Clinical Toxicology (2014), **52,** 682–818
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ISSN: 1556-3650 print / 1556-9519 online
DOI: 10.3109/15563650.2014.940163

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ABSTRACTS

2014 Annual Meeting of the North American Congress of Clinical Toxicology (NACCT)

Note: authors have no disclosures or conflicts of interest to declare unless otherwise stated at the end of the abstract.

1. Prescription stimulants and hospitalization for psychosis: A case-crossover study

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Background: The prescribing of stimulants for Attention Deficit Hyperactivity Disorder (ADHD) has increased dramatically over the past decade. Case reports suggest that these drugs may precipitate psychosis, as might be expected based upon their pharmacology. We examined whether treatment with prescription stimulants is associated with hospitalization for psychosis.
Methods: We conducted a population based case-crossover study in Ontario, Canada, from October 1, 1999 to March 31, 2013. We studied Ontario residents aged 25 years and younger whose prescription costs were reimbursed by the provincial government. All subjects were hospitalized for psychosis within 180 days of commencing treatment with a prescription stimulant. We estimated the risk of hospitalization for psychosis within 60 days of commencing treatment, relative to a corresponding 60-day reference interval four months earlier. Under the case-crossover design, each patient served as his or her own control, thereby controlling implicitly for fixed patient characteristics. Odds ratios were calculated using McNemar's test, with 95% confidence intervals for binomial proportions.
Results: We identified 219 patients hospitalized with psychosis within 180 days of a first stimulant prescription. Hospitalization for psychosis was associated with stimulant initiation in the preceding 60 days (odds ratio [OR] 1.70; 95% confidence interval [CI] 1.31 to 2.27). The risk was greater among patients with a history of antipsychotic drug treatment (OR 2.00; 95% CI 1.36 to 3.11), but persisted in patients with no such history (OR 1.48; 95% CI 1.03 to 2.19). More than a third of patients hospitalized for psychosis resumed stimulant therapy after hospital discharge; of these, 38% (30 of 78) were readmitted for psychosis shortly thereafter.
Interpretation: The initiation of prescription stimulants is associated with hospitalization for psychosis in young people. Following discharge, resumption of therapy and subsequent readmission for psychosis are common. These findings strengthen the argument for causation, and suggest a lack of awareness of the potential for prescription stimulants to cause psychosis in young people.
Keywords: Amphetamine, Epidemiology, Surveillance

2. Mitochondrial dysfunction produced by diglycolic acid, the nephrotoxic metabolite of diethylene glycol

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Background: Diethylene glycol (DEG), a solvent and chemical intermediate, has caused many cases of acute renal failure and deaths world-wide. Diglycolic acid (DGA) has been shown to be the metabolite likely responsible for the renal toxicity, but its toxic mechanism remains unclear. Our hypothesis is that DGA produces a mitochondrial dysfunction that then leads to cell death and tissue damage.
Methods: To assess mitochondrial function in whole cells, human proximal tubule (HPT) cells were incubated with DGA (50 mmol/L, known to be toxic) for times up to 48 h. Mitochondrial membrane potential was measured using the potentiometric dye JC-1 and the NAD/NADH ratio was assessed using a Bioquest Assay Kit. Rat kidney mitochondria were isolated by homogenization and centrifugal separation.

Oxygen consumption was determined in control and DGA-treated mitochondria using either succinate or glutamate/malate as substrates with (State 3) and without (State 4) ADP.
Results: DGA increased the NAD/NADH ratio by 24 h, suggesting a decreased availability of reducing equivalents into the electron transport chain at complex 1. DGA also substantially decreased the mitochondrial membrane potential (MMP) in 24 h, reflecting changes in inner membrane integrity and in pore forming proteins that can lead to the membrane permeability transition and ultimately to inhibition of oxidative phosphorylation-produced ATP. The anti-oxidant Trolox blocked DGA-induced ROS but did not reverse the decrease in the MMP, suggesting that the change in MMP was a direct effect of DGA not from ROS produced by DGA. DGA decreased State 3 respiration with either succinate or glutamate/malate as energizing substrates, but did not affect State 4 respiration or the ADP/O ratio in isolated mitochondria. These results indicate that DGA operates by inhibiting mitochondrial respiration per se and not via an uncoupling mechanism. The effects of DGA on glutamate/malate respiration occurred at very low DGA levels (significant by 6 mM), while those on succinate respiration occurred only at 100 mM.
Conclusions: These results suggest that DGA directly affects mitochondrial function via an inhibitory effect on Complex I activity, since glutamate/malate would feed into that complex, while succinate would feed Complex II. Because DGA decreased NADH relative to NAD, another interpretation is that DGA inhibited the

supply of reducing equivalents into Complex I thus decreasing glutamate/malate respiration. By understanding the mechanism by which DGA inhibits mitochondrial function, we may be able to develop an antidote that can counter-act this effect and thereby treat DEG poisoning in its later stages.

Keywords: Nephrotoxicity, Mechanism, Antidote

3. Serum acetaminophen-protein adduct concentrations in pediatric patients

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Background: Oxidation of acetaminophen forms a reactive intermediate that binds to proteins & forms acetaminophen-protein adducts. Serum adducts (APAP-CYS) are considered a biomarker of acetaminophen exposure & concentrations may help differentiate therapeutic doses from overdose. To be appropriately interpreted, the normal range of APAP-CYS concentration must be characterized in the general population.

The objective of this study was to describe APAP-CYS concentrations in pediatric patients with & without reported therapeutic acetaminophen exposure.

Methods: This observational study included children (age 1 – < 12 years) presenting to a pediatric ED. Caregivers reported subject medication use over the past 14 days using a comprehensive Medication History Assessment Tool (MedHAT®). Subjects were stratified by reported acetaminophen use over the14 days, including the day of enrollment (Day 0). Daily acetaminophen doses were calculated. Subjects with reported use ≤ 75 mg/kg/day were classified as receiving therapeutic doses. Serum for adduct analysis was collected on Day 0. The relationship between APAP-CYS concentration & dose & time from last dose was explored using regression.

Results: 100 subjects completed the study; 75 reported acetaminophen use, 25 did not. 3 subjects reported daily use > 75 mg/kg/day. Adducts were detected in 39/75 (52.0%) of reported acetaminophen users & in 0 of reported non-users, resulting in 64.0% (64/100) overall concordance. Mean cumulative dose for all acetaminophen subjects was 86.0 mg/kg (range 4.4–832.4 mg/kg). Among 72 subjects reportedly receiving therapeutic doses, the mean APAP-CYS concentration was 0.06 μM (range undetectable to 0.75 μM). Most subjects with detectable APAP-CYS (64.1%) had ≥ 1 dose of acetaminophen on Day 0. The proportion of subjects with detectable adducts stratified by day of last dose was 25/35 (71.4%) for Day 0, 11/22 (50.0%) for Day -1, 2/6 (33.3%) for Day -2 & 1/2 (50.0%) for Day -3. No (0/10) subjects who reported a last dose > 3 days prior to presentation had detectable adducts. APAP-CYS concentrations were higher for subjects with more recent ingestions, higher cumulative doses & more than a single ingestion.

Conclusions: Slightly more than half of children with reported acetaminophen use in the 14 days preceding their ED visit had detectable APAP-CYS concentrations while no subjects without recent reported use had APAP-CYS detected. Concentrations were correlated with time from last dose & total dose. Our results suggest APAP-CYS is a specific biomarker of acetaminophen exposure, but that it may be of limited use to identify pediatric exposures to therapeutic doses occurring more than 3 days prior to sampling.

Keywords: Acetaminophen, Adducts, Pediatric

Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

4. Positive association between ondansetron and significant cardiac events in adult and elderly hospitalized patients

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Background: Ondansetron is a commonly used antiemetic that has been linked to QT interval prolongation. Prolongation of the QT interval may result in tachyarrhythmias, including torsades de pointes, potentially placing patients at risk for sudden cardiac death. To date, it is not clear whether ondansetron is responsible for clinically significant cardiac events. The aim of this case-control study was to determine whether there is an association between ondansetron and cardiac events, specifically cardiac death or events requiring cardiopulmonary resuscitation (CPR). Secondary covariates assessed included age and use of other QT-prolonging medications.

Methods: In this case-control study, data was gathered using the Epic Clinical Research Data Warehouse, a hospital-wide analytical tool that captures clinical data for over 100,000 de-identified patients. Case inclusion criteria included adult patients who suffered a significant cardiac event during their hospital stay between 2010 and 2013. Patients who presented to the hospital in cardiac arrest were excluded. Control patients, who did not suffer a cardiac event, were matched to case patients by admission diagnosis. Each patient chart was examined for ondansetron administration during the 24 hours prior to the case patient's cardiac event. Analysis was performed using conditional logistic regression, adjusting for sex, age, and race/ethnicity.

