywords: Sustainable, Parents/caregivers, Prevention

259. Electronic communication and public health partnership can save money and strengthen a preventive health education project

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Background: Funding constraints to education programs have forced our regional poison center (RPC) to reanalyze the manner in which education programs are executed in an effort to maximize participation while keeping costs at a minimum. The goal for this education project was to increase participation in a preventive health poster contest while significantly decreasing costs.
Methods: Historically, RPC community educators have informed regional schools about a poisoning prevention poster contest by conducting a costly mass mail-out to all regional elementary schools. Many times the information does not get to the proper contact or the mail is returned as undeliverable. This year, our RPC publicized and disseminated contest information solely through the use of electronic media. A poster contest information packet was developed and published on our website, Facebook webpage, and on the webpages of regional radio and television community calendars. Email was employed to directly notify all public schools that participate in our RPC school nurse coalition. The newest and most successful strategy utilized was to partner with a program division within our state department of health that works with all state public schools. This program was able to email each school in our region to encourage them to participate in the poster contest while providing the contest packet and link to our website.
Results: During our initial attempts to contact our regional public schools, it was noted that many emails sent from RPC educators to schools often get returned as undeliverable due to district email filters. However, it was then learned that all school districts accept emails from our state health department. By utilizing department of health emailings we were able to ensure that each school received our information. There was an overall increase in the number of participants and schools submitting posters for this year's contest. Significant budget savings were created since no funding was used on non-electronic mail-outs. Funding was used to successfully implement the regional contest through the time used by educators to develop the contest packet, send emails, and organize contest judging, and the relatively small cost of mailing the submitted posters as a whole to our national organization for judging.
Conclusions: We used electronic media and partnered with an established statewide public health education program that works with regional schools to disseminate information regarding community education programs. This resulted in maximizing our poisoning prevention community outreach while decreasing staff time and project expenditures.
Keywords: Education, Public health, Poison center

260. Multi-center quality assurance: The team approach

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Objective: Poison center (PC) chart data are analyzed for quality and documentation in an effort to improve coding and data accuracy that is vital to improve the accuracy of toxic exposure surveillance. Call-takers enter call report data onto templates using code numbers, check-off boxes, drop-down menus, and typed notes. We sought to increase accuracy amongst six PCs using a newly created quality improvement process that is applied monthly.
Methods: Monthly, each network SPI is provided with a list of cases to review that are representative of call reports from all six PCs, including their own PC. Twenty charts per SPI FTE are randomly selected from each SPI in the network and cases are equally divided amongst the SPIs so that each is involved in the Quality Assurance (QA) process. Charts are evaluated on a ten-point scale encompassing eight areas regarding the poison exposure, including reason, route, history, assessment, plan, clinical effects, therapy, and general. Call-takers receive periodic feedback of coding and documentation errors to encourage improvement and SPIs are involved in adjusting the tool to encompass areas of concern such as case continuity in follow-up calls.
Results: After an extensive monthly QA process utilizing this multi-center approach; we have been able to achieve an improvement in charting completeness exhibited each month. QA projects often have some component of variability that is dependent upon the SPI/PC scoring the chart. Data shows that all six PCs self scored their charts higher than the average of their scores for all centers combined. This may support the concept of internal bias and the importance of having a multi-center QA process to lessen its potential effect on QA. This project has led to a consistent average chart score of 9 or above from all six centers on our 10-point scale.
Discussion: A team approach to QA projects is integral to long term change. Managing Directors, Medical Directors, and SPIs must be involved in the process in order to provide ongoing education and address focus areas to create quality improvement. Periodic feedback and group discussion provided to SPIs allowed for correction of inaccurate data charting practices and was felt to be the key element in leading to a gradual improvement in accuracy. The QA team has recently expanded the project where substance-specific QA is performed monthly, while chart documentation QA is conducted on a quarterly basis.
Conclusion: An inter-center continuous QA strategy has proven to be effective in improving poison center case documentation. This model may be applied as a useful tool for other poison centers to improve poison center case documentation and data quality.
Keywords: Quality assurance, Education, Documentation

261. Implementing network scheduling to increase multi-center efficiency

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Background: In September 2011, facing budget shortfalls and a grantor mandate to establish efficiencies in network operations, 6 poison centers (PCs) began working on a concept to create an optimal network-wide SPI schedule. Funding cuts to PCs had affected the ability to provide 24/7/365 operations and adequate staffing based on call volume demand outweighed inadequate staffing based on the ability to run a 24-hour operation. Staffing models developed to match call volume had previously been published and utilized by one of the participating PCs, but no attempt to adopt the model had been integrated across the 6 PCs.
Methods: Hourly call data from all 6 centers over a one year period was used to develop a baseline number of SPIs needed network-wide and center-specific to cover call volume. A three-month schedule of all network PCs were analyzed to illustrate current staffing by hour and schedule preference data was collected from all 49 network SPIs. A staffing algorithm was developed around three factors: Exposure call volume, Paid time off, and Activity time.
Results: The three-month schedule review showed that the network was overstaffing from 1am–7am and 12pm–4pm and severely understaffed from 5pm–11pm. Shift times were adjusted across the network to accommodate call volume and more SPIs were shifted to work during peak call volume hours and moved off of times where overstaffing was occurring. Data indicated no need to staff 6 SPIs during the night shift, but rather that 2–3 were adequate. After organized feedback from network SPIs, it was determined that 3–4 SPIs provided a comfortable balance while maintaining room for concurrently received inbound calls. Activity time gave SPIs 8 hours per month of protected time to work on dedicated projects such as quality assurance, education, teaching, and meeting attendance. Benefits of network scheduling were determined to include the ability to prevent excess staffing and understaffing, find efficiencies where all PCs were not needed to remain open to handle call volume, understaffed centers could work with other centers to fill shifts, and SPIs were allowed dedicated time off the phones.
Conclusions: Benefits of network scheduling have outweighed drawbacks as a unified cooperative schedule is used to staff 6 regional poison centers. The need to reanalyze this scheduling model and adjust shift times and staffing fluctuates as call volume continues to change. Continuous effective communication and collaboration between center managers and clinical staff is critical to implementation and creating improvements to network scheduling.
Keywords: Scheduling, Poison center, Management

262. Creating poison center work schedules that improve efficiency and lower costs in a cost-reduction environment

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Background: Regional poison center (RPC) clinical staff scheduling processes have not been well studied. The salaries and benefits of clinical personnel account for a majority of RPC budget costs. We chose to refine our previous innovative model of assigning call-taker clinical staff to best match incoming call volume by time of day to maximize call-taking efficiency in a single RPC and apply this methodology to a multi-center RPC network.
Methods: Incoming poison center call volume data was collected from a multi-center RPC electronic database system and then evaluated with relation to available staffing by Specialists in Poison Information (SPIs). Under our original model for a single RPC, we scheduled 9 SPIs (8.5 FTEs) to match call volume over 24-hours. During a three-month cooperative study period for our multi-center RPC network, we had available to us an average of 45 FTEs to schedule. We matched network-wide incoming call volume by hour of the day that calls are received and by the number of clinical call-takers available network-wide during those hours. Institutional work hour requirements placed some limitations on the number of work hours that could be assigned to a call-taking SPI within a given block of time. Work hours that closely reflected incoming call volume was given much more weight than work hours preferred by SPIs. Actual network-wide total work hours were reduced due to decreased funding allocation. Staffing levels, through attrition, new hiring and illness, as well as reductions in RPC funding, led to further modifications and adaptations to our model.
Results: Following our previously published call-taker scheduling model, we further refined our ability to match incoming call volume across a multi-center RPC network and created cost efficiencies while improving SPI call-taking efficiency. Our model allowed for dynamic staffing assignments due to illness, attrition, and level of training and expertise.
Conclusions: Regionally based poison centers can improve call-taking efficiency and lower personnel costs through a cooperative process of matching incoming call volume with assigned clinical staff work hours.
Keywords: Poison center, Scheduling, Management

263. Synthetic cathinones in the global media and United States poison control centers

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Background: Synthetic cathinone derivatives, serving as an alternative to traditional illicit drugs, circulated in European and Asian markets before entering the United States (U.S.). Due to a lag in detection of these drugs by U.S. surveillance efforts, these products flowed though U.S. markets until increasing morbidity and mortality trends prompted legal banning. The aim of this study is to describe global media attention to synthetic cathinones as a surveillance method to enable earlier interdiction in the worldwide spread of new substances of abuse.
Methods: A newspaper database, Factiva, was queried through September 2012 using the search terms "mephedrone," "methylenedioxypyrovalerone (MDPV)," and "synthetic cathinone". Publications were restricted to English language. Frequencies of unique publications of each derivative were tabulated for select countries over time. Trends in U.S. media reports were compared with calls reported to the National Poison Data System (NPDS). The NPDS was queried from June 2010 through September 2012 for exposure and information calls using specific product codes for synthetic cathinones. Using averages of U.S. 2010–2012 Census population data, total call volume for these product codes per 100,000 population was evaluated for each state.

Results: Global media attention to MDPV emerged and steadily increased in 2010, peaked in 2011, and declined in 2012. The greatest sources of MDPV publications were from the U.S. and Canada. Attention to mephedrone peaked in early 2010, especially in the United Kingdom, before decreasing three-fold by the end of 2012. The volume of NPDS calls (n = 10,500) pertaining to synthetic cathinones far surpassed the volume of U.S. media articles (n = 809). NPDS calls reached their peak in the middle of 2011, before declining four-fold in 2012. Among publications where the state could be identified, over 33% of all articles were from Maine (n = 149). Call volumes were greatest for Ohio, New York, and Indiana. Maine, West Virginia, and Ohio had the highest call volume per unit population.
Conclusion: Continual surveillance of global media pertaining to emerging substances used for abuse can empower public health entities. Such surveillance can lead to earlier awareness of trends in sales and abuse of emerging substances before they expand to further international markets. In addition to current efforts to monitor drugs, use of local and national media coverage should also be utilized. Consistent monitoring of other country's media can prompt earlier bans in countries that have not yet experienced such abuse patterns, limiting the time they are sold as "legal" alternatives.
Keywords: Cannabinoid, Synthetic, Surveillance, Drug of abuse

264. Evaluating utilization of a regional poison control center

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Background: This abstract describes the results of a statewide survey used to characterize whether population awareness and utilization of our state Poison Control Center (PCC) varies by age or socioeconomic status.
Methods: Three questions were added to a statewide survey conducted by a prominent regional public opinion and market research firm and funded by AARP to assess knowledge of the poison control center.

If someone in your home accidentally swallowed bleach or gasoline, or was bitten by something potentially poisonous, where would you turn for help? Have you heard of the Poison Control Center? Do you know how to readily find the number for the Poison Control Center?

The data was analyzed using SPSS Statistics Version 20. Frequency and cross tabulations were used to describe the data. Chi-square was used to evaluate contingency tables.
Results: A total of 498 people completed the survey. Fifty-nine percent of the respondents were 50 years and older. The majority (88.5%) had heard of the poison center, but only 53.4% knew where to find the number. In response to question 1, more respondents would call 911 (43.3%) compared to the PCC (36.7%) or go directly to the hospital (27.4%). Those ages 18–29 years (58.3%) and 30–39 years (47.8%) were more likely to call the poison center compared to those 40 years and older who were more likely to call 911 first. Respondents with household incomes $35,000–$70,000 preferred calling 911 (47.8%) compared to other household income groups where equal portions would call 911 or the PCC. Those with less than a high school diploma were more likely to go directly to the hospital (66.7%) compared to those with a graduate or professional degree who were more likely to call 911 (47.1%) than other educational attainment.
Conclusion: The results of the survey showed that younger respondents were more likely to call the PCC than respondents over 40 years of age. While many people are aware of the PCC, a majority still prefer to turn to another resource for help; calling 911 or visiting a hospital. The survey over sampled older adults and may not be truly representative of callers to the PCC. The survey demonstrated that there are a variety of factors affecting the public's awareness and utilization of the poison center.
Keywords: Education, Poison center, Public health

265. Polydrug overdose with benzodiazepines and psychotropics: the Medical Toxicologist's perspective

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Background: Benzodiazepines (BZ) have been used for over fifty years in a wide variety of clinical scenarios: as sedatives, anxiolytics, anti-convulsants, and muscle relaxants. Their danger in overdose is well characterized, and their abuse and misuse is well known. Recent Psychiatry literature has suggested an increased rate of suicide among patients with mental illness who are prescribed BZ along with other psychotropic medications (PM). We explored this relationship from the perspective of a Medical Toxicology (MT) consultation service.
Methods: We retrospectively reviewed the consult log of our MT service to identify cases of intentional overdose of all PM including BZ. Records from our MT service along with any shared regional poison center documentation were reviewed. We included all cases of patients 16 and older from 7/1/10 to 6/30/11. Data collected included: age, gender, suspected medications ingested, and whether BZ were involved. We assessed for a polydrug ingestion by collecting the total number of medications suspected to be involved in the overdose. We also reported the coded severity of the overdose (none, minor, moderate, major, and death), and if there was an ICU admission. Comparisons were made between PM overdose cases that contained BZ versus those that did not.
Results: There were 148 cases identified and included for review. There were 78 females and 70 males. The mean age was 39 years. Of these cases, 53 (35.8%) included at least one BZ. In 13 (8.8%) cases, a BZ was the only PM involved in the overdose, and in 4 cases (2.7%), more than one type of BZ was ingested. The mean number of medications was 4.4 and 2.0 ($p < 0.01$) in the BZ group and in the non-BZ group, respectively. In the BZ group, 4 (7.5%) were coded as fatalities. Twelve (22.6%) were coded as major, 28 (52.8%) as moderate, 6 (11.3%) as minor, zero as no effect, and 3 (7.0%) as unknown. In the non-BZ (PM) group, 7 (7.4%) were coded as fatalities. Eighteen (18.9%) were coded as major, 42 (44.2%) as moderate, 18 (18.9%) as minor, 5 (5.3%) as no effect, and 5 (5.3%) as unknown. In the BZ group, 41 (77.4%) cases were coded as needing intensive care unit (ICU) care while in the non-BZ group, 77 (81.1%) cases needed ICU care.

Conclusion: Of all intentional overdoses of PM, over one third includes at least one BZ. Moreover, overdoses involving a BZ involved a significantly higher total number of medications, raising important questions about the role of polypharmacy in polydrug intentional overdoses. Medical Toxicologists play an important role informing our colleagues of this association.
Keywords: Benzodiazepine, Polydrug, Overdose

266. Down the toilet and into your drinking water

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Background: Medication overuse has raised concern about the proper disposal of medications and the effects of improper disposal on everything from drinking water safety to antimicrobial resistance. To better understand the disposal habits of our patients, we undertook a survey of the practices of patients at our large inner city county hospital.
Methods: Participants were randomly selected from the first 98 patients willing to participate while waiting for their prescription medication at an urban outpatient hospital pharmacy. Inclusion criteria were English fluency and greater than 18 years of age. Exclusion criteria were cognitive impairment.

Basic demographic data was collected and participants were asked a series of 5 questions related to the: storage of medications, disposal of medications, use and disposal of insulin syringes, medication expiration dates, and knowledge of drop off centers for unwanted medications.

Following the survey, participants were given an educational tutorial on medication storage and disposal, and a list of addresses for the 5 medication drop off centers within the city.
Results: The mean age was 45 years (19–83). Thirty nine participants were male and 56 female. Sixty one participants were African-American, 19 Hispanic, 14 Caucasian, and 5 Asian. Six participants had completed post-graduate education, 33 college, 46 high school, and 9 grade school.

Thirty eight participants kept their medications in the bathroom, 35 in the bedroom, 23 in the kitchen, 8 used their purse, and 9 stored them in other locations.

Ninety participants knew that medications had an expiration date. Eighty seven and 85 participants were able to find the expiration dates on a prescription and over-the-counter bottle respectively.

Forty seven participants disposed of medications in the garbage, 30 in the toilet, 2 in the sink, and 21 did not throw out medications. No participant admitted to selling, giving medication away, nor using medications on others.

Nine participants used insulin syringes. Of these, 4 disposed of syringes in an empty plastic containers (e.g. laundry detergent bottle or coffee jar) as recommended by the city, 4 used a sharps container, and 2 placed syringes directly in the trash.

