Introduction

We examined 4 sets of US Poison Center National Poison Data System (NPDS) closed, human exposures from 2000 - 2012:
- Carbon monoxide (CO),
- All pesticides (Pesticides),
- Pyrethrins/pyrethroids (Pyrethrins),
- All exposures (All).

Methods

- We examined geographic data and change over time (COT), in particular changes within the year (seasonality), and differences among NPDS population-adjusted exposures based on by-state linear regression of census data, and geographic relationships for seasonality based on mean temperature data by state by month.
- An anomaly was defined a Z-score > 2 in the normalized residuals from the by-day multivariate models.
- Raw data plots versus time, descriptive statistics, and multivariate modeling used SAS JMP 9.0.0 (Cary, NC).
- Analyses included state, 1-digit zip, day, week, month, season, and year.
- Results were judged highly statistically significant (HSS) where p-value (2 sided) was <0.0001.

Results

- Variation among states was greater for CO versus other 3 sets.
- Seasonality showed a spring-summer decrease for CO and the converse for all other groups.
- Seasonal variation and temperature relatedness were greatest for Pyrethrins and least for All exposures.
- Anomalies were most frequent for CO and least frequent for All exposures.
- Population adjusted GIS differences, seasonality, and temperature dependence were HSS for CO, Pesticides, and Pyrethrins.
- COT was HSS and increasing (Pyrethrins) and decreasing (CO).

### Measure / Model Parameter, N

<table>
<thead>
<tr>
<th></th>
<th>Carbon Monoxide</th>
<th>All Pesticides</th>
<th>Pyrethrins</th>
<th>All Exposures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposures/year, US</td>
<td>15,283</td>
<td>91,323</td>
<td>24,193</td>
<td>2,337,594</td>
</tr>
<tr>
<td>Exposures/day, US</td>
<td>42.2 (39.6, 44.6)</td>
<td>253 [245, 261]</td>
<td>67.2 [57.8, 76.6]</td>
<td>6473 [6265, 6661]</td>
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<tr>
<td>Exposures/day, US</td>
<td>32.2 / 43.4 / 708</td>
<td>253 / 230 / 1.10</td>
<td>96.0 / 23.5 / 1.23</td>
<td>6289 / 5710 / 1.10</td>
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<tr>
<td>Exposures/day / pop by</td>
<td>0.168 (0.051, 0.407)</td>
<td>0.908 (0.501, 1.54)</td>
<td>0.240 (0.124, 0.445)</td>
<td>22.9 (15.1, 44.4)</td>
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<tr>
<td>seasonality, mean (min, max), N=46</td>
<td>49.4 / -37.3 / -43.4 / 31.2</td>
<td>-66.4 / 34.1 / 48 / -35.7</td>
<td>-52.5 / 22 / 68.5 / -36.1</td>
<td>-5.1 / 16 / 3.51 / -4.98 / -5.30</td>
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</tbody>
</table>

### Conclusions

Understanding NPDS human exposure toxin-specific seasonality and COT trends can:

1. Help focus research, public and professional education, intervention, and surveillance programs;
2. Form the basis of an adaptive threshold for real-time surveillance of poisoning anomalies.