Results: In all, 230 cases were identified and matched with up to 5 controls to form 1,059 case-control pairs. Forty-five (20%) of the cases and nine (1%) of the controls received ondansetron. Patients in the case group were 59% male with mean age of 61.4 ± 16.6 years. Patients in the control group were 52% male with mean age of 60.2 ± 19.1 years. There was a significant positive association between ondansetron use and cardiac events (OR 31.9, 95% CI 12.3–82.6). The effect was higher among geriatric patients age 65 + years vs. adult patients aged 18–64 (OR 13.6 vs. 154, respectively; interaction OR 11.4, 95% CI 1.0–128; $p = 0.049$). There was also a positive association between use of other QT prolonging drugs and having a cardiac event (OR 12.2; 95% CI 7.8–18.9). However no interaction was found between ondansetron and administration of other QT prolonging drugs (interaction OR 1.7; 95% CI 0.15–18.9; $p = 0.66$).

Conclusion: In this case-control study within a single adult hospital, there was a positive association between ondansetron administration and significant cardiac events in both adult and geriatric populations. Ondansetron and co-administration of other QT-prolonging drugs were each associated with greater odds of having a cardiac event.

Keywords: Ondansetron, Cardiac toxicity, QT prolongation

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5. Geographic information systems of influenza-like illness (ILI) based on medications: Relating National Poison Data System (NPDS) exposure data to CDC reporting of ILI

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Background: The Centers for Disease Control (CDC) monitors ILI and NPDS tracks exposures to medication in near real time. We examined the relationship between exposures to medications commonly used to treat ILI as reported by the NPDS, and weekly reports of ILI.
Methods: ILI was defined as temperature ≥ 37.8 C with cough and/or sore throat without a cause other than influenza. CDC reports ILI weekly by age-group (0–4, 5–24, 25–64 and ≥ 65 years of age) for each of 10 Health and Human Services (HHS) regions. We examined NPDS exposures to acetaminophen, cough/cold medications, promethazine, and promethazine containing combinations for the same weeks, 4 age groups and 10 HHS regions for 13 flu seasons starting week 34 of each year. Changes over time in the 60 groups (4 age groups $\times$ 10 HHS regions) were examined using graphical plots and descriptive statistics. For 13 flu seasons, the best 60 ILI predictors and 95% confidence intervals (CIs) were selected by stepwise regression of the 24 NPDS data groups (6 med groups $\times$ 4 age groups) + all NPDS calls + ILI year. Within each flu season, an unpredictable ILI "pop" was defined when the largest ILI peak was greater than $2\times$ the upper 95% CI of the NPDS predictor for that week. All analyses were via SAS JMP 9.0.0 with statistical significance defined as $p < 0.05$ (2-tailed).
Results: There were 302,449 ILI cases and 158,884 exposures during the 13 seasons (679 weeks). The Table 1 shows the number of NPDS parameters (out of 26) and R^2 for each model ($p < 0.001$ for all models), and the number of pops (out of 13). Number of NPDS parameters ranged from 5 to 12 and R^2 from 0.248 to 0.717 with a mean of 0.495. An R^2 of 0.495 ($R = 0.704$) means the model describes 49.5% of the ILI observations. Best fit models for ILI US data for the last 1, 2 and 3 flu seasons had R^2 of 0.967, 0.936, and 0.911.
Conclusions: NPDS medication exposure data predictors were highly correlated with CDC ILI data. Since NPDS data are available in near-real time, it may provide early and complimentary ILI monitoring. This approach may provide public health value in predicting other illnesses, such as food-borne illness which are not currently as thoroughly monitored.
Keywords: National Poison Data System, Epidemiology, Public health

Table 1.

HHS Region	Means: # Predictors/R^2/# Pops
1-Boston	7.5/0.464/2.3
2-New York City	7.5/0.476/2
3-Philadelphia-DC	6.8/0.464/1.8
4-Atlanta	6.8/0.602/2.3
5-Chicago	10/0.608/2.3
6-Dallas	7.3/0.56/2
7-Kansas City	7.8/0.406/2
8-Denver	5.8/0.321/2.3
9-San Francisco	9.8/0.655/1
10-Seattle	5.8/0.394/1.8
Mean	7.5/0.495/2

6. Poison center surge capacity

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Background: On Jan. 9, 2014, a tank spilled ~10,000 gallons 88.5% 4-methylcyclohexanemethanol (MCHM) into a river 1.5 miles upstream of a water treatment facility intake serving 300,000 people. MCHM exposure began 7 hours (hrs) before the Governor's "do not use the water" order at 17:55 (later exposures (exp) occurred during flushing of water lines & incidental use after the 9th). The Governor and multiple media outlets prominently displayed the Poison Center's (PC's) toll free #. This report describes the largest PC surge response in National Poison Data System (NPDS) history.
PC Staffing: On Jan 9th, the PC had 7 certified poison specialists (CSPI) (none remote), 1 SPI 12 days into training, 1×0.48 FTE educator, 1 FTE director, & 0.25 FTE on-site medical direction; 6 SPI workstations were standard.
Pre-event PC Plan: A National Incident Management System compliant plan was in place; accessible by all staff and signed off, and tested via a Homeland Security Exercise & Evaluation Plan compliant drill and smaller scale events with after action reports. Staff (except new SPI), had incident command system (ICS) 100, 200, & 700 training; Director also had 300, 400, & 800 training. One CSPI was the designated Logistics Supervisor; the Director participates in state Health Command Emergency Operations Center drills/planning activities. Volunteer surge is via the PC's state-supported call-down system (SoP students are 1st line surge (cell #'s entered yearly). Available phone lines exceed daily need.
Surge Description: The first PC call was received at 17:57; the PC disaster plan was activated using the ICS; onsite were 3 CSPI's, 1 pharmacy (SoP) student, and the Director. When the PC ICS stood down at 12:30 Jan 19th, 1939 human exp cases, 100 animal exp cases, & 384 information cases were entered in NPDS. Scripted messages were not used and not acceptable for call types received. On the 9th, 27% of total case volume was received (647/2423 cases); phone records show 4172 calls not answered (avg 695 calls/hr, high 82/min) with 140 times all trunks busy, 501 times all stations busy. From the 10th, dropped calls were at normal rate $< 4\%$ and NPDS data entered in near real time. Extra time logged: WVPC staff 136 hrs $>$ normal hrs, SoP students 106 hrs, SoP faculty 7 hrs, state health 36 hrs, National Guard 107 hrs, Director 106 hrs $>$ normal hrs. Workstations numbered 11. All usual WVPC calls were answered, none by volunteers. While the PC ICS was up, ~ 500 people self-referred to hospitals.
Conclusions: Offsite CSPI's would add complexity to event coordination. Even with planning, initial event hours in a PC will be sub-optimally supported. Use of the ICS system, a written disaster plan, & a documented plan for volunteers are crucial. Scripted messages may not be appropriate for all event types.
Keywords: Poison center, Disaster, Surge capacity

7. Human effects of 4-methylcyclohexanemethanol

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Background: On January 9, 2014, a 48,000 gallon tank leaked an unknown amount of a mixture containing 88.5% 4-methylcyclohexanemethanol (MCHM) and 7.3% propylene glycol phenyl ether

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(PPH) into the Elk River 1.5 miles upstream of a water treatment facility serving approximately 300,000 people in West Virginia. The highest concentration measured in drinking water was 3.35 ppm MCHM (>0.150 ppm in some areas >2 weeks post spill) and 0.011 ppm PPH (PPH not detected post Jan 11th). Lingering chemical odors and delayed flushing of contaminated water lines in homes prolonged concerns for human exposure. The objective of this report is to describe clinical effects ascribed to the chemical exposure reported to a Poison Center (PC).

Case Presentation: From 17:57 Jan 9th through the 26th, the PC documented 2014 human contaminated water exposure cases. The most common effects reported were: 12% nausea, 10.25% headache, 9.18% skin rash, 7.43% diarrhea, 7.31% vomiting, 7.28% skin irritation/pain, 6.62% eye irritation/pain, 5.73% throat irritation, 3.74% skin erythema, 3.12% oral irritation, 3.03% abdominal pain, 2.97% pruritus, 2.44% dizziness/vertigo, 2.49% dyspnea, and 1.16% red eye/conjunctivitis. Overall, 25.3% were dermal effects and 39.11% were gastrointestinal (GI) effects. Many dermal effects were reported to last <30 min or <24 hrs. No hospitalizations attributed to contaminated water were documented. Symptoms, unless clearly not related, were amenable to home treatment.

Case Discussion: As measured PPH was low and detected for <2 days, this cohort largely describes effects attributed to MCHM. Although clinical effects reported were consistent with MCHM toxicity predicted by chemical structure and animal data, it is unlikely that all reported effects were directly related to MCHM toxicity. Several confounding factors existed: 1) influenza and viral GI illness were prevalent at the same time, 2) acute onset/worsening of other medical conditions would have been expected in a cohort of 300,000 over 17 days and likely explains some reported effects, 3) rashes may have been associated with hand sanitizer overuse (used exclusively for hand washing for days in place of water) or cold weather-associated dermatitis, and 4) MCHM has a noxious licorice odor (present at 0.0022 ppm, water potable at ≤1 ppm); odors can result in physiological or psychological responses. The number of residents reporting clinical effects was low compared to the total number of people exposed (2014 out of 300,000).