Only 2 participants were aware that there were 5 drop off centers located at various police stations in this city.
Conclusions: The majority of patients in this study lacked knowledge about proper medication disposal. Virtually none were aware of the existing city drop off centers. Participants who use insulin syringes were more likely to properly dispose of their used syringes. No participant admitted to giving away, selling, or using their medications to treat others.
Keywords: Education, Public health, Disposal

267. Treatment improvement for drug abuse: A PCC proposal

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Background: Each year, the National Poison Control Center (PCC) in Milan, Italy, handles approximately 50.000 human cases of exposure, accounting for more than 70% of all cases referred to the Italian PCCs. Assistance for diagnosis and treatment is provided by toxicologist medical doctors. For each case of human exposure the following main categories of information are collected in real time by using a standard form: demographic characteristics; exposure characteristics (e.g. substance/commercial product, route of exposure, reason for exposure, dose and latency between exposure and onset of clinical effects); signs/symptoms; therapy; outcomes. The present contribution is aimed at providing a preliminary description of drug and psychotropic agents abuse cases
Methods: The NPCC data base was searched in order to identify all cases of abuse due to assumpion of drugs and psychotropic agents occurred between 1st January 2009 and 31st December 2012.
Results: In the period under study, the National PCC handled 1,992 cases of interest, accounting for 2% of all human exposures. The vast majoryty of cases were at an emergency room (ER) when the National PCC was consulted (N = 1,821, 91.4%). Most cases were young adults aged 18–39 years (N = 1,203, 60.4%). Patients presenting with signs/symptoms accounted for 80.6% of cases (N = 1,606).

The most frequently reported agents were cocaine (N = 216, 10.8%), cannabis (N = 156, 7.8%), heroin (N = 69, 3.5%), ecstasy (N = 44, 2.2%).
Conclusions: A systematic revision of human exposures to substances of abuse referred to PCCs could provide indications to improve toxicological training of the ER personnel and to optimize the patient treatment under a PCC supervision.
Keywords: Medical toxicology, Drug of abuse, Training

268. Results of a train-the-trainer program assessment: Developing outcome measures

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Background: Training community providers is one effective method for poison centers to provide health education to parents. A multilingual Community Partnership Program (CPP) was implemented in 2007 by the Poison Center (PCC) incorporating a train-the-trainer model. Over the five-year period, more than 100 community providers have been trained by the PCC to provide *Poison Prevention in the Home* key messages and conduct workshops. Previous qualitative evaluations of the CPP were conducted by the PCC. This study was developed in order to better capture outcome measures of the program, create a standardized training

session, and establish mechanisms for quantifying outreach events. In addition, assurance of content quality of trained CPP members requires an observational component.
Methods: A survey was sent via email using SurveyMonkey software to active CPP participants in July 2012 (N = 106) to quantify the roles of current CPP participants and guide the program's direction and outcome measures. Questions were designed to collect information about each CPP members' participation, poison prevention workshops conducted and/or materials distributed in the last year and preferred method to report outreach events and share information. Usefulness of a new medicine safety program for parents was also collected.
Results: The survey was completed by 49 CPP participants (46%). Answers reflect more than one response when applicable. In the last year, more than half (n = 31) had conducted at least one presentation to parents (n = 27), staff (n = 17), community groups (n = 10), older adults (n = 9) and children (n = 7). Almost all CPP respondents (n = 43) had distributed poison center materials. Materials were distributed in Spanish (n = 32), Chinese (n = 5), Creole (n = 2) and Korean (n = 1). The most common material distribution venues were: lobby at site (n = 23), staff and clients at program (n = 21), health fairs/community events (n = 20) and home visits (n = 9). Results showed that the preferred method for reporting outreach activities to the PCC was through an online system. In addition, all respondents felt a medicine safety program for parents would be very useful (n = 27).
Conclusions: A standardized training program has been developed incorporating the "roles" for CPP participants. Workshop instructors will be observed by a PCC educator to ensure accurate content delivery in the community. An online reporting system will collect information to accurately measure the impact and reach of the CPP. A new multilingual medicine safety program for parents is being developed and will be piloted with interested CPP sites.
Keywords: Education, Public health, Community provider training

269. Planning for a coordinated network of nurse triage lines during an influenza pandemic: Critical role for poison control centers

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Background: During a severe influenza pandemic its likely that hospital EDs, clinics, and medical offices would be overwhelmed as large numbers of ill people simultaneously seek care. Current planning focuses on reducing surge on hospitals and other medical facilities during a pandemic by improving the "supply" of medical care services. Equally important is reducing the "demand" for such services that efficiently and cost-effectively match patient needs with alternative types and sites of care. Based on lessons learned during the 2009 H1N1 pandemic, the CDC and its partners are exploring the acceptability and feasibility of establishing a coordinated network of nurse triage telephone lines during a pandemic to assess the health status of callers, help callers determine the most appropriate care site (e.g. ED, outpatient center, home), disseminate information, provide clinical advice, and provide access to antiviral medications for ill people, if appropriate.
Methods: The integration and coordination of poison centers, existing nurse advice lines, 2-1-1 information lines, and other hotlines are being explored. A 1-day simulation exercise was conducted with a poison center handling a baseline of scripted exposure calls and then challenged with scripted influenza calls all placed by trained actors. Calls were received by 2-1-1 operators, and then transferred to poison center staff for triage according to a protocol. Additionally, community stakeholder meetings were held in two communities to discuss the concept of a coordinated network of nurse triage lines. Poison centers serving these communities (one servicing a state, another servicing several states), public health agencies and other stakeholders needing to coordinate activities during a pandemic response participated.
Results: A total of 214 scripted calls were handled by five SPIs during two 2-hr sessions (1st at 2×, 2nd at 2.5× standard call handling rates). Call center metrics tracked for exercise were Call Duration (mean = 6:54 min, range = 0:52–14:20 min) and Wait Time (mean = 0:33 min, range 0:24–5:30 min). Actors placing scripted calls reported 95% of calls met callers' needs in scenarios. Community meetings solicited feedback from stakeholders regarding use of nurse triage lines and integration of poison centers in support of pandemic influenza response efforts.
Conclusions: The simulation and planning exercises confirmed feasibility and acceptability of poison centers triaging influenza related calls. Poison centers are positioned to play a critical role in this effort and are ideally suited to participate in serving the public during a pandemic emergency.
Keywords: Public health, Poison center, Pandemic influenza response

270. Perspectives on collaboration between poison centers and health departments

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Background: In 2010, the CDC, in collaboration with the Council of State and Territorial Epidemiologists (CSTE) and the AAPCC, implemented the Poison Center and Public Health Collaborations Community of Practice (CoP) with a primary goal of characterizing then improving the interaction between poison centers and their state/city health departments. The CoP leadership committee requested AAPCC and CSTE administer a survey to ascertain impediments to poison center (PC) and health department (HD) relationships and to detail the areas of cooperation that can be improved between the groups. The objective of this study is to determine the barriers to collaboration between poison centers and health departments via tailored surveys administered to poison centers and state/large city health departments.
Methods: A survey was administered to poison center managing directors, and a complementary survey was administered to state/large city health departments. The surveys, after review and

approval by both CSTE and AAPCC boards, were administered via a free, online data collection tool accessible by a link emailed to appropriate PC and HD officials identified by AAPCC and CSTE. The surveys were sent to all poison centers, all state health departments, and 6 city health departments. Surveys included questions about infrastructure, current data sharing capabilities and capacities, barriers to collaboration, and willingness to bolster collaboration. The two completed survey groups were linked based upon the geographic service areas of the PCs and HDs. A descriptive analysis was performed.

Results: A total of 46 of 57 (81%) PCs and 54 of 56 (96%) HDs responded to the survey. The majority of HDs work with only one PC within their jurisdiction (n = 33, 61%). Most HDs interact with their respective PCs through periodic phone/email contact on public health issues (n = 37, 69%), and most have access to or receive data or case reports from their poison center (n = 46, 85%). The most common impediments to establishing, maintaining, or expanding the interface between PCs and HDs include: lack of dedicated funding (n = 43, 80%), information technology limitations (n = 20, 37%), and lack of familiarity with the data (n = 12, 22%). All poison centers and the large majority of health departments (n = 47, 87%) believe that the relationship between PCs and HDs needs to be strengthened.

Conclusions: The extent and depth of collaboration between PCs and HDs vary widely. Enabling information technology improvements, expanding understanding of PC data among HDs and increasing funding are needed for enhancing collaboration. Respondents indicated an overwhelming desire to strengthen the PC-HD relationship.

Keywords: Poison center, Public health, Collaboration

271. Making of a CSPI: Evaluation of the Prerequisites for the CSPI Examination

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Background: Current AAPCC regulations require that in order to become a certified specialist in poison information (CSPI) specialists in poison information (SPIs) must successfully complete a standardized examination. SPIs can only sit for the examination after having achieved 2000 hours of on-the-job experience and having managed at least 2000 human exposure cases. No statistical or experimental evidence were used to demonstrate the utility of these prerequisites. We sought to evaluate whether these criteria predict passing rates on the CSPI examination.

Methods: Test results (pass/fail) were obtained for 77 consecutive first-time test participants for the 2010 CSPI examination. Test outcomes were analyzed for potential predictors of success, such as: number of hours worked, number of human exposure cases managed, and self-reported study hours (when provided). Descriptive statistics and the nonparametric K-sample test (median test) were utilized to evaluate the results using Stata/SE 12.1 (StataCorp LP, College Station, TX). The level of significance was set at $p < 0.05$.

Results: 43 of the 77 first-time examinees passed (56%). Median hours worked were 3320 (IQ25–75, 2720–4200) in those passing vs. 3180 (IQ25–75, 2600–4080) in those failing, respectively. Median human exposure cases managed were 3679 (IQ25–75, 2857–4658) in those passing vs. 2856 (IQ25–75, 2403–3757) in those failing, respectively. Median self-reported study hours were 80 (IQ25–75, 40–200) in those passing vs. 100 (IQ25–75, 60–100) in those failing, respectively. Only the median number of human exposure cases managed was statistically higher in those passing ($p = 0.028$). Hours worked and self-reported study hours were statistically insignificant ($p = 0.414$ and $p = 0.796$ respectively).

Conclusions: The current AAPCC criteria required to qualify to sit for the CSPI examination incompletely predicts passing the certification examination in this sample year. Human exposure cases managed correlated with a passing score, but hours worked and self-reported study hours did not. Further work will be required to determine if these trends are sustained in other years. Confirmation of these data would suggest that a re-evaluation or alternative markers of ability and/or experience could be used to determine the qualification criteria for the examination.

Keywords: Poison center, Certification, Examination

272. Information-seeking behavior among callers to a poison center

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Background: Many regional Poison Control Centers (PCCs) have observed a reduction in exposure call volume. While the cause of this reduction is likely to be multi-factorial, it has been hypothesized that a significant proportion of the public with potential toxic exposures seek health-related information from online resources. Research indicates this is likely the result of increased access to and reliance on online resources.

Objectives: The primary goal of this study was to assess the proportion of callers to a PCC who sought information elsewhere when confronted with a potential poisoning emergency. A secondary goal was to identify characteristics of the caller and exposure that may be associated with seeking information prior to calling the PCC.

Methods: A survey was administered to 501 callers to the PCC in December 2011 and January 2012. Surveys were conducted by full-time Specialists in Poison Information at the end of an exposure call and consisted of 10–15 guided questions; questions asked were determined by caller's responses and the use of a flow chart. Callers less than 18 years old, healthcare professionals, callers from a healthcare facility, and those seeking information unrelated to either a human or animal exposure or seeking treatment recommendations for an intentional ingestion were excluded.

Results: Only 33% of respondents reported seeking information prior to calling. The most commonly cited sources of information were healthcare professionals and the Internet. At the time and location of exposure, 86% of the respondents reported that Internet access was available. Ages of survey respondents ranged from 18–81 years. Mean age of all respondents was 33 years and respondents who reported prior searching were on average 5 years older than callers who did not search. The time between exposure and call was nearly double for callers reporting searching. Gender, insurance status and education level were not associated with searching behavior of callers.

Conclusions: The majority of callers to this PCC did not report searching prior to calling. This indicates that people who are aware of PCCs are more likely to call them without searching for answers on their own. The elusive demographic that can help explain the decrease in calls to PCCs are those potential callers who seek and find information online after an exposure and make final decisions based on that information. Potential future research includes interviewing non-healthcare providers to examine their information-seeking behavior when presented with a poisoning related scenario, examining of the accuracy and readability of online poisoning information, and exploring the role of severity of exposure on information-seeking behavior.

Keywords: Internet, Health information, Poison center

273. Medical toxicology telemedicine consult service to assist physicians in remote locations

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Background: Specialty care (such as medical toxicology) is not readily available to military and civilian physicians in overseas contingency operations. The US Army Medical Department designed an email telemedicine system in 2004 to provide consultations for remote healthcare providers. The service provides e-consultation 24 hours/day to assist government providers managing cases in austere environments. Our objective was to describe the types and frequency of toxicology consultations and toxicologist's recommendations that occurred using the military telemedicine service from 2005–2012.

Methods: Consults were generated using the military email system routed to on-call military, medical toxicologists. A project manager monitored all teleconsultations to ensure HIPPA compliance and consultant's recommendations were transmitted within a 24-hour mandated time period. A single, unblinded medical toxicology trainee reviewed all medical toxicology email consultations from 2005–2012. Using a previously developed data collection worksheet the extractor documented the frequency of various types of consultations and the frequency that the consulted toxicologist aided in providing diagnoses, provided specific management recommendations, or provided the consulting physician with resources to aid in the management of future cases.

Results: 98 consults were performed over 7 year and 6 months. The average reply time was 3 hours and 46 minutes (range 0.06 to 29.18 hours). 77 consultations involved patient interactions and 22 were for general management protocols. The 77 patient consultations included 59 US military patients, 4 US contractors, and 14 local nationals (7 of whom were pediatric). The most common consultations were for snake envenomation and antivenom recommendations (22%; 95% CI 15% to 32%), accidental chemical exposures (14%; 95% CI 9% to 23%), and drug testing (13%; 95% CI 8% to 21%). Other consultations were for substance abuse, intentional overdoses, scorpion envenomations, and occupational exposures.

In 41 consults (41%: 95% CI 32% to 51%) the toxicologist provided a differential diagnoses or specific diagnosis and in 60 cases (61%: 95% CI 51% to 70%) the toxicologist provided specific management recommendations. In 25 cases (25%: 95% CI 18% to 35%) the toxicologist provided the consulting physician with resources to aid in the management of future cases.

Conclusions: Medical toxicologists provided diagnoses, management recommendations, and toxicology resources to consultants in remote locations with limited resources. Development of a similar volunteer teleconsultation program could assist physicians serving in austere locations worldwide.

Keywords: Internet, Occupational, Telemedicine

274. Cases of levothyroxine and liothyronine exposure reported to a regional poison control center

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Background: The authors previously reported a case of early onset thyrotoxicosis in a young child exposed to 1.2 mg of levothyroxine within 8 hours. Based on this case, we felt levothyroxine overdoses needed to be reevaluated for risk stratification and acute management.

Methods: We conducted a retrospective chart review of cases of levothyroxine and liothyronine exposure recorded through our local Poison Control Center from 2003–2012. We received IRB approval through a tertiary care Children's Hospital . Patient cases were compiled based on exposure to levothyroxine or liothyronine. Exclusion criteria were multi-drug ingestions and non-human exposures. Two reviewers were trained by the principal investigator to abstract data from charts systematically. Inter-reviewer reliability was confirmed by overlap of at least 10% of patient cases. Data was recorded using Microsoft Excel® spreadsheet software.

Results: There were a total of 1721 cases of levothyroxine single exposure. Of these, 1604 were calls from home and 117 were healthcare facility calls. Of home calls, only 28 were referred to a healthcare facility for evaluation. Fifteen patients were reported symptomatic, and six patients had time to symptom onset

Table. Results for abstract number 274.

Case	Sex	Age (Yr)	Amount Ingested	Time to Symptom Onset	Symptoms
1	F	3	0.6 mg	10 Hr	Diaphoresis, Abdominal Pain
2	F	38	400 µg/day over weeks	Chronic	Tachycardia
3	F	36	2.7 gm	Immediately	Diarrhea
4	M	5	0.75–3 gm	24 Hr	Tachycardia
5	M	19	10 mg (Liothyronine)	58 Hr	Tachycardia
6	F	15	Unknown	24–48 Hr	Tachycardia

available in the PCC record. Please see Table for a description of symptomatic patients.