Conclusions: This is the largest cohort ever reported of human exposures to MCHM. Overall, the severity of human clinical effects appears minor at the concentrations measured following this spill; initial home management is a valid triage option.

Keywords: Environmental, Hydrocarbon, Epidemiology

8. Impact of time on market & prevention strategies on accidental childhood exposures to single use laundry detergent packs

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Background: Prior to introduction of Single-use Liquid Laundry Detergent (LLD) Packs in North America (Feb 2012) a prospective observational study was initiated with Poison Centers (PCs) to evaluate the reporting rates, situational variables and biological response to this product category. Since introduction, PCs have continued to receive calls involving accidental exposure. In response to heightened concerns for childhood injury, manufacturers implemented a variety of prevention strategies including education initiatives, labeling changes and packaging modifications.

Method: This is a two year trend analysis of LLD pack exposures involving children (age ≤5 years) reported between March 2012 and Feb 2014 to 12 US PCs participating in the ongoing prospective study. The complete PC record was obtained to evaluate key study parameters including demographics, morbidity and exposure scenario. The case narrative was reviewed to verify coding accuracy and to isolate situational variables and packaging characteristics associated with each exposure. Trend analysis was performed in two segments, including a comparative yearly evaluation across all LLD Pack exposures and a separate analysis of exposures associated with the market leader (Tide Pods®) to evaluate whether prevention strategies implemented by the manufacturer may have impacted the rate of childhood exposure.

Results: The comparative yearly analysis of LLD Pack exposures revealed that total case count and outcome data was similar for Year 1 (Y1) and Year 2 (Y2). Exposures coded with moderate outcome represented 8.2% of total cases in Y1 vs. 7.9% in Y2, while major outcome decreased from Y1 (1.0%) to Y2 (0.3%). Ingestion and ocular continued to be the major routes of exposure (86% and 12% respectively) and yearly proportions did not change. Review of available case narratives indicated that in 1/3 of childhood exposures, the LLD Pack was accessed outside of the original container or when the container was left open.

Rate of exposure for the market leader (Tide Pods®) peaked in May 2013 (196 exp/month) followed by a downward trend beginning May 2013 through Feb 2014 (119 exp/month). Interestingly, this downward trend brackets the timing of packaging/labeling changes and related educational initiatives that were implemented, without a corresponding reduction in market sales.

Conclusions: Yearly comparative analysis indicated that exposure outcomes and routes did not significantly change. Data for the market leader (Tide Pods®) demonstrated a reduction in exposure rate over the last two quarters which coincided with access prevention strategies that were implemented.

Keywords: Laundry Detergent Pack, Safety Surveillance, Prevention

Disclosure: Do you or any member of your immediate family have a relevant financial interest or other relationship with the manufacturer(s) of any of the products or providers(s) of any of the services you intend to discuss?

Commercial Interest	What Was Received	For What Role?
Procter & Gamble (P&G)	Study sponsored/funded by P&G (including all participating poison centers). Cincinnati DPIC receives additional fee for service functions for P&G.	Study sponsored/funded by P&G (including all participating poison centers). Cincinnati DPIC receives additional fee for service functions for P&G.

9. Prehospital ketamine for excited delirium in the setting of acute drug intoxication

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Background: Excited delirium syndrome (ExDS) is a potentially fatal condition that poses danger to patients and providers. Chemical sedation with benzodiazepines or antipsychotics is standard care for ExDS but may be ineffective. In July 2013, our paramedic system instituted a protocol for high dose ketamine (5 mg/kg IM) for ExDS resistant to verbal de-escalation and/or other sedative agents. We report results from the initial cohort of patients. Prehospital data were collected prospectively on all patients receiving ketamine, and history of drug intoxication, emergency department (ED) and hospital data were obtained by chart review.
Case Series: Between July 2013 and January 2014, 35 patients received prehospital ketamine. 29 (83%) were male, with average age 29.5 years (range 18–53). In 32 cases (91%) acute intoxication was described, including ethanol (8/32), synthetic cannabinoids (8/32), amphetamines (5/32), cocaine (2/32), opioids (2/32), LSD (1/32), 25-I NBOMe (1/32), and unknown substances (6/32). Among intoxicated patients, 21 (66%) required no additional sedation. 16 (50%) were intubated, with indications of airway protection, low Glasgow Coma Scale (GCS), and hypoxia. 15 (47%) were admitted to ICU, 6 (19%) to the ward, and 10 (31%) were discharged home from the ED. 4 (13%) developed hypoxia, 3 of whom received benzodiazepines in addition to ketamine. No laryngospasm, emergence phenomena or deaths were reported. The average length of stay for admitted patients was 1.3 days.
Case Discussion: The vast majority of ExDS cases were associated with acute drug intoxication. An outbreak of ExDS caused by a novel synthetic cannabinoid, ADB-PINACA, occurred during this time; it is likely that several of the unknown substance intoxications also involved this compound. High rates of intubation and ICU admission were primarily due to deep sedation. High dose ketamine commonly causes dissociation with a low GCS, but only rarely with loss of airway reflexes. A decline in the rate of intubation was noted over time, possibly because providers became more comfortable with the presentation of these patients. While 14 patients did receive additional sedation, all patients were adequately controlled for safe transport to an ED for definitive care prior to requiring additional medication. Most patients, despite intubation or admission, had a short length of stay and good clinical outcomes.
Conclusions: This is the largest series of prehospital ketamine administration reported to date. Acute drug intoxication was commonly associated with ExDS in patients receiving prehospital ketamine. Although intubation and admission were common, patients had few complications and good clinical outcomes.
Keywords: Katamine, Excited delirium, Synthetic cannabinoid
Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

10. Diagnosis of snake envenomation using a simple phospholipase A2 assay

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Background: Snake envenomation is a major health problem in the rural tropical world. A key issue for improving antivenom treatment for snake envenomation is to have a rapid and accurate test to determine if patients are envenomated and require antivenom. Phospholipase A2 (PLA2) is a common toxin/component in snake venoms. No studies have tested for PLA2 activity in the blood of patients with snake envenomation.
Objective: We aimed to test the hypothesis that envenomated patients would have measureable PLA2 activity in their blood compared to minimal activity in non-envenomated patients as the basis for developing a bedside test to diagnose snake envenomation.
Methods: There were pre-antivenom samples for 32 Russell's viper (Daboia russelii), 35 hump-nosed pit viper (Hypnale hypnale), 3 Indian cobra (Naja naja), 2 Indian krait (Bungarus caeruleus), 5 red-bellied black snake (Pseudechis porphyriacus) envenomated and 31 non-envenomated patients. PLA2 activity was analysed by PLA2 assay kit (Cayman Chemical Company, USA). Venom concentrations were measured with enzyme immunoassays.
Results: The median PLA2 activity was 55.7 µmol/ml/min (95% percentiles:18.0–226.2) for Russell's viper envenomation, 13.6 µmol/ml/min (95% percentiles: 9.7–24.5) for hump-nosed viper envenomation, 14.8 µmol/ml/min (11.3–200.2) for cobra, 17.2 µmol/ml/min (15.8–18.7) for krait, and 98 µmol/ml/min (43–281) for black snake which were significantly different from non-envenomated patients (Median: 6.0 µmol/ml/min;95% percentiles: 2.3–8.4). There was good correlation between venom concentration and PLA2 activity in the sera of patients with Russell's viper envenomation ($r = 0.61$; $p = 0.0002$), hump-nosed pit viper envenomation ($r = 0.49$; $p = 0.003$) and in multiple samples from black snake envenomations ($r = 0.95$; $p < 0.0001$).
Conclusion: The PLA2 assay was positive in both coagulopathic snakes (Russell's viper and Hump-nosed viper) and neurotoxic snakes (kraits and cobras) and other elapids (black snakes) in a study of patients envenomated by Australian and Asian snakes. This provides the proof of concept for a simple bedside version of the PLA2 assay to diagnose snake envenomation in resource poor areas.
Keywords: Snake envenoming, Snake bite, Phospholipase A2

11. A prospective, multicenter, double-blind, randomized, controlled, clinical trial comparing Crotalinae Equine Immune F(ab')2 and Crotalidae Polyvalent Immune Fab (ovine) for the treatment of US Crotalinae envenomation

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Background: Crotalidae Polyvalent Immune Fab (Ovine) is the current FDA-approved and commercially available antivenom for treatment of envenomation by snakes of the subfamily Crotalinae (genera *Crotalus*, *Sistrurus*, and *Agkistrodon*). Late coagulopathy (thrombocytopenia, hypofibrinogenemia, and/or prolongation of prothrombin time) can occur or recur after treatment with Fab antivenom, often after hospital discharge, lasting in some cases more than 2 weeks and at a frequency and severity greater than reported with other antivenoms. Frequent follow-up is required, and reemergence of venom-induced effects may necessitate additional intervention, hospitalization, and costs. There have been serious, even fatal, bleeding complications. Phase 2 clinical trials suggest that treatment with Crotalinae equine immune $F(ab')_2$ antivenom may prevent late coagulopathies.
Objectives: We hypothesized that late coagulopathy rates for patients treated with $F(ab')_2$ versus those treated with Fab would be equal or lower.
Methods: In a prospective, multicenter, double-blind, randomized, Phase 3 clinical trial, patients bitten by US Crotalinae received $F(ab')_2$ with maintenance doses, $F(ab')_2$ with placebo maintenance doses, or Fab with maintenance doses. The primary efficacy endpoint was coagulopathy between end of maintenance dosing and day 8. Patients were assessed as experiencing coagulopathy if they had any one of the following: platelet count less than 150 K/mm^3 or fibrinogen level less than 150 mg/dL or clinical coagulopathy between end of maintenance dosing and day 5 requiring additional antivenom.
Results: 121 patients were randomized at one of 18 US clinical sites and received at least one dose of study drug. 114 completed the study. Of these, 4 of 39 (10.3%) in the $F(ab')_2$/$F(ab')_2$ cohort, 2 of 38 (5.3%) in the $F(ab')_2$/placebo cohort, and 11 of 37 (29.7%) in the Fab/Fab cohort experienced late coagulopathy. No serious adverse events were related to study drug. One death unrelated to study drug occurred. One patient in each arm of the study experienced an acute serum reaction, and one patient in each arm experienced serum sickness.
Conclusions: $F(ab')_2$ (with or without maintenance dosing during acute care) is associated with less late coagulopathy than Fab during the week following treatment of US Crotalinae envenomation. The risk of immune reaction to the two antivenoms is similar.
Keywords: Antivenom, Snake bite, Envenomation
Disclosure: Do you or any member of your immediate family have a relevant financial interest or other relationship with the manufacturer(s) of any of the products or providers(s) of any of the services you intend to discuss?

Commercial Interest	What Was Received	For What Role?
BTG plc	Honorarium	Honorarium

12. Reasons for hospital admission after Centruroides envenomation treated with antivenom

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Background: Arizona bark scorpion *(Centruroides sculpturatus)* antivenom (Anascorp®) (AV) was approved by the FDA in 2011. The availability of a safe and effective AV has decreased admissions to critical care units but has not eliminated the need for admission. The reasons for admission to hospitals in spite of AV therapy have not been studied.
Methods: Data from the poison centers of Arizona was analyzed to identify patients who received AV and were admitted to hospital in 2012 and 2013. These charts were reviewed to identify reasons for admission. Age, number of AV vials received, admission to ICU versus general ward, and reason for admission were recorded.
Results: 24,017 scorpion stings were reported; 1941 were seen in a healthcare facility, and 392 were treated with AV. Of the patients treated with AV, 33 (8.3%) were admitted, 21 (63.6%) to an ICU. Admitted patients had a bimodal age distribution, with peaks at average ages of 1.7 and 64.5 years. The average number of AV vials received was 3. The most common reason for admission was respiratory distress necessitating ICU admission (n = 11, 33%). Poison center records indicate that in most cases, the decisions to intubate and to give AV were made concurrently. Seven (21%) patients were admitted due to significant medical comorbidity complicating care of the envenomation. The identified comorbidities were primarily cardiac/pulmonary and were associated with risk for respiratory compromise. Sedation for prior to AV administration (4), allergic reaction to the venom (4), and severity of symptoms (4) resulted in admission of 12 patients (36%). Four patients had no specific reason for admission and one was admitted due to a head injury. Delay in AV therapy was identified in two patients who required as transfer due to lack of AV at the primary hospital. Average length of stay was 1 day.
Conclusions: Admissions to hospitals for *Centruroides* envenomation treated with AV are associated with respiratory distress either from a significant envenomation or as a result of comorbidities. Patients requiring admission represent a very small fraction of those stung. Nonetheless, the number of admissions may be further reduced by availability of AV and as medical providers become more experienced with Anascorp®, including the decision to administer early in the course of illness and the expected time to symptom improvement. Early administration should be considered for patients at the extremes of age and in those with cardiopulmonary comorbidities. In patients requiring aggressive supportive care prior to AV administration, the use of short acting opioids and benzodiazepines might prevent excessive or prolonged sedation resulting in admission once the AV has taken effect.
Keywords: Centruroides, Scorpion, Venom

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13. The effect of ginkgo biloba and panax ginseng on driving ability: A pilot study

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Background: Driving under the influence of xenobiotics is an important national safety issue. Panax ginseng and Gingko biloba are commonly used supplements in the United States whose use has been reported to increase alertness and cognitive function. The objective of this study was to investigate the effects of these specific herbals on driving ability.
Methods: Twelve volunteers were tested using the STISIM3® Driving Simulator (Systems Technology Inc., Hawthorne, CA) in this double-blind, placebo-controlled study. The subjects were randomized into 3 groups of 4 subjects per group. After 10-minutes of simulated driving, subjects received either ginseng (1200 mg), gingko (240 mg), or placebo administered orally. The test herbals and placebo were randomized and administered by a research assistant outside of the study to maintain blinding. One hour following administration of the blinded herbals or placebo, the subjects completed an additional 10-minutes of simulated driving. Standard driving parameters were studied including reaction time (RT), standard deviation of lateral positioning (SDLP), and divided attention (DA). Data collected for the DA parameter included time to response and number of correct responses. The data was analyzed with repeated-measures analysis of variance (ANOVA) using SPSS 20 (IBM, Armonk, NY).
Results: The results are shown in Table 1. Improvement in RT was demonstrated in the ginseng group however, the results were not statistically significant ($p = 0.251$). There was no improvement in SDLP within the three groups. Improvement was demonstrated in DA in all three groups with regard to time to response and number of correct responses. The ginseng group demonstrated the greatest improvement with regard to time to response and number of correct responses. However, the intergroup differences were not statistically significant ($p = 0.197$ and $p = 0.059$ respectively).
Conclusion: The data suggests that ginseng and ginkgo may improve certain parameters of driving ability without negatively impacting overall driving performance. However, the results reported herein do not rise to statistical significance. We postulate this is due to the relatively small numbers in our pilot study. Further study with a larger sample size is planned in order to elucidate more fully the effects of ginkgo and ginseng on driving ability.
Keywords: Herbals, Driving, Public health

Table 1.

	Reaction Time (seconds)		Standard Deviation of Lateral Positioning (feet)		Divided Attention Time to Response (seconds)		Divided Attention Number of Correct Responses	
Group	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Placebo	0.96	0.91	0.92	1.93	3.17	2.46	6.25	7.50
Ginseng	1.41	1.22	0.58	0.75	3.45	2.17	6.00	9.25
Gingko	1.67	1.81	0.53	0.66	2.71	2.12	7.75	8.25

14. Impact of ethanol on integrity of the sustained release properties of Avinza®

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Background: Sustained-release medications allow for once- or twice-daily dosing of selected drugs that would otherwise require more frequent dosing. Several years ago the Food and Drug Administration (FDA) issued a warning that ethanol enhances the release of morphine from the sustained-release capsules Avinza®. To the best of our knowledge, the data demonstrating this effect have not been published. As a preliminary aspect of a larger study examining the potential impact of polyethylene glycol solutions on the integrity of sustained-release morphine products and given the absence of published data we first undertook a confirmation of the FDA–based warning.
Methods: Simulated gastric fluid was prepared. 100 mL of simulated gastric fluid was mixed with either 100 mL of water (control) or 100 mL of 40% ethanol (final solution 20% ethanol) and placed in an agitated heated water bath to 37° C. One Avinza® 90 mg tablet was added to each flask and 1 mL samples were obtained at 30, 60 and 90 minutes. A total of five duplicate comparisons (control and ethanol) were utilized. Specimens were stored @ - 70° C until assay. After solid phase extraction, morphine concentrations were measured with a triple quadrupole GC/MS/MS operated in the Multiple Reaction Monitoring (MRM) mode. Comparative analyses were conducted by two separate statisticians to assure results confirmation.
Results: Ethanol dramatically increased the rate of release of morphine from this proprietary tablet over the time frame studied. Within 30 minutes there was over a 100% increase in free morphine in the presence of 20% ethanol compared to control ($p < 0.01$). At 90 minutes nearly 50% of the available morphine had been released into the gastric/ethanol solution compared to less than 12% in the control solution ($p < 0.0001$).
Conclusions: These results vividly confirm the FDA's warning of loss of sustained-release properties when Avinza® is taken with ethanol. The potential impact of ethanol (and possibly other solvents like PEG) on the sustained-release properties of medications-particularly the impact on time related alterations of concentration curves- needs to be considered when managing an overdosed patient. Further investigation into the effect of polyethylene glycol solution on the integrity of sustained release morphine products is being investigated to determine whether this therapeutic intervention alters the tmax of sustained-release opioids.
Keywords: Pharmacokinetics, Alcohol, Opioid