Conclusion: Levothyroxine therapy is ubiquitous among the general population. Levothyroxine has a relatively large therapeutic window. Hyperthyroid symptoms usually do not develop until several days after exposure, if symptoms occur at all. Data from this regional Poison Control Center confirm that levothyroxine exposure appears to be relatively benign. Of the 1721 cases of levothyroxine exposure, only 0.87% (15/1721) were symptomatic, 1.04% were admitted to an inpatient setting, and 0.17% were admitted to an ICU setting. The earliest documented time of symptom onset among the symptomatic cases was 10 hours after exposure. This confirms that a subset of patients may develop clinical signs of hyperthyroidism within 24–48 hours of levothyroxine exposure, contrary to traditional teaching. A prospective study following patients exposed to levothyroxine over time may elucidate risk factors for early symptom onset and highlight individuals prone to the development of thyrotoxicosis.

Keywords: Poison center, Levothyroxine, Thyrotoxicosis

275. Serious mushroom poisonings more common in population of foreign origin

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Background: Exposures to mushrooms are common emergency inquiries to the poison center (PC) in the fall. The five most poisonous mushrooms in the Norwegian nature (*Cortinarius rubellus*, *Cortinarius orellanus*, *Amanita virosa*, *Amanita phalloides* and *Galerina marginata*) can be confused with the edible wild mushrooms commonly gathered in other countries. Our goal was to investigate whether the population in Norway of foreign origin had an increased risk of serious poisoning after misidentification of mushrooms.

Methods: A retrospective analysis of all human mushroom inquiries to the PC was undertaken for the years 2010 to 2012. Patient and exposure characteristics were recorded at the time of the call. Cases categorized as risk of major poisoning with hospitalization were further analyzed. Cases categorized as suspected suicide were excluded.

Identification of the mushrooms was done by the aid of mycologists hired by the PC. The mycologists have expert knowledge in identifying mushrooms by telephone and can analyze biological material microscopically when needed.

Results: The PC received a total of 2387 calls from health care professionals and the public requesting advice following human ingestions of mushrooms during the period. Of these inquiries, about 64% involved children (<9 years old), 32% involved youths and adults and the rest was of unknown age. 27 patients were hospitalized and categorized as risk of major poisoning. All patients were adults. The identified mushrooms included *Amanita virosa* (14), *Cortinarius rubellus* (7), *Amanita muscaria* sp (4) and *Amanita phalloides* (2). In 2010 6 cases met the inclusion criteria whereof 3 patients were of foreign origin. One of these cases was fatal. In 2011 there were 14 cases included, where 7 patients had a foreign background. In 2012 the number included was 7 with 5 of foreign origin respectively. The patients' countries of origin were Bosnia, France, Germany, Estonia, Russia, Palestine, Vietnam, China and Thailand.

Conclusions: Our study shows that people with foreign origin have an increased risk of serious poisonings after misidentifying wild toxic mushrooms as edible mushroom species. In our study of the patients hospitalized with a risk of major poisoning, 56% were of foreign origin. This population has a pressing need for information about the geographical differences between mushrooms, before harvesting fungi in other countries.

Keywords: Mushroom poisoning, Foreigners, Poison center

276. Synthetic drugs smoked out: Outcome of a unique public health partnership

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Background: Synthetic drug use became prevalent in 2011. Packages of drugs were marketed as "not for human consumption" and sold in retail outlets as potpourri, bath salts, plant food and other consumer products. However, retailers and buyers knew the packages were intended for human consumption. To combat this threat, both state and federal agencies enacted bans based on the chemical structure of the compounds implicated in synthetic drug use. In spite of this, the effect of state and federal bans were slow in changing the trajectory of synthetic drug related calls to poison centers.

A regional poison center (RPC) partnered with the state Attorney's General's (AG) office on a multi-pronged approach of surveillance, reporting, law enforcement partnership and legislative changes to combat the spread of synthetic drugs in the state. RPC data was used by the AG to track reports of harm from synthetic drugs, location of use and when available, store where products were sold. Additionally, RPC data was used to monitor the outcome of strategies to combat synthetic drug use, including clandestine buys at retail outlets with subsequent removal of product.

This collection of data resulted in broadening of the state Food, Drug and Cosmetics Act to define a synthetic drug product as one that contains a controlled substance not regulated by the U.S. FDA; selling the product with labels claiming they are legal but being promoted for human consumption made it a 'misbranded drug'. Sale of misbranded drugs was elevated to a felony and penalties were significantly increased.

Methods: RPC data on synthetic drug exposures was tracked and compared to the national monthly average of calls posted by AAPCC from 1/1/2011 through 2/1/2013. The cases were adjusted for population to provide a comparison of cases/1,000,000 population.

Results: For presumed cathinone derivatives, during the peak of the outbreak in the region, cases were 11% higher than the national average. At the end of the surveillance period, cathinone cases were 59% lower than the national average. For THC homologs, the peak was 30% higher than the national average and at the end of the monitoring program were 78% lower than the national average during the 25 month surveillance period.

Conclusions: RPC data can be used in wide ranging partnerships. These partnerships in turn can create action plans that protect and safeguard the public health. Calls to the RPC dropped dramatically after the partnership implementation. In October 2012, the AG office confirmed there were no retail outlets selling synthetic drugs in the state. The signal of calls to the regional PCC essentially disappeared at that time with internet sales reported to the RPC as driving the few remaining exposures.

Keywords: Poison center, Designer drug, Drug of abuse

277. Accessing the poison center in the 21st century-How do patients find and contact their poison center?

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Background: Human exposure call volumes to US poison center (PC) have been declining at the rate of approximately 2% per year since 2007. Intensive public education efforts have been directed at educating the public about PC access. We examined 1) how callers obtained the PC phone number, and 2) whether the callers used a cell phone or landline phone.

Methods: We conducted an IRB approved, observational prospective survey on exposure calls to a multistate regional PC over 5 days in December 2012. At the completion of the call, according to the operating protocol of the PCC, the callers were verbally consented by a Certified Specialist in Poison Information and asked: "How did you obtain the PC phone number you used to contact the poison center" and "Are you calling on a cell phone or landline". We used descriptive statistics to characterize the answers. Replies were entered into a dedicated field on the electronic PC data collection instrument. Data was collated by the authors, analyzed and described with simple descriptive statistics.

Results: 1057 exposure calls occurred during the study period. Of these 688 (65%) callers answered one or both of the survey questions. The median (range) age of the exposed patient was 3 (0.1 to 98) years and 50% were male. 68% of callers were mothers, 18% were fathers and 6% were grandparents. 94% of the calls originated from their home. 586 callers answered the first question (where they obtained the poison center phone number) and 676 callers answered the second question (cell phone vs. landline). The majority of respondents (497/676, 74%) called on a cell phone.

Conclusions: Most callers use cell phones to access the PC for exposures. The phone number is most likely obtained from the Internet. Public education dollars may be best spent to create more convenient access for cell phone users and improve Internet search engines to enhance on-line presence.

Keywords: Poison center, Public health, Internet

278. Poison center managers retirement-A 2013 survey

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Background: A demographic change is beginning that will have major consequences for U.S. poison centers (P.C.), the retirement of "baby boomer" P.C. managers. A survey of current P.C. managers provides insights into their level of preparedness for retirement and the impact of their departure on poison centers.

Methods: A survey was prepared covering demographics, factors affecting the decision to retire, retirement finances, retirement expectations, poison center succession planning, and post retirement professional activities. An email invitation was sent to 63 P.C. managers as listed by AAPCC to participate in an online, electronic survey.

Results: 53 managers responded (84%). Of those responding, 74% were born between 1947–1967. About 30% had 20+ years of experience as P.C. managers and 85% had >10 years of P.C. experience with 40% having >25 years. In ≤ 10 years, 40% of these managers expect to retire and 57% will retire in the next 15 years. Most managers, 60%, will retire between the ages of 65–70, and 32% will retire <65 years. The most important factor determining when an individual will retire was having medical insurance (89%). P.C. managers appear to be well prepared financially for retirement. About 90% of managers said they were very or somewhat confident that they had done a good job of planning for retirement. The 3 sources of expected income ranked in order of importance were employer sponsored retirement saving plans (47%), traditional pension (43%) and individual retirement accounts (49%). The 2 highest rated retirement expectations were having enough money to spend time with family (100%) and pursue leisure activities (94%). Future retirees (76%) plan on volunteering and/or voluntarily working part-time or full-time and 66% were confident that they could find employment if needed. Expectations for successful leadership succession were low. A majority of mangers, 62%, were not confident that there was anyone at their center who could take over as manager or that an external candidate could be found in a timely manner (52%). Time to recruit, relocate and start a new manager was estimated to take ≥ 7 months (68%). Only 30% of managers expect to be involved in any way with a P.C. after retirement, 50% will drop their membership in toxicologically related professional organizations, and 66% plan on maintaining their professional licensure in active status.

Conclusions: Over the next 15 years, almost 60% of current P.C. managers will retire. Although they appear to be well prepared financially for retirement, they have low expectations that their replacements will be easily found. Given the level of experience needed to be a P.C. managing director, centers need to begin now to cultivate and train future managing directors.

Keywords: Retirement, Poison center, Managers

Table. Results for abstract number 277.

PC Number source	Internet	Health Care Facility	Promotional Materials	Phone Book
	43.0% (252/586)	22.2% (130/586)	10% (60/586)	7.2% (42/586)
95% Confidence Intervals	39.1–47%	19–25.7%	8–13%	5.3%–9.5%

279. The epicenter of fungal meningitis-The poison control center experience

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Background: On September 18, 2012, the Department of Health (DOH) was notified of a case of fungal meningitis related to Epidural Steroid Injections (ESIs). A multistate investigation ensued as the ESIs were associated with illness and deaths. DOH asked the Poison Center (PC) to answer calls from the public regarding this outbreak as the PC had provided a similar service during the H1N1 outbreak. This study describes the impact the ESI outbreak had on the PC and what was learned from the experience.
Methods: On October 1, 2012, the PC began taking calls related to the tainted vials of methylprednisolone which had been used for ESIs. The DOH communicated with the PC daily to provide up-to-date triage recommendations and general information about the outbreak. Data was entered prospectively by Specialists in Poison Information (SPIs) with notes to differentiate the ESI calls from poison exposure and information calls. Based on this data, the number of calls received was reported to the DOH daily. The number of fungal meningitis calls per hour was also recorded.
Results: Between October 1, 2012 and January 1, 2013, 1,366 calls related to the outbreak were coded. A surge occurred in the first 5 days as the news media broadcasted the story informing the public to contact the PC with questions. Peak calls per hour related to the outbreak were 36. Peak times for these calls were during news broadcasts. The largest number of calls occurred between 1600 and 1800 daily although one other peak time was in the morning during call back times. Additional staffing was needed to handle the surge of calls. All but two of the calls were related to adult patients. The PC received calls related to other products the implicated company had manufactured. There were also calls from the public regarding a concomitant outbreak of viral meningitis and a recent death from bacterial meningitis in our state. This data does not include the calls that were directed to PCs outside of our state.
Conclusions: The PC maintained two way communication with the DOH to receive information about current recommendations and to provide an update on the number of calls to the PC. The outbreak impacted the daily operations of the PC due to the surge of calls in the first 5 days. An extra, dedicated phone line and number may be more efficient for answering calls relating to an outbreak, e.g., the model used for the H1N1 outbreak. This would enable the PC to continue its primary function and would reduce the impact on other PCs. Although we could handle some surge capacity, we needed extra staffing for peak call times (evenings), and peak call back times for hospital follow up calls (mornings).
Keywords: Fungal meningitis, Public health, Poison center operations

Table. Data for abstract number 279.

	10/1/12	10/2/12	10/3/12	10/4/12	10/5/12
ESI CALLS	133	160	139	158	126
TOTAL PC CALLS	394	454	441	461	401

280. A comparative study of a new mobile TOXBASE® App with the current internet poisons database

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Background: Poisoning is a common reason for emergency department (ED) attendance and rapid access to poison specific information is essential. TOXBASE® is the UK and Ireland internet-based poisons database. Currently, this database is only available online, however, many clinicians own application or "app" capable smartphones and tablet PCs. A TOXBASE® app has been developed that supplies regularly updated toxicological information and stores it directly to the mobile device's memory, allowing access to the information independent of internet connection. This study compared the app with the TOXBASE® website, and gathered feedback on the app's ease of use.
Methods: Medical students, ED nurses, and doctors completed two fictional toxicological scenarios involving four information gathering tasks. All participants were randomised to complete one scenario using the TOXBASE® website and the other scenario using the app on either an Apple iPad2 or iPhone4S. The time taken to complete each scenario was recorded, as were the number of correctly completed tasks. Upon finishing both scenarios, participants completed a questionnaire on their use of TOXBASE® and mobile technology, and were asked to evaluate the performance of the app. Space was provided for participants to make suggestions on improvements.
Results: In total 63 participants (24 doctors, 20 nurses, 19 medical students) completed the tasks and questionnaire. There was no significant difference in time taken to complete the tasks using either the app or website (Scenario 1: website median time = 213s [Interquartile Range (IQR) = 312-178]; app median time = 195s [IQR = 250-164]. Scenario 2: website median time = 273s [IQR = 358-194]; app median time = 274s [IQR = 340-215]), nor was there a significant difference between the number of correctly completed tasks (Scenario 1: website median score = 4 [IQR = 3–4]; app median score = 4 [IQR = 3–4]. Scenario 2: website median score = 3 [IQR = 4–3]; app median score = 3 [IQR = 4–3]). In the questionnaire, participants scored the performance of the app highly (median score across all 6 usability heuristics = 4 [IQR = 3–5] out of 5). 62% of participants favoured using the app over the current website, whilst 24% needed more time to decide, and the remaining 14% preferred to use the website. Suggested areas for improvement included a reduction in on-screen text and layout change to make finding specific information easier.
Conclusion: This evaluation study demonstrated that the TOXBASE® app performed well against the website, and it met with general approval from current and future medical staff. Future studies could investigate the benefits of using the TOXBASE® app in real clinical practice.
Keywords: Internet, Education, Information

281. Comparison of diphenhydramine and Datura abuse

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Background: Abuse of diphenhydramine or Datura (e.g., jimsonweed) for their anticholinergic effects has each been reported in the literature. Although they have similar pathophysiologic effects, it is unknown if significant clinical differences exit. This study compared the demographics and clinical effects of cases of diphenhydramine and Datura abuse reported to poison centers.
Methods: All diphenhydramine and Datura exposures due to "intentional abuse" reported to a statewide poison center system during 2000–2012 were identified. Exposures with multiple agents were excluded. Exposures not followed to a final medical outcome were included. The distribution by selected demographic and clinical factors was determined and comparisons made between the 2 groups by calculating the rate ratio (RR) and 95% confidence intervals (CI).
Results: There were 131 Datura and 309 diphenhydramine cases. Datura and diphenhydramine patients were, respectively, 84% and 58% male (RR 1.45, 95% CI 1.28–1.64) and 79% and 54% < 20 years (RR 1.46, 95% CI 1.28–1.67). Ingestion was the most common route of exposure for Datura (93%) and diphenhydramine (99%) (RR 0.94, 95% CI 0.90–0.99). 80% of Datura and 52% of diphenhydramine patients were already at/en route to a healthcare facility (RR 1.54, 95% CI 1.34–1.76). The most commonly reported clinical effects for Datura and diphenhydramine were hallucinations (60% vs 17%) (RR 3.47, 95% CI 2.62–4.61), tachycardia (45% vs 28%) (RR 1.62, 95% CI 1.25–2.10), mydriasis (41% vs 8%) (RR 4.90, 95% CI 3.22–7.46), agitation (40% vs 12%) (RR 3.38, 95% CI 2.34–4.88), confusion (40% vs 13%) (RR 3.21, 95% CI 2.24–4.59), and drowsiness (16% vs 27%) (RR 0.60, 95% CI 0.39–0.93). Serious outcome was reported in 94% of the Datura and 58% of the diphenhydramine exposures (RR 1.63, 95% CI 1.47–1.81).
Conclusion: Single-agent Datura and diphenhydramine abuse were most common in males and patients < 20 years. Compared to diphenhydramine, Datura cases were more likely to have hallucinations, tachycardia, mydriasis, agitation, and confusion; conversely, diphenhydramine caused more sedation. Thus, abuse of Datura more frequently causes anticholinergic symptoms than does abuse of diphenhydramine.
Keywords: Datura, Diphenhydramine, Abuse