15. Epidemiology of patients in whom levamisole was detected in comprehensive urine drug screens

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Background: Cocaine and other street drugs are commonly adulterated with other xenobiotics. Levamisole is an immunomodulatory drug previously used in the United States (US) as an adjunctive treatment for colon cancer and rheumatoid arthritis and is FDA approved as a veterinary antihelminthic. It was removed from the US market in 1999 due to increased risk of agranulocytosis, vasculitis, and leukoencephalopathy. Levamisole was first detected in cocaine samples in 2003. Adverse effects associated with levamisole-tainted cocaine first appeared in 2008. The incidences of agranulocytosis and vasculitis in patients with a history of levamisole-tainted cocaine use is believed to be low based on the relative rarity of reports compared to the common use of cocaine.
Methods: This was a retrospective chart review. The results of all available gas chromatography-mass spectroscopy comprehensive urine drugs screens (CUDS) on subjects 14 years and older at our tertiary care facility and associated children's hospital from the year 2013 were reviewed. Data collected from the charts of these subjects included age, race, date and setting of CUDS, initial WBC and absolute neutrophil count (ANC), presence and characteristics of a rash, history of leukoencephalopathy, dermatology, rheumatology, or vascular surgery consultation, route and date of last use of cocaine, and CUDS results including presence or absence of cocaine or its metabolites and presence or absence of levamisole.
Results: A total 2086 CUDS were reviewed. Cocaine without levamisole (CN) was detected in 103 (4.94%), cocaine with levamisole (CL) was detected in 70 (3.4%), and levamisole without cocaine was detected in only one subject. The mean WBC and ANC of subjects in the CN group were 8671 and 5987 cells/mcL. The mean WBC and ANC of the CL group were 9481 and 6686 cells/mcL. Their difference was not statistically significant. There was one subject with levamisole-associated vasculitis and none with leukoencephalopathy.
Conclusions: Levamisole was commonly detected in CUDS positive for cocaine and/or its metabolites (40.5% of cocaine positive results). There was not a statistically significant difference in initial WBC or ANC in cocaine users in whom levamisole has also been detected. There was one case of neutropenia and vasculitis that could be solely attributed to levamisole. Cocaine metabolites have a longer half-life than levamisole; therefore, not detecting levamisole in a cocaine positive patient does not preclude an exposure. This is the largest study of cocaine-adulterating levamisole-related complications in the medical literature.
Keywords: Adulterant, Cocaine, Epidemiology

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16. A novel bedside analysis for formate in methanol poisonings – A pilot study

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Background: Methanol poisonings represent a diagnostic challenge worldwide, and methanol analyses are limited most places. We are in the course of developing a dry-chemistry, strip-based analysis for bedside measurement of the toxic metabolite of methanol, namely formate. We hereby present the results from the first pilot study on formate in whole blood from the prototype under development.
Methods: The method was first developed to be used on buffer solutions, then serum, until reaching the goal of measuring formate in whole blood: The primary identifying reaction is NADH generation from NAD using formate dehydrogenase to oxidize formate to carbonate. An additional enzyme (diaphorase) and a yellow indicator substance are also added, converting the yellow indicator into a strongly blue substance, to be read visually and by a refractometer. A porous membrane was used for vertical separation of the blood cells from the serum, to avoid the need for prior centrifuging. Quantitative measurements were performed using a portable reader, where samples containing 0, 1, 3, 5, 10, and 20mM formate were read three times. A blinded study was also performed on three subjects for visual readings using 0, 2, 5 and 20mM of formate.
Results: The reader showed a correlation of $R^2 = 0.9996$ in serum and $R^2 = 0.9949$ in whole blood. The visual readouts from the pilot study showed a correlation of $R^2 = 0.8966$. Two of three subjects in the latter trial were uncertain about the control versus the low concentrations. All three experienced uncertainties on the exact distinction, but found the trends of the color changes obvious.
Conclusions: These are the first data from the strips-based formate-assay, showing very promising results from the prototype, especially with objective read-outs (by a refractometer). There were, however, some challenges making clear distinctions on the visual scale, prompting for an adjustment in composition of the strips: Especially the distinction between the negative- and the low concentration is of crucial importance. Still, these are very promising first steps towards a potential new era in the diagnostic process of methanol poisoning, as well as screening to eliminate this as the cause. Further steps will be focused on improving color reaction to yield clearer differences, as well as well as stability- and specificity-testing, and adjustments according to these results. The similar wet-chemistry (spectrophotometric) method has a very high specificity, also making the specificity testing promising.
Keywords: Methanol, Diagnosis, Formate
Disclosure: Do you or any member of your immediate family have a relevant financial interest or other relationship with the manufacturer(s) of any of the products or providers(s) of any of the services you intend to discuss?

Commercial Interest	What Was Received	For What Role?
V. Evtodinenko (3rd author) owns the company Evik Diagnostics	This has been done on a contracting basis, and so he owns no rights to the development of the product	All potential financial income in the future has been donated to an ideal foundation to deal with future research on methanol poisoning
KE Hovda, G. Gadeholt and D. Jacobsen are the inventors of the formate dip-stick	This has been done on a contracting basis, and so he owns no rights to the development of the product	All potential financial income in the future has been donated to an ideal foundation to deal with future research on methanol poisoning

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17. Non-fatal adverse events associated with pediatric exposures to single ingredient dextromethorphan cough/cold products

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Rocky Mountain Poison & Drug Center – Denver Health, Denver CO USA

Background: Dextromethorphan (DEX) is the most common antitussive ingredient available in over-the-counter (OTC) cough suppressants and is also available in combination and prescription cough/cold (CC) medications. The purpose of this analysis is to describe the adverse events (AEs) reported among pediatric exposures to single ingredient DEX products only.
Methods: Cases detected from 1Q08–1Q13 were systematically collected from 5 data sources: NPDS, FDA Adverse Event Reporting System, English language medical literature, news/media reports, and manufacturer internal safety reports. Case inclusion criteria for the surveillance program: age <12 y; oral exposure to ≥ 1 cough/cold index ingredient; ≥ 1 AE; event occurred in US between 2008 and 2012. The Pediatric CC Medication Safety Surveillance Expert Panel assessed causal relationship between exposure and AE, estimated the ingested dose, assessed intent of administration, and identified contributing factors. The Expert Panel evaluated dose (therapeutic, supratherapeutic, or unknown) based on established monograph dosing guidelines (21 CFR Part 341). Analysis was limited to non-fatal AE cases involving only a single-ingredient DEX product (no other substances).
Results: Of the 2996 non-fatal cases determined by the Expert Panel to be at least potentially related to an index ingredient, 1229 (41%) involved a DEX-containing product. 518 of these DEX cases (42%) involved a single product with a single ingredient (DEX only). The majority of DEX only cases involved a supratherapeutic dose (81%). Table 1 shows the most frequent AEs by dose. Ataxia was the most common AE reported among all doses; 57% of DEX only cases reported ataxia. When stratified by dose, ataxia was the most common AE reported among supratherapeutic cases (57%), while hallucinations was the most common AE (38%) reported among therapeutic cases.

Table 1. Most common AEs* reported among DEX only cases by dose.

	Supratherapeutic Dose (n = 420)	Therapeutic Dose (n = 16)	Unknown Dose (n = 82)	All Doses (n = 518)
Ataxia	239 (57%)	2 (13%)	54 (66%)	295 (57%)
Somnolence	184 (44%)	2 (13%)	28 (34%)	214 (41%)
Mydriasis	133 (32%)	4 (25%)	23 (28%)	160 (31%)
Hallucinations	104 (25%)	6 (38%)	15 (18%)	125 (24%)
All Other AEs	958	30	168	1156

*Each case could report ≥ 1 AE

Conclusions: DEX containing products are reported frequently (41%) among pediatric cough/cold medication AE cases. Common AEs reported among single-product, single-ingredient DEX cases include ataxia, but the type of event may vary by dose. Analysis of the AEs associated with pediatric exposures to DEX is important to understanding the safety of pediatric CC exposures.
Keywords: Dextromethorphan, Adverse Event, Pediatric

Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

18. Pediatric serious adverse events after exposure to immediate and extended release opioids

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Rocky Mountain Poison & Drug Center – Denver Health, Denver CO USA

Background: There is a constant safety concern surrounding children being exposed to prescription medications. While the imminent danger of pediatric exposures to medications is a well-known threat, it is also important for the public to be aware of potential outcomes and which prescription medications may be the most dangerous. This study examined the frequency of serious adverse events (SAE) in pediatric patients who were exposed to either immediate release (IR) or extended release (ER) prescription opioids.
Methods: Pediatric unintentional exposure cases from 1q2013 through 4q2013 were reviewed by the RADARS® System staff for either IR or ER oxycodone, hydromorphone tablets, morphine tablets, oxymorphone tablets, or tramadol tablets. A pediatric unintentional exposure was defined as a case involving a child less than 6 years of age who accessed a prescription opioid while outside of adult supervision. Cases involving both an IR and ER formulation of the same drug were excluded. SAE cases were defined as exposures resulting in a major medical outcome, death, or the child being admitted to a health care facility. The proportion of SAE cases for the IR and ER groups was calculated.
Results: There were 1,087 total IR cases, and 289 total ER cases observed in this study. The proportion of SAE cases reported to poison centers was greater for the ER formulations of oxycodone, hydromorphone tablets, morphine tablets, oxymorphone tablets, and tramadol tablets, compared to IR formulations of these drugs. One case involved both an ER and IR formulation product, and was excluded from this study. None of the cases within this study resulted in death.
Conclusion: A greater proportion of SAE cases involved ER formulation drugs compared to IR formulation drugs. Pediatric exposures to any formulation of prescription opioid are potentially dangerous. Our findings, however, suggest that children who are exposed to ER formulations are at a higher risk for major medical outcomes, hospitalization, and death, compared to those exposed to IR formulations.