282. Non-Ethanol hyperlipasemia in toxicology consultation

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Background: Elevated serum levels of lipase have been reported in critically ill patients. There are little data on hyperlipasemia associated with xenobiotics other than ethanol. We used the Toxicology Investigators Consortium (ToxIC) database of the American College of Medical Toxicology to investigate which xenobiotics other than ethanol were associated with hyperlipasemia.
Methods: The ToxIC database is a registry of patient bedside encounters seen by medical toxicologists. We searched for cases with hyperlipasemia, defined by lipase > 100 U/L from May 2012 to April 2013. We excluded ethanol exposures, multiple and unknown xenobiotic exposures, and cases that were thought to be unlikely xenobiotic related.
Results: We found 107 hyperlipasemia cases in this database. Of these, 16 involved cases of non-ethanol single xenobiotic exposures whose symptoms were thought to be xenobiotic related. 56% were male, 62% between 19–65 years old, 56% of the exposures were intentional. Seven cases (44%) were acetaminophen exposures, 2 (12%) methamphetamine cases and 1 case each of colchicine, glyphosate, bath salts, lithium, diphenhydramine, methadone, and oxymorphone. Hepatotoxicity (AST > 1000 U/L) and significant coagulopathy (PT > 15) were reported in the acetaminophen exposures. Acute kidney injury (creatinine > 2.0), metabolic acidosis (PH < 7.2), and coma were reported in acetaminophen, glyphosate, diphenhydramine, methamphetamine, and methadone cases.
Discussion: The most common xenobiotic found in this group was acetaminophen. Most of the patients were men between 19 to 65 years old. The majority of the exposures were intentional. The most common concomitant clinical problem was hepatotoxicity with acetaminophen exposure. The hyperlipasemia in many of these cases was likely related to multiorgan failure.
Conclusions: Non-ethanol related hyperlipasemia with a single xenobiotic exposure was observed in 15% of all hyperlipasemia cases found in the ToxIC registry. Acetaminophen was the most common xenobiotic exposure in these subjects.
Keywords: Non-ethanol, Hyperlipasemia, Poison center

283. Accuracy of poison center data improves after targeted training

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Background: Previous reports suggest that the accuracy of poison center (PC) data needs improvement. Acetaminophen-containing products are involved in 6% of exposures reported to US PCs each year and are linked to > 3800 Poisindex codes. Given the prevalence of acetaminophen exposures and complexity of acetaminophen Poisindex codes, we assessed the impact of a targeted training intervention to improve PC coding of acetaminophen exposures.
Methods: Training programs targeted product identification, quantity/quantity unit, level of care, weight, and medical outcome.11 participating PCs were randomized to receive a passive or interactive training program. Passive training included an initial newsletter and 3 subsequent weekly memos. Interactive training provided

Component	Pre-Training Score (SE)	Post-Training Score (SE)	p-value
Demographics	96.58 (0.25)	97.04 (0.25)	0.2040
Exposure Characteristics	95.31 (0.26)	95.58 (0.26)	0.4616
Outcome	97.27 (0.25)	97.05 (0.25)	0.5202
Substance	88.94 (0.38)	92.98 (0.38)	< 0.0001
Product Name/Code	68.26 (1.27)	74.04 (1.27)	0.0013
Generic Code	94.07 (0.57)	96.95 (0.57)	0.0003
Quantity	87.87 (0.85)	91.68 (0.85)	0.0015
Quantity Unit	91.42 (0.68)	95.87 (0.67)	< 0.0001
Certainty	85.60 (0.87)	93.07 (0.87)	< 0.0001
Formulation	97.25 (0.33)	99.44 (0.33)	< 0.0001
Route	98.60 (0.21)	99.79 (0.21)	< 0.0001

the passive material plus a weekly email memo with interactive quiz. Accuracy was measured in 100 cases pre- and 100 cases post-training by comparing call recordings to coded case fields (18 core NPDS fields/case and 7 product-related fields/product). Mean quality scores were calculated as percent correct for the total score and for each component score (demographics, exposure characteristics, outcome, substance).

Results: Overall pre-training coding accuracy was 94.0% (SE 0.17). Pre-training component scores were lowest for substance (88.9%) and highest for outcome (97.3%). Among substance fields, accuracy was lowest for product name/code fields (68.3%). After training, the total quality score improved +1.3% ($p < 0.0001$) to 95.34% (SE 0.17). Substance field scores improved the most (+4.0% $p < 0.0001$), with the greatest improvement in specific substance fields (product name/code +5.78%; certainty +7.47%). Pre- and post-training improvement scores did not differ by passive or interactive training program.

Conclusion: Targeted training improved the accuracy of PC data collection in acetaminophen-related cases. The results of this study are currently limited to these specific types of cases but provide supportive evidence that training interventions can impact data accuracy. Additional training programs and evaluation of sustainment of results are warranted.

Keywords: Amphetamine, Quality improvement, Poison center

284. Standard treatment protocols and electronic charting: Shortcuts to error?

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Background: In their 2000 study "Implementation of Toxicall: Impact on Documentation", Gopalan et al concluded that electronic charting of Poison Center calls resulted in "a significant increased percentage of time… dedicated to the documentation process". To minimize charting time, this RPC created "standard treatment protocols" (STPs) to be an adjunct to electronic charting. Individual STPs as applicable may be selected by a SPI to become part of the chart.

Objective: Given that it is implied in medical record keeping that anything "charted" (such as symptoms reported or therapies done) actually occurred, items not charted cannot be assumed to have been occurred. The purpose of this study was to determine if STPs coded in the electronic charts of this RPC were appropriately utilized.

Method: All exposure charts from 1/1/2012–12/31/2012 were queried for use of a STP. Charts with STPs were separated by SPI and STP #. Calls from the 6 SPIs most frequently using STPs were queried for the 5 STPs most often used in our PC. The STPs to be studied were reviewed by one medical director, one managing director, and two Senior CSPIs. Reviewers identified the 3 most essential statements in each STP to have been relayed to the caller. Ten calls per SPI per STP underwent audio review.

Results: Of all 72,530 human exposure calls to this RPC in one year, the percentage of calls utilizing STPs ranged from 0.08% of calls handled by an individual SPI to 25.6% by another individual SPI; 6 of 21 SPIs accounted for 75.7% of all STPs used.

Conclusions: SPIs were inconsistent in relaying all key elements of an STP, at times because the key elements were not all applicable. Consensus of what is imperative varies among staff members. Some STPs (such as INSECT BITE) may incorporate elements that apply only in rare situations. Other STP features are applicable only early after exposure, and may be inappropriate in a given case.

Discussion: While STPs may be an adjunct to electronic medical record charting, they are better utilized as standard phrases that may be modified to record information actually relayed in a specific situation.

Keywords: Poison center, Documentation, Electronic medical records

285. Another role for poison center surveillance - The case of the "frequent flier"

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Background: Poison Center (PC) data is often looked at for surveillance purposes as a means for identifying clusters of cases or unusual presentations. We present a case series of a patient with 17 separate emergency department (ED) encounters across 3 states for self-reported brake fluid ingestion. The PC was able to identify this patient as a "frequent flier" by his name and unique ingestion. By identifying the patient and recognizing a pattern of benign clinical outcome we averted administration of costly treatments.

Case: Over 10 years (2003–2012) the PC documented 17 encounters, encompassing 3 states and 14 hospitals, of a man with self-reported brake fluid ingestion. Quantity of brake fluid ingested varied from unknown amount up to 12 ounces, with an average time of 13.8 hours (range 15 min–30 hrs, n = 13) before presentation to the ED. Mean initial serum bicarbonate was 24 mmol/L (range 21.6–27 mmol/L, n = 15) and mean pH was 7.3 (range 7.33–7.45, n = 8). Osmolal gap was obtained on 3 cases (range 6–10 mOsm/L) and anion gap was calculated for 5 cases (median 12,

Table. Results for abstract number 284; Standard Treatment Protocol.

INSECT BITE		OCULAR		HYDROCARBON	
Obs for Allergy	41/53 (77%)	Irrigate	48/56 (86%)	No Emesis	9/55 (16%)
When Seek HCF	41/53 (77%)	Obs for Residual Sx	50/56 (89%)	Limit PO, Obs	41/55 (75%)
When Use Tape	N/A in 52/53	When Seek HCF	48/56 (86%)	When Seek HCF	43/55 (78%)
GI IRRITANT		ANTIHISTAMINE			
Initial Dilute	53/57 (93%)	When Seek HCF	23/29 (79%)		
Obs for Irritation	38/57 (67%)	Allow Pt to Sleep, Check Hourly	10/29 (34%)		
N/V/D/ Dysphagia	48/57 (84%)	Pt Should Be Arousable	7/29 (24%)		

range 11–24 mmol/L). He was prophylactically treated with fomepizole twice and ethanol infusion once after recommendations by a medical toxicologist. Final serum bicarbonate was documented in 7 cases with a mean of 24.6 mmol/L (range 21.5–29 mmol/L) and no elevation in serum creatinine was noted. Patient routinely complained of abdominal pain and requested opioids. Once this patient and pattern of ingestion was identified by the PC, further recommendations were for observation and monitoring of metabolic panel rather than empiric treatment.

Case discussion: Brake fluid often contains diethylene glycol; ingestion can be fatal and may require costly interventions such as fomepizole or dialysis. This case series illustrates how our PC was able to provide management recommendations for a patient with potential toxic ingestion, suspected drug-seeking behavior, and no objective proof of significant toxicity based upon multiple prior encounters. By averting the use of empiric fomepizole in favor of observation, supportive care, and serial chemistries, the PC potentially saved these hospitals thousands of dollars.

Conclusion: PCs should be cognizant of patients with multiple case records and attempt to track this data as it might guide future management recommendations. This case series emphasizes a unique opportunity for PCs to develop surveillance systems which may mitigate unnecessary healthcare spending.

Keywords: Poison center, Surveillance, Cost

286. Regional trends in pharmaceutical information calls to a regional poison center in 2012

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Background/Objectives: Controlled Prescription Drugs (CPD) are a common abused drug in the US. The National Drug Intelligence Center identified the diversion, trafficking, and abuse of CPDs as the primary drug threat in the Appalachian region of the US. This project aims to analyze the "Information" calls (pharmaceutical) placed to the state's regional Poison Center (PC). A comparison is made with the prescription rates identified from the State's Control Substance Monitoring Database (CSMD).

Methods: PC database was queried for 2012 "Information" calls, the majority of which are pill ID calls. We calculated the rate of pill ID calls to identify top 5 and lowest 5 counties and compared to the top 5 and lowest 5 counties in the state in terms of top pharm. class and drug type. The latest "script rate" (# of opioid prescriptions/2011 population), per county, from the CSMD database was calculated and used to compare to pill ID rates.

Results: There were 103,011 total calls placed to the TPC in 2012. Of these, 41,025 (40%) were pharm. related "Information" calls. The top pharm. classes are analgesics (29% of all "Information" calls), unknown drug (12%), sedative/hypnotics/antipsychotics (11%), muscle relaxants (6%), and antihistamines (5%). In these classes, acetaminophen (APAP)/hydrocodone, unknown drug, benzodiazepine, "other" muscle relaxant, "other" antihistamine were the top drugs in each class, respectively. The Appalachian region, had counties with the highest rate of pill ID calls. The lowest rate of pill ID calls was found in central and western portions of the State. Forty of the 95 (42%) counties were above the average pill ID call rate in the state. In the highest county, 87% of all calls were pill ID calls, whereas they were 14% in the lowest county. The top 5 highest "script rate" counties were, all rural but in Appalachian region or proximity. The lowest 5 were in urban/suburban, non-Appalachian.

Conclusions: A large percentage (90%) of "Information" calls coming into the PC are pill ID calls. The counties with the highest rates of "Information" calls are clustered in the Appalachian region of the State. Although the PC and CSMD data do not overlap exactly, the highest rates of prescriptions and the highest rates of pill ID calls all occur on or near the Appalachian region of the State. The hypothesis that a percentage of pill ID calls to the PC is placed by persons involved in illicit activities related to controlled prescription drugs warrants further studies.

Keywords: Prescription, Opioid, Information call

287. Participation and response times of U.S. poison centers in a nationwide chart review

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Background/objectives: Obtaining nationwide poison center data for research purposes requires an investigator to enlist the help of multiple institutions with varied practices regarding IRB requirements, processing of requests, and time to fulfill requests for data.

Methods: We report a convenience sample of poison center response times and individual institution IRB requirements obtained while collecting data for a national chart review pertaining to a single, specific exposure.

Results: 63 poison centers were queried for charts pertaining to a specific exposure and given desired coding parameters related to the exposure of interest. 95% (n = 60) provided charts for inclusion in our study. 5% (3) did not provide charts, citing reasons for non-participation such as loss of archives (1 center) and lack of access to alternate site's records (2 centers). 28% (17) of the participating centers required IRB approval from our poison center prior to the release of records, and 13% (8) required a separate, new IRB approval to occur at their own institution.

Of the 60 participating centers, the mean response time from date of initial request (March 8, 2012) to provision of materials was 75.35 days (range, 12 to 332). The mean number of contacts with each center between initial request to provision of materials was 4.15 (range, 1–25), with 55% (33) fulfilling the request in 3 or fewer contacts.

IRB involvement was associated with a longer response time in both scenarios (64.9 vs 103.9 days if prior IRB approval required; 65.9 vs. 138.9 days if separate, new IRB required).

Conclusions: The majority of poison centers were willing and able to participate in our chart review study. Response times varied widely, with longer response time associated with requirement of IRB approval. Our results are limited by association with a single request for information and may have be affected by timing of request, perceived importance of our study at recipient centers, or other similar factors.

Keywords: Poison center, National Poison Data System, Public health

288. Poison control centers and global health

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Poisoning is a significant public health concern, with poison control centers worldwide offering various services to both prevent and mitigate this global health issue. The World Health Organization (WHO) recommends building capacity for poison prevention and management by promoting and strengthening poison control centers. The purpose of this descriptive study is to offer a comparative view of poison control centers' health services, provided to communities in various parts of the world. Data was gathered by electronic communication to 5 centers, with 4 respective centers electing to participate. The Centro de Información y Asesoría Toxicológica (CIAT) Guatemala City, Guatemala; the National Poisons Information Centre (NPIC), Dublin, Ireland; the Poisons Information Centre (PIC), Cape Town, South Africa; and the California Poison Control System (CPCS), USA are representative centers. The CIAT in Guatemala offers select clinical laboratory and analytical services, in addition to patient information services. The CPCS uses toxicovigilance, collecting data in real-time, and is part of a national database of poison control centers; with capacity for education and community outreach, including the use of social media. The NPIC in Dublin offers public and health professional telephone consultation services. Data is collected in real-time, and is considered the national database for Ireland. Other services provided include an "outreach" program in the form of an annual Poisons Awareness Day. The PIC in Capetown offers a 24 hour service to both medical personnel and the public. This center developed AfriTox, the main information source for poisonings in South Africa. Outreach efforts are constrained by critical staff and funding shortages. Global services for participating poison control centers were found to consistently utilize telephone services for consultation, with varied capacity of laboratory and educational offerings. All centers offered varying degrees of education and training for healthcare providers. Addressing regional health policies and funding is essential for increasing poison control center capacity to include: electronic resources, laboratory services, toxicology consultations, professional training, and educational outreach – all essential for addressing poisoning issues, globally.

Keywords: Public health, Poison center, Education

289. A ten-year review of nutmeg toxicity reports to the Illinois poison center 2001–2011

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Background: Nutmeg is commonly consumed spice. Nutmeg's toxic effects have been noted, mainly due to Myricistin oil. In a recent review by the California Poison System, only three out of 119 cases (2.5%) involved children < 13 years old. An examination of the Texas Poison Centers also revealed that only 2 of 17 involved patients younger than 13 (11.8%). Case series from these centers did not record drug exposures combined with nutmeg. These patterns differed from calls to the Illinois Poison Center (IPC) for nutmeg exposures between January 2001–December 2011.

Methods: Each telephone encounter was noted at the time of the call. Data from calls were collected and filed according to primary toxic exposure. Programming techniques for data extraction were used to ensure accurate reporting. Medical outcomes were noted as

Table 1. Patient demographics (Abstract number 289).

	Intentional (%) n = 15	Unintentional (%) n = 17	Total (%) n = 32
Patient gender			
Male	13 (59.0)	9 (40.9)	22
Female	2 (20.0)	8 (80.0)	10
Patient age (years)			
< 13	0	10 (100)	10
13–19	10 (76.9)	2 (16.7)	12
> 19	2 (40.0)	3 (60.0)	5
Unknown (above age 20)	3 (60.0)	2 (40.0)	5
Management site			
Own Residence	7 (35.0)	13 (65.0)	20
Hospital	7 (70.0)	3 (30.0)	10
Acute Care Facility	1 (50.0)	1 (50.0)	2
Outcome			
No effect	0	5 (100)	5
Minor	5 (35.7)	9 (64.3)	14
Moderate	4 (100)	0	4
Major	0	0	0
Death	0	0	0
Follow up unknown	6 (66.7)	3 (33.3)	9

Table 2. Secondary drugs taken (Abstract number 289).

Age	Sex	Drugs taken
17	Male	Cannibis
17	Female	Amphetamines, dexamfetamine (Vyvanse)
15	Male	Benzodiazepines, Dihydramines
16	Female	Cymbalta, Klonopin, Benzodiazepines, Acetaminophen, K2
20	Male	Cough Syrup, Acetaminophen, Antihistamine

recorded. Tachycardia was designated as heart rate >90 beats/min and hypertension as systolic pressure >140 mmHg or diastolic pressure >90 mmHg.

Results: 32 cases of nutmeg ingestion were reported (see Table 1). Of the 17 (53.1%) unintentional exposures, 10 subjects (58.8%) were under the age of 13. Four of the exposures in children under the age of 13 did not involve oral ingestion (ocular exposures). Fifteen exposures (46.9%) were classified as intentional exposures. Of these intentional exposures, five (33.3%) were recorded to have combined drug intoxication (see Table 2). 18 patients (56.3%) had minor to moderate effects. One patient with polypharmaceutical exposure required ventilatory support in the hospital. No deaths were reported.

Conclusions: Nutmeg exposures generally do not result in severe toxicity. Our study shows a large number of unintentional exposures in juveniles under the age of 13. Mixing of nutmeg with other drugs was seen and required more intervention. Parental monitoring to prevent pediatric exposures and awareness of use of nutmeg in polypharmacy cases is advised.

Keywords: Abuse, Intoxication, Poison center

290. Potassium permanganate poisoning in a woman in labor

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Background: Potassium permanganate ($KMnO_4$) is an inorganic chemical that is a strong oxidizing agent and corrosive. It has an intense purple color when dissolved in water. We report a case of a woman in labor and her unborn fetus that were poisoned by intravenous (IV) $KMnO_4$.

Case report: A 26-year-old female, G2P1, was in labor and receiving IV Oxytocin. She woke up complaining of her right arm burning. The nurse found the IV bag and line contained a bright purple liquid. The IV line and bag were disconnected and confiscated by hospital security. There were no signs of fetal distress. The obstetrician performed an immediate caesarean section. The fluid was tested on the advice of the Poison Control Center and was found to contain a high concentration of manganese (Mn) by Inductively Coupled Argon Plasma Atomic Emission Spectrometry. The obstetrician and pediatrician were advised to obtain whole blood Mn levels. The mother's Mn level was 31.1 μg/L (normal 8–18.7 μg/L). A neurologist was consulted and found the mother to be asymptomatic with a normal neurological exam. An MRI with T2-weighted images showed no changes in the basal ganglia consistent with Mn toxicity and an incidental mass in the fourth ventricle. A repeat Mn level obtained 3 weeks later was 29.8 μg/L. Since the Mn levels were not decreasing, a decision was made to perform chelation. She received five days of 25 mg/kg/day of CaEDTA. The Mn level prior to chelation was 35 μg/L, and after the 5 days it was 38 μg/L. Subsequent levels were 26 μg/L at 1 month, 25 μg/L at 3 months and 15.4 μg/L at 1 year. During this time, she had the mass on her fourth ventricle removed with a residual tremor in her left arm. She was asymptomatic at one year with the exception of this tremor.

After birth, the newborn was normal with an APGAR score of 9. His initial Mn level was 31 μg/L 11 days after the exposure. At one month of age he also received 5 days of treatment with IV CaEDTA. The Mn level prior to chelation was 30 μg/L and was 25 μg/L after the treatment. At one year, his level was 10.6 μg/L. The pediatrician has not noticed any abnormalities on exam and the child is meeting all developmental milestones.

Case discussion: Historically, $KMnO_4$ has been used as an abortifacient, for treating gonorrhea and some skin conditions such as candidiasis. Chronic Mn exposure from certain types of welding has been implicated in a Parkinson-type syndrome. In this case, neither mother nor child developed any adverse sequelae from the $KMnO_4$. Chelation with IV EDTA has been used to treat elevated Mn levels. In these cases, it had minimal effects on the Mn levels.

Conclusion: Mn levels returned to normal within one year and neither mother nor child became symptomatic.

Keywords: Manganese, Potassium permanganate, EDTA

291. Online Social Networking and United States Poison Control Centers: The utilization of Facebook as a means of information distribution

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Objective: For over 20 years, the 57 US Poison Control Centers (PCCs) have been providing free, comprehensive medical advice via their telephone help line. Since 2004, there has been an explosion in the use of social networking sites, particularly Facebook (FB), which cites more than a billion monthly active users as of December 2012. PCCs have been operating FB pages since 2008 to provide users with information. To date, no study has examined the FB activity of PCCs. This study describes the utilization of FB by PCCs and the volume of activity of their online users.

Methods: The study took place over a two week period in December 2012–January 2013. Our study sample was compiled from a manual FB search of PCC pages. The sample was then described in terms of FB page start date, number of followers, and number of posts for the year 2012. Posts were categorized by general toxicological subject: childhood safety, drugs of abuse, general overdose, environmental poisonings, general public education, and promotional activities. Additional information about each post including number of comments, likes, and shares was collected to quantify the activity of online users.

Results: We identified 29 active (at least one post in 2012) and 10 inactive (no posts in 2012) FB pages from among 57 PCCs. The earliest page was created on September 22, 2008. The number of followers of active FB pages ranged from 40 to 2,456 (mean 387, SD 523), and 2 to 322 for inactive pages (mean 65, SD 107). In 2012, a total of 2,298 posts were created. Posts concerned childhood safety (10%), drugs of abuse (7%), environmental poisonings (5%), general overdose (0.5%), general education (44%), and

promotional activities (33%). Individual posts by PCCs garnered an average of 42 comments, 166 likes, and 49 shares from online users.

Conclusions: Online social networking sites such as Facebook have created a medium through which individuals and organizations can readily publish information and obtain followers. US PCCs may be able to use FB as a primary resource for poisoning information and as a point of intervention to reach out to the public.

Keywords: Social networking, Facebook, Poison Control Centers

292. The toxicity and clinical outcomes of paliperidone exposures reported to U.S. poison centers

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Background: Paliperidone ER (Invega®) is an atypical antipsychotic that was approved in the U.S. in 2006. Based on several case reports, overdosed patients may experience tachycardia, altered mental status and dystonias. Serious toxicity or deaths have yet to be reported. The objective of this study was to evaluate the toxicity of paliperidone exposures using a single national poison center database.

Methods: A retrospective review was performed for all confirmed single substance paliperidone exposure cases followed to a known outcome reported to the National Poison Data System from January 2007 to June 2012. Cases were evaluated for demographics, reason for exposure, related clinical effects, treatments, disposition, and coded medical outcomes. The relationship between dose and severity of medical outcome was performed for acute exposure cases.

Results: There were 802 single substance paliperidone cases that met inclusion criteria. The age break down was: 593 adults/teens greater than 12 years of age, 67 children 6 to 12 years, 140 children less than 6 years, and 2 unknown ages. The most frequent reason for exposure was suicide attempt (39.5%), followed by unintentional general (21.1%), therapeutic error (15.0%), and adverse drug reaction (11.8%). The most commonly observed clinical effects were drowsiness/lethargy (28.7%), tachycardia (23.3%), and dystonia (14.1%). In 18.1% of the cases, a single dose of charcoal was administered. Treatments included antihistamines (14.8%) and benzodiazepines (6.6%). Dispositions were: 40.3% treated/released from the emergency department, 15.2% admitted to critical care unit, 14.8% admitted to non-critical care, 14.5% managed at a non-health care facility, 12.6% admitted to psychiatry, and 2.6% left against medical advice or refused referral. Coded medical outcomes were: no effect (35.0%), moderate (33.2%), minor (30.5%), and major effect (1.2%). There were no deaths.

Of 493 acute exposures, dose was coded for 366 (74.2%) cases. There was no difference observed in the median dose among the medical outcomes in the adults/teens ($n = 246$) or children 6–12 years ($n = 29$) ($p > 0.05$). In children less than 6 years ($n = 91$), there was a significant difference in the median dose between the moderate outcome cases (12 mg) and those with no effect (6 mg) ($p < 0.05$).

Conclusions: The majority of patients experienced minor toxicity and did not require medical admission. However, a third of patients developed moderate or major toxicity and were admitted for medical care. Although a higher dose has led to the development of more serious toxicity in children less than 6 years, the data did not provide clear-cut triage guidelines.

Keywords: Antipsychotic, Overdose, Ingestion

293. Retrospective evaluation of lurasidone ingestions reported to the national poison data system

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Background: Lurasidone, an atypical antipsychotic for schizophrenia, was approved by the Food and Drug Administration on October 28, 2010. Lurasidone is an antagonist with high affinity at the D2, 5-HT2A, and 5-HT7 receptors. It also has moderate affinity at human α2C adrenergic receptors and is an antagonist at the α2A adrenergic receptors. Lurasidone is also a partial agonist with moderate to high affinity at 5-HT1A receptors. Lurasidone has little or no affinity for histamine H1 and muscarinic M1 receptors. A review of the literature reveals no published case reports or studies on the toxicity of lurasidone since its approval. Given this lack of clinical information, our goal was to characterize isolated exposures to lurasidone.

Methods: Utilizing the National Poison Data System, a retrospective data collection of all single substance ingestions of lurasidone was gathered from October 28, 2010 to October 8, 2012. Inclusion criteria consisted of single substance ingestions of lurasidone in humans of all ages with a known outcome. Exclusion criteria consisted only of multiple substances ingested, and unknown outcomes. Data collected included age, gender, reason for exposure, clinical effects, outcome and therapies that were recommended and/or performed specifically including intubation.

Results: The first exposure was reported on March 23, 2011, and through October 8, 2012 there were a total of 128 exposures. Out of the 128 cases, 24% were 19 years of age or under. 61% were female and 39% were male. 64% of the 128 ingestions were intentional, 27% were unintentional, and 9% were reported as an adverse drug effect. Outcomes included 53 cases with no effect, 46 with minor effect, 27 with moderate effect, and 2 with major effect. No deaths were reported. Clinical effects seen in major outcome cases included coma, hypotension, respiratory depression, and "other." Two patients required intubation; one moderate effect that experienced respiratory depression and one major effect. Other reported effects that were coded as related to ingestion were drowsiness/lethargy (31), tachycardia (16), hypotension (7), respiratory depression (2), dystonia (6), muscle rigidity (2), vomiting (6), nausea (5), and confusion (3).

Conclusions: It appears that in overdose the majority of lurasidone exposures resulted in either no effect or minor effects. Most commonly patients experienced drowsiness/lethargy which is consistent with lurasidone's mechanism of action. More data will need to be collected to further characterize lurasidone exposures but from this data lurasidone overdose appears benign.

Keywords: Antipsychotic, Poison center, Overdose

294. The use of dexmedetomidine for sedation in patients with toxicological events

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Background: Dexmedetomidine (DEX) is a selective α2-adrenergic receptor agonist approved for continuous infusion sedation of mechanically ventilated patients. DEX use in patients admitted secondary to toxicological sequelae has not been well established. The primary objective of this study was to evaluate the safety of sedation with DEX in poisoned patients.
Methods: An institutional review board approved retrospective medical chart review of poisoned patients treated at an academic medical center between January 2008 and August 2012 was conducted. Patients were identified through the poison center database. Primary evaluation assessed incidence of adverse effects (ADEs) including bradycardia, hypotension, and seizures. Additional outcomes: target Richmond Agitation Scale Score (RASS), duration of sedation, and concomitant sedative, analgesic and vasopressor requirements.
Results: A total of 22 patients were included. Fifteen patients (68%) had known agents of ingestion/exposure. The median initial and average DEX infusion rates were 0.2 mcg/kg/hour and 0.51 mcg/kg/hour, respectively. The median duration of therapy was 44 hours. Overall, the median average heart rate (HR) was lower during vs. prior to DEX initiation (83 beats/minute vs. 96 beats/minute, $p < 0.05$). One patient experienced significant bradycardia (HR of 98 vs. 57 beats/minute before vs. during DEX therapy, respectively). The overall median average systolic blood pressure before and during DEX use was similar (118 mmHg vs. 112 mmHg, $p = 0.94$). Patients were within target RASS at a median of 6 hours. Seventeen patients (77%) had concomitant use of other sedatives and/or analgesia. In 3 of the 17 patients, concomitant use of sedatives and/or analgesia occurred after DEX therapy was initiated possibly indicating the need for deeper sedation. Seven patients (32%) had concomitant vasopressor support. In 3 of the 7 patients, vasopressor support was initiated prior to DEX therapy. The known agents of ingestion could have warranted the need for vasopressor support. In 4 of the 7 patients, however, vasopressor support was initiated during DEX therapy. Two of these patients had ingestions unlikely to cause hypotension indicating possible hemodynamic compromise, while one was unknown and one may have been impacted by the ingested agent.
Conclusions: Observed ADEs of DEX were consistent with those previously described in the literature. The requirement for vasopressor support in patients with ingestions unlikely to cause hypotension warrants further investigation into the safety of DEX in poisoned patients. Larger, comparative studies need to be performed before use can be recommended in this population.
Keywords: Dexmedetomidine, Overdose, Sedation

295. Bint al dahab: Still a threat to children in Oman

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Background: Bint al dahab is a traditional remedy that contains 90% lead oxide. One study of 25 Omani infants with acute lead encephalopathy showed significant association with the use of bint al dahab. We report the first case series of lead poisoning related to such use in Oman.
Cases Presentations: Case One: an 8 months old male with congenital heart disease (CHD), microcephaly, hypotonia, failure to thrive and developmental delay was found to have radio-dense lines in the intestine on abdominal x-ray. X-rays of the knees showed dense metaphyseal bands in the distal femur and proximal tibia and fibula. The mother admitted giving the baby bint al dahab mixed with honey orally for 2 months. Lead level was 83.88 mcg/dL (reference range < 10 mcg/dL), and blood smear examination showed coarse basophilic stippling. The child was treated with locally available British Anti Lewisite (BAL) and discharged after the lead level decreased below the reference range. Case Two: A 9 months old male with CHD, duodenal atresia and failure to thrive was admitted to the intensive care unit with recurrent seizures, encephalopathy, elevated intracranial pressure and hemodynamic instability requiring intubation and inotropic support. Radiographic evaluation revealed dense metaphyseal bands in the distal radius and ulna, raising the possibility of lead poisoning. The mother admitted administering bint al dahab with honey to her child over the preceding month. The blood lead level was 167 mcg/dL. The child was treated with BAL, with dramatic improvement in his clinical condition. Repeated lead levels decreased over the following months to below the reference range. Case Three: An 8 weeks old female was admitted with excessive crying, repeated vomiting and poor feeding. Her evaluation revealed normochromic normocytic anemia with basophilic stippling, elevated liver transaminases, with radio-opaque lines in the cecum and blood lead level of 82.4 mcg/dL. Further history revealed the use of bint al dahab in her diet to treat chronic constipation. She was treated with BAL and her clinical condition improved.
Discussion: Despite the well-documented lead toxicity associated with the use of bint al dahab in children, serious toxicity is still occurring as we report in these 3 recent cases.
Conclusion: This highlights the urgent need for toxicologists and public health professionals to increase public awareness of this risk and advocate for legislation that bans its sale in Oman. Additional studies that characterize its pattern of use and geographic distribution will be needed to better target future interventions.
Keywords: Lead, Ingestion, Pediatric

296. Fake Xanax in the United States

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Background: Various drugs are seized by law enforcement in the United States and are often sent to laboratories for testing. Adulterants are sometimes found in these drugs. The identity of the adulterants is poorly reported. The purpose of this study is to

identify the adulterants present in drug samples that are supposed to be Xanax (alprazolam).