Drug	Extended Release SAEs (n = 108)	Immediate Release SAEs (n = 116)
Hydromorphone	2 (50.00%)	5 (10.42%)
Morphine	49 (36.03%)	3 (16.67%)
Oxycodone	46 (43.40%)	55 (7.33%)
Oxymorphone	4 (33.33%)	0 (0.00%)
Tramadol	7 (22.58%)	53 (5.92%)

Keywords: Opioid, RADARS® System, Pediatric exposures

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Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

19. Ceftriaxone-induced immune hemolytic anemia: Systematic review and proposed screening strategy

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Background: Ceftriaxone-induced immune hemolytic anemia (CIIHA) is a rare but potentially fatal complication of ceftriaxone therapy. Patients with sickle cell disease (SCD) may be at a higher risk to develop CIIHA due to disease prevalence and common use of ceftriaxone. Thus, there is a need to better characterize the phenomenon. We present a report of a case, followed by a systematic review of the literature and suggestions for screening and prevention of CIIHA.
Methods: EMBASE (1947 to January 13, 2013) and Medline (1946 to January 13, 2013) were searched to identify articles on the topic of CIIHA. The search was expanded to include all third-generation cephalosporin agents in both children and adults. Descriptive statistics were performed to establish a set of clinical and laboratory characteristics.
Results: Thirty-seven cases of CIIHA were identified including our patient. The median age was 10 years (range, 0.66–80 years). There were 18 males and 19 females; 26 (70%) were children. The majority had chronic underlying illnesses (70%) of which SCD (22%) and human immunodeficiency virus (HIV) infection (8%) were most common. A variety of other hematologic conditions and, less commonly, recurrent bacterial infections have been implicated sporadically. Previous ceftriaxone exposure was reported in 65% and not reported in 32%. Overall morality was 30%, 64% of fatalities were in children. Clinical and laboratory features included elevated LDH (70%), new-onset dark urine/hemoglobinuria (59%), acute renal failure (46%), acute back-pain (40%), positive direct antibody testing (70%) and anti-ceftriaxone antibodies (68%). The three most commonly reported complications included acute kidney injury, elevated serum transaminases and disseminated intravascular coagulopathy. Thirty-two percent had a preceding, unrecognized, hemolytic episode associated with ceftriaxone. Fatal cases had higher rates of underlying medical conditions, past ceftriaxone exposure and new-onset dark urine/hemoglobinuria.
Conclusion: CIIHA is severe and potentially fatal condition, particularly in patients with SCD. A high index of suspicion, along with screening and monitoring for the appropriate clinical and laboratory features associated with CIIHA, could substantially reduce the morbidity and mortality associated with CIIHA. We therefore suggest repeat urinalysis to detect early, new-onset hemoglobinuria in high risk patients receiving ceftriaxone. Further studies are required to better characterize this condition and validate appropriate screening measures.
Keywords: Adverse drug event, Antibiotic, Pediatric

20. Comparison of iatrogenic adverse drug events occurring in hospital and community settings reported to three poison centers

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Background: An iatrogenic adverse drug event (IADE) is an injury resulting from medication use in a healthcare setting. Few comparison data exists on IADEs occurring in hospital and community settings (e.g., nursing homes, clinics, jails). We characterized reported IADEs resulting from errors occurring in the hospital by comparing them to errors occurring in the community.
Methods: An IADE was any exposure call received by a study poison center (PC) involving an iatrogenic event (e.g., formulation error, wrong medication). Three PCs were recruited (convenience sample) and each performed 50 PC chart reviews in early 2013 using a standardized data abstraction form. IADEs were selected starting from the most recent until fifty were identified. Age, gender, IADE type, implicated medication(s), symptoms, treatments (excluding observation/telemetry), judgment of health effect severity (moderate, major, or death) and level of medical care were collected. ADEs caused by a lay person were excluded. A blinded secondary review of 25 charts by each PC was done to assess inter-rater reliability (kappa statistic). Microsoft Excel and SAS v9.3 were used for analysis.
Results: Data on 150 IADEs were collected (43.3% were hospital IADEs). After stratifying by IADE setting (hospital vs. community), no significant age, gender, or medication differences were found. Hospital IADEs were more likely than community IADEs to be from a formulation error (27.7% vs. 10.6%, $p < 0.01$). Hospital IADEs were more likely to affect the cardiovascular (40% vs. 22.4%, $p < 0.05$), dermatological (20% vs. 3.5%, $p < 0.005$), and genitourinary (10.8% vs. 0%, $p < 0.005$) systems. Hospital IADEs were more likely to need treatment (74.1% vs. 30.5%, $p < 0.0005$) when compared to community IADEs. Hospital IADEs were more likely to result in a clinically significant adverse health effect (70.8% vs. 32.9%, $p < 0.0005$), require specialist consultation (24.6% vs. 2.5%, $p < 0.0005$), and vasopressors (7% vs. 0%, $p < 0.05$). Community IADEs were more likely than hospital IADEs to be the result of a pharmacy dosing error (23.5% vs. 3.1%, $p < 0.0005$) or an incorrect medication given by a pharmacy (43.5% vs. 15.4%, $p < 0.0005$). Community IADEs compared to hospital IADEs more often resulted in gastrointestinal (32.9% vs. 12.3%, $p < 0.005$) or neuropsychiatric (31.8% vs. 13.9%, $p < 0.05$) effects. Inter-rater reliability was 1.00 for all comparisons except: PC 1, IADE type (0.31); PC 2, gender and type of error (0.92).
Conclusion: Hospital and community IADEs reported to PCs differed by type, symptom, treatment, and health effect severity.

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More work is needed to determine how these differences could impact activities designed to reduce IADEs.
Keywords: Adverse drug event, Poison center, Prevention

21. A characterization of cases of severe hyperthermia reported to the ToxIC Registry

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Background: Drugs and medications associated with hyperthermia are ubiquitous. Adverse effects and risk of death in the hyperthermic patient are significant. Our objective is to describe a cohort of cases of severe hyperthermia reported to the ToxIC (Toxicology Investigators Consortium) Registry in order to better characterize the clinical effects and outcome in these patients.
Methods: All cases of hyperthermia, defined as a recorded temperature $>105°$ F, reported to the ToxIC Registry between January 1st, 2011and April 1st, 2014 were extracted using the field specific search function. Descriptive statistics were generated for demographic data, substances involved, clinical effects, treatments, and medical outcomes, as defined by the ToxIC Registry.
Results: Over the study period there were 268 cases of severe hyperthermia. The most common age range was 19–65 years (74.2%,n = 199). 10 cases occurred in individuals less than 6 years old and most were males (62.7%, n = 168). Illicit drugs were identified as the causative agent in 21.3% (n = 57). The most common agent identified was cocaine (5.9%, n = 16). 28 cases (10.4%) were identified as adverse drug reactions. 215 patients (80%) had major CNS abnormalities. The most common toxidrome identified was sympathomimetic (15.0%, n = 40) followed by serotonin (13.4%, n = 36), anticholinergic (4.9%, n = 13), and neuroleptic malignant syndrome (4.5%, n = 12). 63.1% (n = 169) received primarily benzodiazepines or intravenous fluid resuscitation. 80 cases (29.9%) received a specific antidote. Intubation and mechanical ventilation were performed in 29.1% (n = 78) and cardiopulmonary resuscitation in 3 cases. There were 2 deaths reported.
Conclusions: This represents the largest prospective series of severe toxic-hyperthermia ever reported. The most common cases were males with a sympathomimetic toxidrome. Cocaine was the most common agent implicated. Death was a rare outcome, possibly because all cases were cared for by medical toxicologists. These findings may not be generalizable to cohorts other than that reported to the ToxIC Registry.
Keywords: Severe hyperthermia, Toxidrome, ToxIC