Methods: Drugs labeled as Xanax but found to have either other drugs or a combination of alprazolam and other drugs in a law enforcement laboratory from Oct. 2008 to Feb. 2012 were identified. Gas chromatography-mass spectrometry analysis was used in testing the tablets. The types and frequency of the adulterants used to form fake Xanax was determined.

Results: There were 32 fake alprazolam tablets. These tablets consisted of diazepam & phenazepam (n = 10); alprazolam & phenazepam (n = 7); diazepam (n = 7); phenazepam (n = 2); alprazolam & diazepam (n = 2); bromazepam & ketamine (n = 1); alprazolam, diazepam & phenazepam (n = 1); and melatonin (n = 1). Of these tablets, 97% contained a benzodiazepine, 94% contained a long-acting benzodiazepine, 34% contained only one drug, 31% contained alprazolam with another drug, and 6% contained non-benzodiazepine drugs.

Conclusion: Fake Xanax tablets do exist in the United States. Most of them contain long-acting benzodiazepines. The health impact of the common substitution of a long acting benzodiazepine for alprazolam is not known and should be addressed.

Keywords: Alprazolam, Benzodiazepine, Adulterant

297. Turning the ICU into a HAZMAT incident-communication breakdown on a toxic patient

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Background: Zinc phosphide (Zn_3P_2) rodenticide is a readily available toxin. It reacts with water to form phosphine gas (PH_3). While Zn_3P_2 ingestions are rare, they can pose a significant health risk to both patients and staff. This report highlights the aspects of this case that went well with discussion of key points from the after event action plan.

Case report: A 28-year-old male with a history of seizures, substance abuse, and mental illness presented to the hospital after ingesting an unknown amount of Zn_3P_2. In the emergency department, the patient was hemodynamically stable and there was no reported odor. The patient was intubated for airway protection. Lavage returned 200 mL of a white substance and whole bowel irrigation was started with all waste being double bagged. A rectal tube was inserted. Approximately 18 hours into the admission, staff reported "a strong odor". When self-contained breathing apparatuses (SCBAs) were brought in, the local HAZMAT team placed phosphine sensors. The patient was moved to a negative pressure room. One of the sensors detected a level above the short-term exposure limit (STEL). Laboratory work repeated 30 hours after presentation showed a drop in hemoglobin from 11.2 to 8.2 gm/dL, platelets dropped from 296 to 148×10^6/mL. There was no change in renal function, liver function, or acid/base status. Methemoglobin was 0.6%. The patient was subsequently transfused. The patient had transient pulmonary complications without an obvious pneumonia. The remainder of the care was uneventful. He was discharged to psychiatric care on hospital day 11.

Discussion: Although the Poison Control Center advised the treating physician of the potential hazardous nature of the rectal effluent and flatus with recommendations for a negative pressure room, this information was lost in the admissions process. Consequently the patient went to a normal ICU room resulting in subsequent closure of the ICU on a Monday morning while the patient was relocated to a negative pressure room. It was also discovered that the detector was not properly located.

Conclusion: Patients who have ingested phosphide compounds may off-gas phosphine which can create hazards for the staff. While decontamination is important, staff need protective measures including SCBAs and negative pressure isolation. Appropriate sensor placement is also needed for accurate level measurement. This case highlights the importance of communication with complex cases.

Keywords: Environmental, Ingestion, Decontamination

298. PGI Score: A simple prognostic model for predicting mortality in aluminium phosphide poisoning

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Background: Aluminium Phosphide poisoning is an important cause of morbidity and mortality in India. We propose a 3 point model for predicting mortality in patients with severe aluminium phosphide poisoning.

Methods: A prospective study including all patients with aluminium phosphide poisoning was carried out in the medical emergency attached to Nehru Hospital at our centre from June 2010 till December 2011. At admission, heart rate, blood pressure, blood sugar, electrocardiogram, blood gases, liver functions, renal functions were recorded and all the patients was followed up till discharge or death. Primary outcome was mortality. Parametric variables like blood pressure, pulse rate, heart rate was analyzed by student's t test. For categorical data like mortality, relative risk of death was calculated with 95% confidence intervals ,with chi square test. Further correlation was carried out by univariate, multivariate and multiple logistic regression analysis.

Results: A total of 105 patients were enrolled during the study period. 62% were males and 78% patients were in the age group 15–35 years. The mean dose consumed was 3.6 grams. Mortality was 51%. Important parameters, after multivariate analysis, correlating with mortality were Blood pH < 7.2, Systolic blood pressure < 90, and Glasgow coma scale < 13. On multivariate regression, none of these parameters were independently associated with mortality. The odds ratio for predicting mortality was 12.614 for pH < 7.2, 17.600 for SBP < 90 mmHg, and 18.621 for GCS < 13. The Area under the ROC curve for SBP < 90 was 1.552, for GCS < 13 was 1.591 and for pH < 7.2 was 1.615. A score of 1 each was assigned to SBP < 90 and pH < 7.2 and GCS < 13. When applied to the study group it was noticed that 100% with score of 0 survived and 96.4% with a score of 3 died. The survival with score of 1 was 85% and for a score of 2 was 61%.

Conclusion: pH < 7.2, Systolic blood pressure < 90, and Glasgow coma scale < 13 are important predictors of poor outcome in patients with severe aluminium phosphide poisoning and a scoring system based on these parameters is a useful adjunct in assessing severity of poisoning.

Keywords: Pesticide, Overdose, Acidosis

299. Pet poisonings involving new, EPA-approved bromethalin rodenticides: Implications for pets and humans

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Background: Recent Environmental Protection Agency (EPA) action to ban long acting anticoagulant consumer rodenticides has resulted in proliferation of rodenticides containing the neurotoxin bromethalin (BR). Given the increased penetration into the consumer market, limited toxicological and clinical data, and conspicuous lack of an antidote, BR exposures can pose serious risk to both pets and humans. Although use of bait stations as a mitigation strategy is also a new EPA requirement, the pet poison center has documented serious BR pet poisonings. The objective of this prospective study was to determine the relative rate and trends of pet exposure to BR, details of exposure, dose ingested, frequency of referral to a health care facility, and outcome.
Methods: A prospective study of pet exposures to BR managed by this center from Oct. 2012–Feb. 2013 were documented in a computerized database and followed via telephone until case closure (confirmed asymptomatic, resolution of clinical signs or expected permanency, or lost to follow-up). Cases involving co-ingestions were excluded. From the same database, the total numbers of bromethalin exposures from 2012 were compared with 2011.
Results: A 33% increase in BR exposures was documented between 2011 and 2012. Of the 244 BR exposures in this prospective study, 67% (n = 164) were to the new EPA compliant BR products (bromethalin, 0.01%). Of these, 45% (n = 74) were related to intentional product misuse (e.g., placement of loose/unprotected bait blocks outside of bait stations). In these cases, the dose ingested ranged from 3–60 grams of finished bait and necessitated an emergency room (ER) referral for 33% (n = 22) of patients. Unintentional exposure to these same products accounted for 55% (n = 90) of exposures and involved scenarios such as dogs chewing through the lightweight, non-child resistant exterior packaging of refill bags (holding up to 1 lb of loose blocks) or chewing through bait stations. For this subcategory of exposures, the dose ranged from 4–18 oz of bait with an ER referral of 48% (n = 43) of patients. With appropriate intensive medical care, the outcome for these 164 exposures was good with 90% (n = 148) remaining asymptomatic; 1 major outcome and 1 death occurred.
Conclusions: Pet exposure to BR appears to be increasing in spite of EPA's risk mitigation measures. Given the risk for severe neurotoxicity and the lack of an antidote, health care providers should be aware of increasing consumer use and misuse of BR resulting in exposure and poisoning in pets. Given the established use of pets as sentinels for human exposure, these findings have implications for risks to children and other vulnerable human populations.
Keywords: Veterinary, Bromethalin, Rodenticide

300. Development of a tool to assist in management of overdoses involving modified-release forms

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Background: A modified-release dosage form (MRDF) is a drug in which the release characteristics have been modified for a specific time course or location in the gastrointestinal (GI) tract for release of the drug. This modified-release technology may offer therapeutic advantages over immediate-release dosage forms of the same drug. However these MRDF can pose challenges following overdoses regarding management decisions. Standard drug and poison information databases usually provide monographs on drugs without specific information on various MRDF brands available. Several medications, such as bupropion and verapamil, are available in multiple different MRDFs with differing release characteristics. Recognition of specific MRDF pharmacokinetics, such as rate of release and time to peak concentrations for specific products would be useful in management of the overdose patient for consideration of potential GI decontamination and observation criteria.
Methods: Common medications available in MRDF were reviewed in Poisindex. Brand specific information on MRDFs was collected from package inserts or manufacturer's websites. Proprietary modified release technology of various brands was reviewed to determine basic release characteristics associated with the specific technology.
Results: Poisindex provided limited information on MRDF and was not brand specific. General statements regarding "delayed release" products were included, but were not brand specific or detailed. All information on MRDF release characteristics was obtained from the manufacturer on either their website or in the package insert. A list was prepared of all available forms of modified release technology and a table was developed from this information that listed the brand name of the product, type of release technology, designed rate of release, and expected time to peak concentration for over 100 medications. This table has been used for several years by our poison center for decisions related to gastric decontamination and observation criteria.
Conclusion: Specific information on MRDF pharmacokinetics, not only drug pharmacokinetics, is important in the management for patients with an overdose of a MRDF medication. This information is frequently lacking in traditional databases, is usually only available from manufacturer resources such as package inserts, and is time-consuming to collect in times of emergency. Use of this brand specific table has been useful for poison center staff and toxicologists regarding management decisions for overdoses of these medications.
Keywords: Poison center, Pharmacokinetics, Decontamination

301. Syndromic surveillance for acute radiation syndrome using the National Poison Data System: findings over a one-year period

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Background: Since 2010, the Centers for Disease Control and Prevention (CDC) and the American Association of Poison Control Centers (AAPCC) have conducted radiation and radiological material exposure national surveillance using the National Poison

Data System (NPDS). Part of this effort included the creation of the acute radiation syndrome (ARS) case definition to detect cases with reported clinical effects mimicking ARS. This definition scans NPDS coded case fields and triggers an anomaly when inclusion and exclusion criteria are met. Since NPDS radiation exposure cases are rare, cases are also tracked for exposure to substances with radiomimetic effects (i.e. capable of producing biological effects similar to radiation exposure such as cellular destruction and chromosomal damage) such as alkylating agents, antimetabolites, and microtubule inhibitors.

Objective: Describe the findings of NPDS case-based surveillance for signs and symptoms of ARS during a one year period.

Methods: We queried NPDS for all ARS case definition anomalies between March 2012–March 2013. Each case was analyzed by one of the authors to determine if radiation or radioactive material exposure occurred. Demographic information was collected. All exposure substances were evaluated to determine if any are considered radiomimetic. Clinical effects and medical outcomes were recorded. Descriptive statistics were used to analyze the data.

Results: One hundred forty-six anomalies were detected. Median patient age was 48 years (range 2–89 years) and 51% were female. One hundred thirty-three cases had at least one known substance of exposure; 13 had unknown substances of exposure. The median number of substances was 2 per case (range 1–11). Eleven out of 146 (7.5%) detected cases involved radiomimetic agents; cisplatin (N = 1), colchicine (N = 4), and methotrexate (N = 6). Among cases involving radiomimetics, 100% (11/11) had cytopenia, 72% (8/11) had GI effects (vomiting, diarrhea, nausea, or abdominal pain), and 63% (7/11) had CNS effects (confusion or coma). Medical outcomes in these cases included 5 deaths, 3 major, and 3 moderate. No cases were reported to involve radiation or radioactive material exposure.

Conclusions: Over a one-year period, 7.5% (11/146) of NPDS anomalies detected by the ARS case definition involved radiomimetic substances. While none of the cases were ultimately thought to be due to true radiation exposures, detection of exposures that cause radiomimetic effects shows that syndromic surveillance of this type may be used to identify cases of possible ARS.

Keywords: Radiation, Surveillance, Public health

302. Hydroxychloroquine and cardiotoxicity: A retrospective review of regional poison center data

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Background: Hydroxychloroquine is a 4-aminoquinolone derivative that is closely related to chloroquine. The medical literature covering hydroxychloroquine overdoses is sparse and primarily confined to case reports. As a result, a majority of regional poison center (RPC) recommendations regarding toxicity, clinical manifestations, and treatment are extrapolated from the experience with chloroquine. The aim of this study is to characterize the degree of cardiotoxicity associated with hydroxychloroquine exposure.

Methods: Utilizing Crystal Reports (Version 11.0), all hydroxycholorquine cases reported to our RPC were retrospectively queried over a five-year period (2008–2012). In addition to demographic data (age, sex, intentional versus accidental), electrocardiographic results (QRS and QTc intervals) were reported.

Results: A total of 95 cases were reported. The mean age was 31.2 years (range 1–91 years old). Two-thirds were greater than six years old. Two-thirds were female. One fifth of the ingestions were intentional. Half of the patients (48/95) were managed at home. Among the patients being treated in a health care facility (HCF), 30 (64%) had confirmed electrocardiograms. Of these 30 patients, 10 (33.3%) had abnormal electrocardiographic intervals (QRS > 100 msec or QTc > 450 msec). QRS duration ranged from 66–118 msec with 6 patients having a QRS duration > 100 msec. QTc duration ranged from 388–644. Eight patients had a QTc duration greater than 450 msec and four greater than 500 msec. No patient experienced a dysrhythmia, torsades de pointe, or death.

Conclusions: Fifty percent of the hydroxychloroquine exposures reported to our RPC were managed without referral to a HCF. While there were a significant number of patients with electrocardiographic abnormalities, no life threatening dysrhythmia or death resulted. QTc interval lengthening was more frequent and significant than the subset of patients with increases in QRS duration. These data are limited in several ways. Reporting bias, missing data in RPC records, and patients lost to follow-up in this retrospective study make definitive conclusions problematic. However, further study defining the frequency of morbidity associated with hydroxycholoquine may improve RPCs management of and referral thresholds for this patient population.

Keywords: Antimalarial, Cardiac toxicity, Electrocardiogram

303. A comparison of DAWN and NPDS data for opioid use

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Background: The Drug Abuse Warning Network (DAWN) is a public health surveillance system that monitors drug related emergency department (ED) visits. Information is derived from a representative sample of hospitals in the United States and used to estimate the total number of drug related ED visits in the nation. The National Poison Data System (NPDS) is a comprehensive poisoning exposure surveillance database derived from cases managed by the 57 US poison centers. DAWN estimates are retrospective in nature and are usually available about two years after the

Table. Results for abstract number 303.

	2004	2005	2006	2007	2008	2009	2010
NPDS	39,539	42,037	44,735	51,086	55,830	59,086	60,739
DAWN+NPDS	184,189	210,416	246,015	288,325	361,721	402,069	420,660
Ratio	0.215	0.200	0.182	0.177	0.154	0.147	0.144

completion of the calendar year. In contrast, NPDS data is available for near real time searches and reports.

Objectives: To compare the number of opioid-related cases reported by the NPDS to the estimated number of opioid-related ED visits reported by DAWN. To determine whether NPDS data can be used as a tool to predict DAWN ED visits prior their publication.

Methods: The number of poison center cases related to opioids from health care facilities was retrieved from NDPS for the years 2004–2010. The DAWN data for the estimated number of ED visits related to opioids was obtained for 2004–2010. A proportion was calculated for each year of NPDS cases divided by the number of DAWN estimated ED visits plus NPDS cases.

Results: This proportion ranged from 0.144 to 0.215. There was a consistent decrease in the proportion each year. Repeat measures ANOVA test showed there was a statistically significant difference between the proportions each year ($p < 0.001$). The percentage of NPDS cases to DAWN ED visits was the highest for tramadol (56.0%) and codeine (48.8%). The percentage of NPDS cases to DAWN ED visits was the lowest for morphine (9.0%) and methadone (6.8%) This study suggests that the proportion of NPDS cases to DAWN estimated ED visits can not be used to predict the upcoming DAWN estimates prior to their release.