22. Atorvastatin associated fulminant liver failure in an 8 week old infant

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Background: HMG-CoA reductase inhibitors (statins) are associated with transient mild transaminase elevations in adults. Their safety in children less than 8 years of age has not been established. We report a case of an 8 week old, 6.2 kg female newly diagnosed with a life threatening dyslipidemia syndrome and prescribed atorvastatin 10 mg daily; the same starting dose recommended for an adult. She developed fulminant liver failure which progressed to multi-organ system failure and death.
Case Report: An 8 week old full term, previously healthy female presented to an emergency department with increased fussiness, low grade fever and an episodes of vomiting over the past day. The patient had similar symptoms 10 days prior, was diagnosed with an "ear infection", prescribed amoxicillin and seemed to improve until 24 hours prior to admission. Lab work was ordered at the time of her 2nd visit. Upon phlebotomy, the patient's blood was described as being "thick and milky" in appearance. A lipid panel revealed a non-fasting triglyceride level of 33,471 mg/dL, total cholesterol of 1428 mg/dL and LDL was unable to be measured. Transaminases were normal at the time of admission. The patient was admitted to the Pediatric ICU and started on atorvastatin 10 mg daily and Lovaza (omega-3-fatty acid) 600 mg. A moderate increase in transaminases developed following the fourth dose of medications (AST 141 U/L, ALT 42 U/L, ALP 594 U/L, total bilirubin 0.8 mg/dL) and a marked increase developed following the sixth dose. Peak transaminases were AST 5075 U/L, ALT of 1404 U/L, total bilirubin 6.5 mg/dL, direct bilirubin 3.5 mg/dL and alkaline phosphatase 898 U/L. Of note, the patient's lipid panel improved to near normal values. Atorvastatin was discontinued after the 6th dose and the patient was transferred to a pediatric specialty hospital for higher level of care. Upon discontinuation, the child's transaminases rapidly trended downward (AST 1623 U/L, ALT 622 U/L, Total Bilirubin 4.8 mg/dL, direct bilirubin 1.5 mg/dL). However, the child developed multi organ system failure thought to be related to a rare cytokine storm syndrome and expired on Hospital Day 10.
Case Discussion: Though statins have commonly been used off-label to treat children with significant dyslipidemias, their safety in children less than 8 years of age and infants is unknown. This is the first published case report of an 8 week old infant treated with a statin. She developed fulminant hepatic failure after initiation of therapy with a dose commonly recommended for patients ten times her weight.
Conclusion: Though use of statins in young children is typically reserved for those with significant dyslipidemias, greater consideration should be given to weight based starting doses.
Keywords: Statin, Fulminant hepatic failure, Infant

23. Inappropriate application of compounded topical pain medication cream leading to significant neurotoxicity

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Background: Inappropriate use of medications may result in significant toxicity. We present the case of a 29 year-old woman who presented with altered mental status and seizure-like activity after dental application of a topical pain cream.

Case Report: A 29 year-old woman with a history of alcohol abuse and seizures presented to the emergency department after having witnessed seizure-like activity at home. Her mother stated that she appeared "altered" and had rhythmic shaking of her arms and legs. There was no evidence of tongue biting or bladder incontinence. Workup revealed a non-anion gap metabolic acidosis. EKG was significant for junctional bradycardia, with a heart rate of 45 beats per minute. Home medications included topiramate, valproic acid, and amitriptyline. Valproic acid and topiramate levels were subtherapeutic. An EEG demonstrated nonspecific findings consistent with toxic metabolic encephalopathy. She was observed uneventfully and extubated on hospital day 4. A comprehensive urine drug screen demonstrated the presence of propofol, caffeine, topiramate, doxepin, ibuprofen, lidocaine, baclofen and ketamine. The patient had not received ketamine, lidocaine, or baclofen during her hospital course. The patient admitted to applying prescribed topical pain cream to her oral mucosa for dental pain.
Discussion: The patient presented with altered mental status and myoclonic jerks after presumed drug overdose. She admitted to applying a topical cream to oral mucosa for dental pain. The compounding pharmacy confirmed the formulation to include pentoxifylline 3%, diclofenac 3%, bupivacaine 1%, gabapentin 6%, baclofen 2%, ibuprofen 3% and ketamine 10% (% = 1 g/100 mL). The compound is dispensed in a pump dispenser with a recommended dose of 1–2 actuations applied topically up to three times daily. A one-month supply consists of 240 gm. An actuation contains approximately 100 mg of ketamine. Ingestion of these medications is consistent with the patient's initial presentation with coma and myoclonic jerks. Baclofen's GABAB agonism may cause coma and seizure. Ketamine is an NMDA antagonist that may cause myoclonus and dissociation. Serum drug levels were not obtained, but the patient's presentation was consistent with ketamine and baclofen toxicity.
Conclusion: When evaluating a patient after overdose, improper use of prescription medications should be included in the differential. This patient applied a compounded topical back pain cream to oral mucosa and presented with significant toxicity. Compounded pharmaceuticals possess unique opportunities for abuse and misuse. Patients should be educated about the risk of improper use of these formulations.
Keywords: Ketamine, Compounded, Baclofen

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24. Adverse drug events: A two-year experience

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Background/Objective: Adverse drug events (ADEs) are a potentially preventable cause of in- hospital morbidity and mortality. We identified themes in severity, medication types involved, nature of error, and the potential role of a toxicologist in managing and preventing these events.
Methods: Two years of standardized ADE reports were obtained from our medical center's internal database. Incidents were classified by hospital location, event type, date, medication(s) involved, severity, and event description. Data were organized quantitatively in each category to identify overall trends in ADE occurrence. Two independent reviewers examined all data, and results were compared for agreement.

Moving forward, we plan to use the recent rollout of an integrated medication management system using barcode technology at our center to compare trends in ADEs pre- and post- implementation.
Results: A total of 3336 cases events were reported during administration (32%), dispensing (34.7%), monitoring (2%), ordering (11%), or transcribing (20.2%). Of the dispensing events, 9.5% were due to misfills of medication management machines. The five drugs most frequently associated with overall ADEs were insulin (4.2%), vancomycin (3.8%), heparin (3.6%), potassium (2.7%) and morphine (1.9%). No associations with day of month or time of year were noted. The most common event types included omitted drug/dose, incorrect drug/dose/time, or extra dose. Among events involving incorrect medication administered, opioids comprised 4 of the top 5 drugs involved (oxycodone, oxycodone/acetaminophen, methadone and morphine respectively). We separately examined events with the National Coordinating Council for Medication Error Reporting and Prevention index severity score E-I to analyze cases where harm reached the patient (n = 125). Characteristics associated with the patient harm included: drug concentration errors and pump programming errors for intravenous drips (28%), patient location in an intensive care unit (22%), or involvement of high-risk (hypoglycemic, opioid or/and antihypertensive) medications (42%). In 59 of these cases (47%), a toxicologist may have provided specific treatment recommendations with regard to antidotes and/or expected effects.
Conclusion: High yield targets for medication safety at our center include medication management machine filling accuracy, opioid administration, insulin administration, and IV pump safety. Toxicologist involvement in cases of ADEs would be beneficial from both treatment and prevention perspectives, and medication safety represents an essential area in which to expand our practice.
Keywords: Adverse drug event, Quality Improvement, Medical toxicology

25. Quantification of pyrimethamine in liquid medication and serum

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Background: Pyrimethamine (PYR) is an antiparasitic medication used for treatment of protozoal infections including toxoplasmosis. The recommended dose for treatment of congenital toxoplasmosis is 1 mg/kg/day for 2–4 days then 0.5 mg/kg/day for one month. Serum PYR concentrations were determined in a 5-month old infant believed to be exhibiting signs of PYR toxicity. The presence of PYR and its concentration in the liquid medication used to dose the infant was also confirmed.
Methods: PYR was quantified in serum using a validated assay. Samples underwent a three step liquid-liquid extraction, and then were dried, reconstituted in toluene and derivatized with butyric anhydride. Samples were then injected on the gas chromatograph with a nitrogen phosphorus detected and separated on a DB-17 capillary column (15m × 0.32 mm I.D., 0.15 mcm film) using a temperature gradient and constant gas flow.
Results: The serum specimen, collected ~18 hours after the last dose contained 3.8 mcg/mL PYR. Four days later PYR concentration had dropped to 1.2 mcg/mL and 11 days post-exposure the

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PYR was below the reporting limit of the assay (0.2 mcg/mL). The liquid medication, which was supposed to contain 2 mg/mL PYR, was determined to have a concentration of 94 mg/mL.

Discussion: Multiple studies have reported concentrations of PYR following different dosing regimens for the treatment of congenital toxoplasmosis in infants. Peak plasma concentrations following doses of 0.5–2 mg/kg/day were 0.29–2.2 mcg/mL with half-lives of 2.7–5.2 days. Although one study reported peak concentrations as high as 2.2 mcg/mL, most infants appear to have concentrations less than 1 mcg/mL and one study of 876 infants established a therapeutic range of 0.08–0.6 mcg/mL. Plasma concentrations in previously reported cases involving toxicity in infants were 1.5, 6.2 and 13.0 mcg/mL.

In this case, the first serum sample was collected 18 hours after the final exposure which is estimated to have been approximately 280 mg of PYR (based on the prescribed dose of 3 mL of a 2 mg/mL solution). Despite the long half-life of PYR it can still be assumed that the peak concentration of PYR would have been achieved well before this serum was collected so it would have been greater than 3.8 mcg/mL and in the range of previously reported toxicities. The concentration of 1.2 mcg/mL 4 days later is consistent with the reported half-life of PYR.

Conclusion: Quantification of PYR in serum was performed to support the treatment of an infant believed to be suffering from PYR toxicity. Treating physicians were able to monitor the excretion of PYR from the infant's system and determine when it was safe to re-start treatment.

Keywords: Pediatric, Pyrimethamine, Analytical toxicology

Disclosure: Do you or any member of your immediate family have a relevant financial interest or other relationship with the manufacturer(s) of any of the products or providers(s) of any of the services you intend to discuss?