Conclusions: The number of NPDS cases related to opioids cannot be used to predict the DAWN reported ED visits. There has been a consistent decrease in NPDS cases related to opioids and a consistent increase in DAWN reported ED visits for opioids. The constant decrease in NPDS cases compared with the constant increase in DAWN reported ED visits for opioids suggests that ED providers are becoming more accustomed to managing these exposures and calling poison centers less often.

Keywords: Opioid, National Poison Data System, Epidemiology

304. Collection of pesticide environmental protection agency registration numbers by poison centers

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Background: The Environmental Protection Agency (EPA) has noted that poison center pesticide data would be more useful if poison centers could collect EPA registration numbers (EPA#s) on pesticide calls. As a result, a 1-year pilot project was created to determine the feasibility of poison centers collecting these numbers. This study describes the process 4 poison centers used to collect EPA#s and the result of their effort.

Methods: In December 2010, 1 poison center created in the data collection software a pop-up window that would prompt poison center agents to collect EPA#s. The pop-up window would appear whenever any substance was assigned any of 40 Generic codes for pesticides. This would occur for both exposure and information calls. If the pop-up window appeared, an entry that it had done so was automatically added to the record notes. The poison center agent was to ask the caller if the pesticide container was available. If so, the caller then was directed to try to find the EPA# and read it to the agent. The agent would then enter the EPA# in the record notes. The agent also might record the circumstances why an EPA# could not be obtained, although this action was not standardized. The process was tested at the poison center beginning in January 2011 and then extended to the other 3 poison centers in July 2011. Although the pilot was intended to run through 2011, the pop-up window was not disabled. To evaluate the effectiveness of this process, the record notes for the 4 poison centers during 2011–2012 were reviewed to identify those indicating that the pop-up window had been triggered. The subset of these records that also included the phrase "EPA" were identified. These records then were reviewed one at a time for mention of an EPA#. The rate of those records where the pop-up window was triggered that also had an EPA# recorded was determined for all records and, for exposure calls, selected variables.

Results: Of 1,604 total records where the pop-up window was noted, 27% had an EPA# recorded. Of 1,202 exposure records where the pop-up window was noted, 32% had an EPA#. An EPA# was found for 32% of insecticide, 28% of herbicide, and 59% of miscellaneous pesticide exposures. The rate by exposure site was 33% at the patient's own residence, 41% another residence, and 14% workplace. An EPA# was found for 34% of patients managed on site, 24% already at/en route to a healthcare facility, and 14% referred to a healthcare facility. 33% of not serious and 9% of serious outcomes had EPA#s.

Conclusion: It is possible for poison centers to collect pesticide EPA#s; however, the numbers will be found in only a fraction of the calls. The ability to obtain EPA#s may depend on the characteristics of the exposure.

Keywords: Pesticide, Poison center, Documentation

305. Comparison of rural and urban prescription opioid analgesic abuse

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Background: Prescription opioid analgesic abuse is increasing in the US. Opioid abuse rates can vary between and within states. This study compares prescription opioid analgesic abuse between rural and urban counties within a single state.

Methods: Cases were all intentional abuse and misuse exposures to prescription opioid analgesics reported to a statewide poison center system during 2000–2011 where the caller county was known. Exposures involving other substances in additional to the opioid and those not followed to a final medical outcome were included. Each county in the state was designated as rural or urban based on United States Office of Management and Budget definitions of metropolitan and non-metropolitan. The exposures were grouped into those originating from rural counties and urban counties. The distribution of exposures was determined for selected factors and comparisons made between the two groups.

Results: There were 1,374 rural and 8,028 urban cases of prescription opioid analgesic abuse with rates per 100,000 population of 3.8 and 3.3, respectively. The rural rate increased 166% over the 12-year period while the urban rate increased 95%. The rates

between the 2 areas were similar during 2000–2007, then the rural rate began to increase faster than the urban rate. The most frequently reported opioids in rural counties were hydrocodone (58%), tramadol (11%), propoxyphene (9%), methadone (7%), oxycodone (7%), and codeine (6%); the most frequently reported opioids in urban counties were hydrocodone (60%), tramadol (9%), codeine (7%), propoxyphene (7%), oxycodone (7%), and methadone (6%). The patient was 20 years or older in 81% of rural and 80% of urban cases. Males accounted for 51% of rural and 52% of urban cases. The management site for rural and urban cases, respectively, were already at or en route to a healthcare facility (67% vs 57%), referred to a healthcare facility (17% vs 22%), and managed on site (16% vs 20%). Not serious outcomes (no effect, minor effect, not followed-judged nontoxic, not followed-minimal effects possible) were reported in 59% of rural and 56% of urban cases; serious outcomes (moderate effect, major effect, death, unable to follow-potentially toxic) were reported in 39% of rural and 43% of urban cases.

Conclusion: Prescription opioid analgesic abuse increased faster in rural counties than urban counties. Although the same 6 drugs were the most common opioids reported in rural and urban counties, their order differed between the areas. Urbanization status did not appear to be related to patient demographics. However, a higher proportion of rural patients were already at or en route to a healthcare facility, and urban abuse was slightly more likely to result in serious outcomes.

Keywords: Poison center, Opioid, Urbanization status

306. Analysis of opioid prescribing in a single health care system from 2006–2010: prescribing patterns in the U.S. military

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Background: The rise in opioid related deaths may be due to increased opioid misuse and to increased provider prescribing. There are no published data on prescribing by military providers. The military has a closed healthcare network and may be an optimal system to evaluate opioid prescribing patterns.

Objective: To describe the opioid prescribing patterns in the military from 2006–2010.

Methods: Prescription data was extracted under an IRB protocol from the Department of Defense's (DoD) Pharmacy Transaction Data Service. Adult Tricare beneficiaries who received an opioid prescription in the ambulatory care setting from year 2006–2010 were included. Both direct and purchased care were included. We evaluated the following clinics: dental care, emergency medicine, general surgery, internal medicine, orthopedic clinic, and primary care. A Chi square test-of-trends was performed and an alpha of 0.05 was significant.

Results: In 2006, 4,452,167 opioid prescriptions were filled, of these, 1,284,388 were written in primary care, ED, surgical, orthopedic, or dental clinics. Over 5 yrs, oxycodone prescriptions increased per patient ($p = 0.009$) as did the length of oxycodone and hydrocodone prescriptions per patient (both $p = 0.01$); however, there was a significant decrease in prescription days for codeine. From 2006–2010, the number of prescriptions per patient increased in the orthopedic ($p = 0.05$) and primary care clinics ($p = 0.005$). The duration of opioid prescriptions decreased for patients in dental clinics ($p = 0.001$), emergency departments ($p = 0.007$), general surgery ($p = 0.013$), and orthopedic clinics ($p = 0.004$). The prescriptions per patient increased among males ($p = 0.02$) and prescription duration increased among males and females (both $p = 0.01$). Patients 25–34 years old ($p = 0.005$) and 35–44 ($p = 0.02$) had an increase in prescriptions per patient. The duration of prescriptions decreased for those ages 18–24 ($p = 0.002$) and 25–34 years ($p = 0.01$) whereas the prescription duration increased for those 35–44 ($p = 0.03$) and 45–64 years ($p = 0.04$). Opioid prescriptions increased for active duty/guard ($p = 0.01$), and their dependents ($p = 0.02$) but the duration of opioid prescriptions decreased for these same groups.

Conclusion: From 2006–2010, more oxycodone prescriptions were issued and the duration of prescriptions for oxycodone and hydrocodone increased. Specifically, more opioid prescriptions per patient were written for in primary care and orthopedic clinics. Patients $<$ 35 years-old received more prescriptions per patient and those $>$ 35 years received prescriptions of longer duration. The prescriptions per patient increased.

Keywords: Opioid, Abuse, Adverse drug event

307. A comparison of opioid overdoses to non-opioid overdoses treated in a emergency department 2009–2012 – complications and health care resources consumed

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Background: Opioid overdoses (OD) are the leading cause of unintentional death in the US, and visits to civilian emergency departments (ED) for opioid ODs have increased over the last 10 years. Military veterans also have increased opioid OD; however, complications and health care resources consumed for opioid overdoses treated in military EDs as compared to non-opioid ODs have not been reported.

Methods: We performed a retrospective cohort study on cases evaluated in one military hospital ED from 2009–2012. The military hospital is a tertiary referral center and Level 1 trauma center with an annual volume of 75,000 pts/yr. Using a search of the ICD-9 codes, we obtained records of patients that were coded with an overdose, suicide attempt, substance abuse, opioid use, intent of self-harm, and poisoning. The study cohort was then divided and analyzed as opioid related overdoses vs. non-opioid. Variables included demographics, military service, method of arrival, vital signs, clinical complications, hospital admission, naloxone use, and drug ingested. One trained abstractor abstracted each chart and used a standard data collection form. Periodic training was performed, and 10% of cases were reviewed by a second author for accuracy.

Results: Over 3 yrs, 342 visits to the ED were related to an OD, and the number of ODs increased each year. The average age was 35 years (SD ± 19), 46% were male, 47% were active duty, 33% were dependents of military member, 13% were retired, 80% had Army affiliations, and 93% were enlisted. 46% arrived by ambulance, 61% were admitted to the hospital or other treatment facility, and 39% were ICU admissions. Of the OD-related ED visits, 18% (n = 62) were opioid OD's and were more likely to arrive by ambulance (56 vs. 40%, $p < 0.02$), be admitted to the ICU (48 vs. 37%, $p = 0.03$), and receive naloxone (18 vs. < 1%, $p < 0.0001$). The was no difference between opioid and non-opioid OD's in regard to gender, age, military status, military affiliation, clinical complications (hypoxia, hypotension, dysrhythmia, CPR, intubation), or alcohol use. Hospital length of stay was greater in the opioid group (3.1 vs. 1.8 days, $p = 0.045$). Non-Opioid OD's are more likely to have a history of a behavioral disorder (54% vs. 84%, $p < 0.01$). Conversely having a history of a medical condition (to include pain) was associated with an opioid-related overdose.
Conclusions: Opioid ODs comprised 18% of all ODs treated in a military ED and were more likely to arrive by ambulance, be admitted to the ICU, and have a longer hospital stay. Opioid ODs consumed greater hospital resources than non-opioid overdoses.
Keywords: Opioid, Overdose, Adverse drug event

308. Screening emergency department patients for opioid misuse using the SOAPP®-R instrument compared to provider clinical judgment

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Study objective: To date no published study has evaluated the efficacy of an objective tool emergency medicine providers (EMPs) can use to assess which patients may be at risk for prescription opioid misuse. We sought to compare EMP clinical judgment to a validated instrument, the Screener and Opioid Assessment for Patients with Pain-Revised (SOAPP-R), to identify patients who may be at risk for prescription opioid misuse.
Methods: We conducted an observational study of patients over age 18 years who sought treatment in the emergency department (ED) of a military tertiary care hospital and received at least one opioid prescription in the 90 days preceding their visit. Subjects completed the SOAPP-R, a validated self-report instrument to measure risk for misuse of prescription opioids (e.g., high vs. low risk). Treating EMPs were blinded to the patient responses and completed a questionnaire to evaluate the risk of opioid misuse among these patients (low, moderate, high). The patients' SOAPP-R responses were compared with the providers' evaluations. Continuous measures were summarized by means (SD), and categorical measures by frequencies (%). To compare the results of the clinicians' evaluation to the SOAPP-R, the sensitivity, specificity, positive- and negative predictive values were calculated. All statistical testing was two-sided at a significance level of $\alpha = 0.05$ using SAS 9.3.
Results: Key demographic characteristics of the study group (n = 74) were as follows: mean age = 43 years, males = 49%, Black = 73% female, White = 73% male, and 38% had a college degree or higher. Additionally, the active-duty population in our study was predominately male (60%). Of 70 treating clinicians, 51% were residents, 27% were staff, and 21% were physician assistants. Clinician assessments of misuse were as follows: Low = 76%, Moderate = 8%, and High = 6%. Female providers were more likely to categorize patients as moderate risk than male providers, whereas males were more likely to categorize patients as low risk. Age was found to be a significant factor in the clinicians' determination of low/moderate/high risk ($p = 0.02$). The clinician assessment of high/moderate vs. low risk for opioid misuse achieved a high measure for specificity (0.82) when compared to the SOAPP-R.
Conclusion: The clinician assessment is a comparable alternative to the SOAPP-R for measuring the potential for prescription opioid abuse among patients who seek treatment at an ED. Furthermore, age was shown to be a predictor of clinician determination of risk, although male and female providers differed in their categorization (low vs. high) of risk for opioid misuse.
Keywords: Opioid, Abuse, Public health

309. Opioid prescribing patterns in emergency departments in the U.S. military system: An analysis of a single health care system from 2006–2010

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Background: Opioid-related deaths have risen and this may be related to increased opioid misuse and to increased provider prescribing. A concern of opioid related adverse outcomes has been reported in the military; however, there are no published reports on prescribing by military providers. The military has a closed healthcare network and may be an optimal system to evaluate opioid prescribing patterns by emergency physicians (EP).
Objective: To describe the opioid prescribing patterns in military emergency departments (EDs) from 2006–2010.
Methods: In collaboration with the Air Force's Health Informatics Division, prescription data was extracted from the Department of Defense's (DoD) Pharmacy Transaction Data Service and reconciled with ambulatory heath encounter data. Any Tricare beneficiary > 18 years of age who received an opioid prescription in a military ED from 2006 to 2010 was included. These cases included direct care and purchased care. We evaluated differences in trends of the number of prescriptions per patient and in the duration of opioid prescriptions per patient (prescription-days). Prescriptions were evaluated by opioid type and duration of prescription as well as age, gender and military status of the patient. A Chi square test-of-trends was performed and an alpha of 0.05 was considered significant.
Results: In 2006, 4,452,167 opioid prescriptions were filled in the military, of these, 1,284,388 were written in primary care, ED,

surgical, or dental clinics, and of these 149,322 (11% of outpatient prescriptions) were written in the ED. When corrected for individual patient counts, we detected a decrease in the duration of oxycodone and hydrocodone prescriptions per patient ($p = 0.01$, $p = 0.004$, respectively) from 2006–2010. Opioid prescription duration decreased among males ($p = 0.006$) and females ($p = 0.008$). When examined by age, the number of prescriptions per patient increased among those 25–34 years of age ($p = 0.03$). However, the duration of prescriptions decreased among all ages groups; 18–24 ($p = 0.007$), 25–34 ($p = 0.005$), 35–44 ($p = 0.009$), 45–64 ($p = 0.008$), and 65+ ($p = 0.02$). When examined by beneficiary status, the duration of opioid prescriptions decreased across all beneficiary groups: active duty/guard ($p = 0.005$), their dependents ($p = 0.008$), retirees ($p = 0.01$), and dependents/survivors of retirees ($p = 0.008$).

Conclusion: From 2006 to 2010, opioid prescriptions issued in the ED increased for ages 25–34. However in all other age categories and all beneficiary categories, there was a decrease in prescriptions filled. The number of prescription-days decreased in all groups.

Keywords: Opioid, Adverse drug event, Medical toxicology

310. Intentional exposures to opioids reported by health care workers

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Background: The RADARS® System Poison Center (PC) Program collects data on intentional exposures to specific opioid drug classes. A subset and component of the PC Program is the Impaired Health Care Worker (IHCW) Program, which records instances of intentional exposures by those who work in a health care setting. This study examines frequency and rate of opioid exposures in the IHCW Program.

Methods: Trained reviewers read case notes from participating PCs to verify reason for drug exposure and product coding. During this review, each intentional exposure with case notes that indicated the exposed individual was an IHCW was flagged to be included in the IHCW data set. Intentional exposures included cases coded as suspected suicide, misuse, abuse, withdrawal, and intentional unknown. Total intentional exposures of oxycodone, fentanyl, hydrocodone, hydromorphone, morphine, methadone, buprenorphine and tramadol from 1Q08 - 4Q12 were summed for IHCWs and across intentional exposure cases involving individuals age 18 years or older. The proportion of exposures involving IHCWs was calculated for each drug and divided by the total number of adult exposures.

Results: There were 104 intentional exposures involving IHCWs between 2008 and 2012, making up 0.06% of all intentional exposures. As shown in the table below, hydrocodone accounted for the majority of all IHCW exposures. The drug with the highest proportion of exposures was hydromorphone (1.71/1,000 adult exposures), followed by morphine (1.33/1,000 adult exposures) and then fentanyl (0.95/1,000 adult exposures). The drug with the fewest number of IHCW exposures was methadone (0.09/1,000 adult exposures).

Conclusion: Results suggest that health care workers represent less than 0.1% of intentional exposures reported to PCs. The majority of IHCW exposures were for hydrocodone, tramadol, or oxycodone (similar to the non-IHCW population). Drugs with the highest proportion of IHCW exposures were hydromorphone, morphine, and fentanyl. These data are limited due to bias of spontaneous reporting of health care worker status. Health care worker status is not specifically asked for all adult exposures.

Keywords: RADARS® System Poison Center Group, Health care workers, Opioid use

Drug	Number of IHCW exposures	Percent of IHCW exposures	IHCW exposures per 1,000 adult exposures
Hydrocodone	56	53.85%	0.83
Tramadol	12	11.54%	0.47
Oxycodone	12	11.54%	0.31
Morphine	10	9.62%	1.33
Hydromorphone	5	4.81%	1.71
Fentanyl	4	3.85%	0.95
Buprenorphine	4	3.85%	0.79
Methadone	1	0.96%	0.09

311. Intentional exposures to prescription opioids in rural areas of the United States

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Background: Intentional exposures (IEs) to opioids in the US are rising. Studies suggest that abuse is highest in rural areas. This study examines the association between the proportion of individuals residing in rural areas and rates of IEs by 3-digit ZIP code (3DZ) level. We hypothesized that, across 3DZs, there will be a positive association between the percent of individuals residing in rural areas and rates of opioid analgesic IEs.

Methods: Data on IE (suspected suicide, misuse, abuse, intentional unknown, withdrawal) cases from the RADARS® System Poison Center program were used. Case mentions of buprenorphine, fentanyl, hydrocodone, hydromorphone, methadone, morphine, oxycodone, oxymorphone, tapentadol, and tramadol in 2012 were summed by 3DZ. Melissa® Data using US Census definitions were used to calculate the proportion of the population in each 3DZ code living in rural areas, classified as all regions not included in urban areas. For this analysis 3 rates were calculated: Unique recipient of dispensed drug (URDD), a measure of retail availability, was used in 2 of the rates. For each 3DZ, the number of IEs adjusted for population (pop rate), URDD adjusted for population (URDD per pop rate), and IEs adjusted for URDD

% Rural	Pop rate (95% CI)	URDD per pop rate (95% CI)	URDD rate (95% CI)
10	3.53 (3.34, 3.73)	13.54 (13.01, 14.10)	0.28 (0.27, 0.30)
50	3.97 (3.77, 4.18)	15.43 (14.90, 15.99)	0.28 (0.27, 0.30)
100	4.59 (4.08, 5.16)	18.17 (16.73, 19.73)	0.29 (0.25, 0.32)

(URDD rate) were determined using negative binomial regression. The proportion of the population residing in rural areas was used as a covariate. The models were also used to estimate the rates and 95% confidence intervals in areas that are 10% rural, 50% rural, and 100% rural.

Results: As the proportion of a 3DZ that is rural increases, the pop rate shows a highly significant increase (p-value = 0.0004), the URDD per pop rate also has a highly significant increase (p-value < 0.0001), and the increase in URDD rate was non-significant (p-value = 0.84). For every 10% increase in the rural percentage of a 3DZ, the pop rate increases by 2.96%, the URDD per pop increases by 3.32%, and the URDD rate increases by 0.17%.

Conclusion: Results indicate that rural regions have a significantly higher rate of IEs involving opioid analgesics. Results also suggest there is a higher rate of prescriptions dispensed to individuals in rural areas. However, the number of opioid IEs and number of individuals receiving opioid prescriptions are increasing at approximately the same rate as the percent rural increases. The URDD rate is relatively constant across all rural percentage levels even though the pop rate and URDD per pop rates are increasing as the percent rural increases.

Keywords: Analgesics, Opiods, Intentional exposure, Rural

312. Non-correlative relationship between World Health Organization-reported opioid consumption and centers for disease control-reported deaths from accidental poisoning by opioids

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Background: U.S. opioid consumption and accidental poisoning deaths have been increasing since 1999. This study was done to see if a relationship exists between opioid consumption and the number of accidental opioid deaths for the years 1999 to 2010.

Methods: The WHO International Narcotics Control Board (INCB) publishes an annual Narcotic Drugs Report which includes statistics on each country's consumption of opioids. Data for the U.S. consumption of eleven opioids was collected from these reports for the years 1999–2010. The WHO also publishes Defined Daily Doses (DDDs) for medications, which is defined as "the assumed average maintenance dose per day for a drug used for its main indication in adults." INCB opioid consumption data was converted to DDDs. The CDC's statistics regarding poisoning deaths is available via the WISQARS website. Data regarding accidental opioid deaths (ICD-10 code X-42) was collected for the years 1999–2010. Deaths and the total DDDs for each year were normalized to the U.S. Census Bureau's population estimate for that year.

Results: U.S. opioid consumption increased each year from 1999 to 2007, fell in 2008, increased in 2009 and fell slightly in 2010. The number of DDDs consumed was 2.23 trillion in 1999 and 5.28 trillion in 2010. Accidental deaths from opioids increased each year from 1999 to 2006, but decreased each year from 2007 through 2010. The number of accidental opioid deaths was 6,009 in 1999 and 12,280 in 2010. The U.S. opioid consumption from 1999 to 2006 increased by 78.5% (from 8.1 to 14.5 DDD per person) while accidental opioid deaths increased by 102% (from 21.9 to 44.4 per million population). From 2006 to 2010, opioid consumption increased by 17.1% (from 14.5 to 17.0 DDD per person) but accidental opioid deaths decreased by 10.8% (from 44.4 to 39.5 per million population).

Discussion: From 1999 to 2006, the increases in accidental opioid deaths outpaced the increase in opioid consumption. From 2006 to 2010, accidental opioid deaths decreased despite the overall trend of continued increasing opioid consumption. However, the increase in opioid consumption from 2006–2010 was notably smaller compared to the increase from 1999–2006. This data needs to be interpreted with caution as the ICD-10 code X-42 also includes accidental deaths caused by hallucinogens.

Conclusion: The rise in accidental opioid deaths outpaced the rise in opioid consumption in the early 2000's, but accidental opioid deaths have fallen since 2007 despite continued increasing opioid consumption. There currently does not appear to be a correlation between opioid consumption and opioid-caused deaths.

Keywords: Opioid, Opioid use, Death

313. Trends in Intentional and Unintentional Prescription Opioid Exposures reported to Poison Centers (PC) in Australia, Germany, Italy, Switzerland and the United States, 2007–2012

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Background: Prescription opioid abuse in the US has been deemed epidemic. However, abuse in other countries is not well studied. This study provides abuse rate data for three common opioids over a 6-year period in 5 countries.

Methods: Human exposures to oxycodone, buprenorphine, and methadone reported from 2007–2012 were obtained from poison centers in Eastern Australia, Italy, Switzerland and US RADARS® System. PCs in all 5 countries manage calls from healthcare providers and the public. Rates are expressed as number of exposures/100,000 population separately for intentional (IE) and unintentional (UE) exposures. IEs include; suicide, abuse, misuse, and unknown intentional. UEs include; unintentional general, unsupervised ingestions, or therapeutic errors.

Results: Rates cannot be compared between countries so changes from 2007 to 2012 were studied within each country. Oxycodone IE and UE increased dramatically in all 5 countries. Buprenorphine IE increased in both Germany and US while UE increased in Australia and US. Methadone rates were relatively stable for all countries except Germany, which illustrated a significant increase in both IE and UE rates.

Conclusion: Rising rates of opioid exposures are not unique to the US. In an attempt to better understand the types of exposures involved, it is clear that the increase is due to intentional misuse

Table. Results for abstract number 313.

Exposures/100,000 Population (rounded to 2 decimal places)			
	2007	2012	% Change 2007–2012
Oxycodone – Intentional Exposures			
Australia	1.14	3.09	172
Germany	0.15	0.35	130
Italy	<0.01	0.05	1371
Switzerland	0.11	0.45	329
United States	3.24	4.24	31
Oxycodone – Unintentional Exposures			
Australia	0.67	2.52	278
Germany	0.03	0.10	225
Italy	<0.01	0.01	153
Switzerland	0.04	0.16	313
United States	1.51	1.81	20
Buprenorphine – Intentional Exposures			
Australia	0.19	0.14	−27
Germany	0.10	0.19	92
Italy	0.03	0.02	−45
Switzerland	0.11	0.16	55
United States	0.29	0.63	118
Buprenorphine – Unintentional Exposures			
Australia	0.09	0.15	57
Germany	0.06	0.05	−13
Italy	<0.01	<0.01	−5
Switzerland	0.12	0.09	−26
United States	0.23	0.47	110
Methadone – Intentional Exposures			
Australia	0.40	0.35	−13
Germany	0.30	0.48	64
Italy	0.08	0.08	1
Switzerland	0.74	0.67	−10
United States	1.28	1.12	−12
Methadone – Unintentional Exposures			
Australia	0.17	0.17	3
Germany	0.08	0.16	110
Italy	0.02	0.01	−37
Switzerland	0.30	0.28	−9
United States	0.35	0.33	−8

and abuse as well as unintentional pediatric accidental unsupervised ingestions and therapeutic errors.

Keywords: Opioid, Exposures, International Poison Centers

314. Geographic description of opioid exposures in pregnant women within the US

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Background: The number of neonates born addicted to opioids nearly tripled between 2000 and 2009, jumping from 1.20 per 1,000 births to 3.39 per 1,000 births. Hospital costs to treat associated symptoms, also known as neonatal abstinence syndrome (NAS), have also increased from $190 million to $720 million during the same time frame. Organizations involved in the prevention of NAS struggle to find at-risk babies in utero due to significant under-reporting during maternal interviews regarding intrauterine drug exposure. The purpose of this study is to determine geographically where opioid intentional exposures (IEs) in pregnant women are being reported to Poison Centers (PCs) participating in the RADARS® System.

Methods: Exposure cases analyzed in this study were collected from the RADARS System PC Program from 1Q2011-4Q2012. Cases were recorded on a 3-digit ZIP code (3DZ) level and population was taken from the 2010 Census. Two different rates were calculated: intentional exposures in pregnant women per 100,000 total population and per 10,000 unique recipient of dispensed drug (URDD), which is a measure of retail availability. These rates were then grouped by quartiles. IEs were defined as suspected suicide, misuse, abuse, withdrawal, or intentional unknown. Opioids included were buprenorphine, fentanyl, hydrocodone, hydromorphone, methadone, morphine, oxycodone, oxymorphone, tapentadol, and tramadol.

Results: Of the 412 exposure cases in pregnant women captured by participating PCs during this time frame, 313 (76%) were IEs. The top ten states with the most IEs during this time frame were California (35), Texas (27), Illinois (15), Louisiana (14), Michigan (14), Florida (14), Indiana (13), Georgia (13), Maryland (12), and Arizona (11). The top five intentional population rates by 3DZ were 084 (NJ, 0.652), 679 (KS, 0.402), 143 (NY, 0.378), 052 (VT, 0.374), and 593 (MT, 0.360). The top five intentional URDD rates by 3DZ were 513 (IA, 0.636), 084 (NJ, 0.445), 583 (ND, 0.372), 593 (MT, 0.304), and 052 (VT, 0.242). The majority of the top 25% intentional population rates are located in the central US, while the URDD rates are more dispersed. The top five opioids reporting an IE were hydrocodone (47.6%), oxycodone (22.0%), tramadol (13.7%), methadone (6.7%), and buprenorphine (5.4%).

Conclusion: While rates per total population are higher in the central US, the widespread reporting to PCs suggests that education and intervention efforts should be a national focus for all pregnant women, specifically those on hydrocodone, oxycodone, and tramadol as well as those on methadone and buprenorphine maintenance therapy. Each state should work with local organizations to develop or review procedures to prevent NAS.

Keywords: Pregnant women, Poison centers, Opioid

315. Outpatient prescription naloxone in a county hospital emergency department: A pilot program

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Background: Death from opiate overdose is on the rise, but is preventable. As prescription opiates have eclipsed street heroin as a cause of death, novel methods to prevent mortality from opioid use are needed. Laypersons trained in administering naloxone can save the lives of their peers and loved ones. In most cases of overdose, EMS is not called and people resort to other ineffective ways of saving each other like using ice to the groin, injecting milk, etc. Community-based programs have taken the lead in training. We explored the mechanics and feasibility of initiating a prescription naloxone program in our urban County Hospital Emergency Department (ED) affiliated with a Toxicology Program.

Methods: IL recently indemnified prescribers of naloxone. Given this environment, departmental and administration support has been secured. Premade "Kits" were stored in outpatient pharmacy. Each Kit contains three single dose vials of Naloxone (0.4 mg/1 ml), three 3 ml syringes, three IM needles, three alcohol pads, and naloxone administration instructions. Materials for the kits are a gift of Chicago Recovery Alliance, a nonprofit harm reduction program that is a veteran in prescription naloxone. Emergency Medicine (EM) Residents in the ED identify participants during routine social history taking. Patients who use heroin or other opioids are asked if they are interested in naloxone training and taking home a free kit. Participants watch a 10 min training video and a live demo on how to draw up the naloxone. They are then given a prescription with a certificate of completion of training. Upon presentation of both documents to the hospital's outpatient pharmacy, participants can receive a free kit.
Results: Our program is approved by Illinois, and we have trained 12 participants in the first two months of initiation.
Conclusions: There is widespread support for the idea of outpatient naloxone at our institution. It supports our mission of saving lives of people from all walks of life. The main limitation we face in prescribing is that the training process is cumbersome for residents during a busy shift, and this is a voluntary effort. We are currently devising a way to cut down training time without sacrificing efficacy. Another limitation is that most of our heroin users do not inject. Some did not want to be trained to use needles for intramuscular injection. Using the intranasal route and developing online training videos may be the answers to these barriers.

It is possible to make prescribing naloxone a part of EM practice. Further study is needed to determine if Emergency Physicians will prescribe naloxone on a widespread basis, and the feasibility of novel electronic training methods.
Keywords: Naloxone, Opioid, Public health

316. Micromedex® Clarification of Suboxone® Products Increases Coding Accuracy in the RADARS® System Poison Center Program

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Background: Misclassification of product-specific codes affects the accuracy of poison center (PC) data. Differential misclassification associated with Specialists in Poison Information (SPI) choosing the first listed code in Micromedex® (MMX) has been described. We sought to quantify the accuracy of product-specific coding within the RADARS® System Poison Center Program before and after the clarification of formulation for specific Suboxone® products.
Methods: During the study period, the Poison Center Program captured drug exposures from 50 United States PCs. SPIs record case data, including product codes and narrative notes using standardized electronic forms, and RADARS System staff verify coding accuracy. When narrative notes and product codes conflicted, the SPI narrative notes with substance formulation are used. Total exposures to Suboxone tablets and oral film from 2Q – 4Q2011 (before) and 2Q – 4Q2012 (after) the coding clarification were reviewed. The change was made in 1Q2012. PCs installed the new MMX version on various dates, so this transition quarter was not analyzed. A Chi square test was used to test the difference in number of recodes after the MMX listing change compared to before. This test is done separately for recodes from tablet to film and from film to tablet. McNemar's test for correlated proportions describes whether the recoding from tablets to film compared to film to tablet was differential. This test was done separately for the before and after period.
Results: There were 3610 cases, 1763 before MMX change and 1847 after. There was a significant decrease in recodes from tablet to film for before MMX change ($n = 20$, 1.1%) compared to after ($n = 3$, 0.2%, $p = 0.0002$). There was also a significant decrease in recodes from film to tablet for before ($n = 577$, 32.7%) compared to after ($n = 57$, 3.1%, $p < 0.0001$). Coding for tablets was 98.9% ($n = 1743$) accurate, and film was 67.3% ($n = 1186$) accurate before MMX change. After MMX change coding for tablets was 99.8% ($n = 1844$) accurate, and film was 96.9% ($n = 1790$) accurate. The misclassification of Suboxone was differential for both the before period ($p < 0.0001$), and after period ($p < 0.0001$).
Conclusion: Data from the National Poison Data System and individual PCs are frequently used to study adverse events related to product-specific medication use. The reliability of this research relies on accurate product coding. This study shows that differential misclassification may introduce systematic bias, in which PC data over-reports the first listed formulation in a product class. Clarifying formulation listing in Micromedex can correct many of these errors.
Keywords: Poison Control Centers, Buprenorphine, Analgesics, Opioids

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