Commercial Interest	What Was Received	For What Role?
NMS Labs	Salary	Salary

26. Reduction of paclitaxel (Taxol®) hypersensitivities in beagle dogs with faster infusion and reformulation

O J D'Cruz, J Hsu, B Murdock, V Trieu

Objectives: Solvent-based paclitaxel (Taxol®) is a highly effective and widely used chemotherapeutic agent for solid tumors. Taxol® is formulated in Cremophor EL (CrEL) which triggers hypersensitivity reactions (HRs) requiring premedication. Abraxane®, a CrEL-free human albumin-bound formulation, has low incidence of HRs. IG-001 is a CrEL-free, non-biologic nanoparticle formulation being developed as an alternative to Taxol®. We report the suppression of HRs for Taxol® through faster infusion and suppression of PTX HRs by using an alternative CrEL-free formulation.

Methods: HR reactions to IG-001 vs. Taxol® were evaluated in 65 beagle dogs (33 M and 32 F) in 3 GLP studies. In a dose-escalation study, 9 dogs received a 30 min intravenous (iv) infusion of Taxol® (0.1–1.1 mg/kg) or IG-001 (1.1–4.5 mg/kg). In the single ($n = 24$) or repeated 5-cycle ($n = 32$) dosing studies, dogs received IG-001 (1.5–4.5 mg/kg for 3 hr) or Taxol® (0.1–2.5 mg/kg for 30 min), the latter group with antihistamine premedication. Measurements included clinical observations, body weight, food consumption, hematology, blood chemistry, and histopathology.

Results: Taxol® produced HRs (vasodilation, branchospasm, facial swelling/reddening and urticarial reactions) at 0.1 mg/kg and above, requiring remedial antihistamine treatment and reduction in infusion time (from 3 h to 30 min). In contrast, minimal clinical signs were noted at IG-001 doses of 1.1 or 2.2 mg/kg, but the highest dose (4.5 mg/kg) was associated with moribundity. The MTD was 0.2 mg/kg for Taxol® and > 2.2 mg/kg for IG-001. IG-001 reconstituted to 1.5, 3, and 4.5 mg/ml was given as a 3 h IV infusion. No HRs were observed in these studies; interestingly, HR-type reactions were observed when the drug was diluted to 0.6 mg/ml and administered in the early exploratory dose ranging study. Overall, 100% (43 of 43 treated doses) from the Taxol® group and only 2 of 108 doses from the IG-001 group induced HR-type reactions to PTX formulations ($P < 0.0001$, Chi-square test). Excluding the severe HRs in the Taxol® group, body weight, food consumption, clinical signs, and hematology responses were comparable between Taxol® and IG-001.

Conclusions: We have shown in this study that faster infusion of Taxol® could circumvent HRs and allow the full dosing of Taxol®. Additionally, reformulation of PTX as IG-001 also eliminated the HRs. IG-001 overcomes the disadvantages of Taxol® allowing higher dosing of PTX for improved therapeutic efficacy and safety. The lack of HRs in the 5-cycle dosing study suggests that IG-001 has a low potential to produce HR-type reactions. IG-001 could potentially be a safe and effective alternative to Taxol® and Abraxane®.

Keywords: Antineoplastic, Adverse drug event, Allergy

Disclosure: Do you or any member of your immediate family have a relevant financial interest or other relationship with the manufacturer(s) of any of the products or providers(s) of any of the services you intend to discuss?

Commercial Interest	What Was Received	For What Role?
Sorrento Therapeutics	Stock	Stock

27. Severe pediatric vilazodone toxicity with laboratory confirmation

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Background: Vilazodone is a new antidepressant with few reports of overdose. We present a case of vilazodone ingestion with central nervous system (CNS) depression, electrocardiogram (EKG) changes, and laboratory confirmation.

Case Report: A 3 year-old male without cardiac history, presented after ingesting 320 mg of vilazodone. Vomiting was induced & 3 pills recovered. On hospital arrival he was stuporous, tachypneic, & had dilated pupils. Labs noted: glucose 59 mg/dL, sodium 128 mEq/L, chloride 97 mEq/L. An EKG showed normal sinus rhythm (NSR), one premature junctional contraction (PJC), & normal intervals. Dextrose IV was given. He was intubated with ketamine & succinylcholine. Chest X-ray was normal. Lorazepam & propofol were given for movement & ventilator synchrony, followed by a propofol infusion. Prior to transfer 3% saline & magnesium were

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given IV, sinus pauses & PJCs noted. Propofol was discontinued, & a fentanyl/midazolam infusion was started. Sinus tachycardia, pupil dilation, & normal reflexes were observed after transfer. Repeat EKG showed NSR at 142 bpm, PJCs, & QTc of 460 msec. PJCs resolved within 10 hours of ingestion. The patient was extubated overnight & returned to neurologic baseline. EKG the next morning showed NSR 126 bpm, QTc of 433 msec, & no PJCs. The patient fully recovered.

A standard 9 compound urine drug screen & 61 compound comprehensive analysis were negative except for ketamine, fentanyl, & lorazepam. Serum & urine samples were analyzed with liquid chromatography/mass spectrometry. Serum vilazodone concentrations at 5, 8, & 15 hours were 252, 299, & 213 ng/ml respectively. Urine vilazodone concentrations at 5 & 15 hours were 1153 & 410 ng/ml respectively. N-dealkylation metabolites, amine hydrolysis products, & glucuronides of vilazodone were not identified.

Discussion: Literature on vilazodone toxicity is sparse. A previous case of pediatric ingestion noted somnolence, seizures, hyperreflexia, response to benzodiazepines & barbiturates, & 24 hour recovery. Our case had similar CNS effects & time course. This child did not seize nor have hyper reflexia, but did receive propofol. EKG changes not previously described were also observed. This may be the first case of pediatric vilazodone toxicity with serum & urine confirmation. The absence of vilazodone metabolites is also intriguing. Literature suggests our patient had nearly double the therapeutic adult concentration of vilazodone.

Conclusions: Vilazodone toxicity may cause significant CNS depression, PJCs, seizures, serotonergic toxicity, & mydriasis. Neurologic recovery is fast relative to half-life. Serum & urine levels confirmed vilazodone exposure. Age related differences in metabolism warrant study.

Keywords: Vilazodone, Pediatric, Overdose

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28. Immunoglobulin concentration & venom binding activity of expired snake antivenoms

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Background: Antivenoms are valuable & effective medications. We sought to determine if expiration date correlates with immunoglobulin concentration & if concentration correlates with venom binding.

Methods: South African Institute for Medical Research (SAIMR) polyvalent antivenom, Antivipmyn polyvalent antivenom, & Antivipmyn TRI polyvalent antivenom with expiration dates ranging from 1998–2010 were analyzed. Ninety-six well plates were coated with protein G, incubated with antivenom, then incubated with biotinylated anti-horse IgG. Streptavidin conjugated to β-galactosidase was added. Hydrolysis generated fluorescence proportional to antivenom concentration then quantified with known standards. A similar method assessed venom binding activity, reported as a multiple increase over nonspecific control serum.

Results: SAIMR with expiration dates 4/98, 4/03, 12/05, & 10/10 had respective immunoglobulin concentrations of 7.7, 25.7, 14.4, & 0.5 mg/mL, while unexpired control was 1.2 mg/mL. Respective *Naja nivea* venom binding was 2.8, 2.8, 3.2, & 3.3, while unexpired SAIMR was 3.2. Respective *Naja naja* venom binding was 2.6, 2.6, 3.0, & 3.3, while unexpired SAIMR was 3.2.

Antivipmyn expired in 2010 had immunoglobulin concentration of 0.4 mg/mL, while unexpired control was 0.02 mg/mL. *Bothrops jararaca* venom binding was 5.0 in the 2010 lot, while unexpired Antivipmyn was 5.5. *Crotalus atrox* venom binding was 4.0 in the 2010 lot, while unexpired Antivipmyn was 4.2.

Antivipmyn TRI expired in 2009 had immunoglobulin concentration of 0.2 mg/mL, while unexpired control was 0.4 mg/mL. *Bothrops jararaca* venom binding was 6.7 in the 2009 lot, while unexpired Antivipmyn TRI was 7.0. *Crotalus atrox* venom binding was 4.8 in the 2009 lot, while unexpired Antivipmyn TRI was 4.6.

Conclusions: SAIMR expiring between 1998 and 2010 had variable immunoglobulin concentrations that did not correlate with degree of expiration, nor with venom binding. The 2010 Antivipmyn lot had more immunoglobulin than unexpired control. An inverse relationship occurred between immunoglobulin concentration & venom binding activity. The 2009 Antivipmyn TRI lot had less immunoglobulin than unexpired control. Immunoglobulin concentration directly correlated to *Bothrops jararaca* venom binding activity, & inversely correlated to *Crotalus atrox* venom binding activity.

Limitations: Results may not apply to the entire expiration lot. Fab fragment analysis with this method may not accurately reflect *absolute* concentration (as with affinity purified antivenoms), or binding, but significant *relative* variability in concentration & venom binding is demonstrated. Safety of expired antivenom is unknown.

Keywords: Expired Antivenom, Snake bite, Venom

29. Nomogram line crossing in acetaminophen combination product overdose

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Background: The Rumack–Matthew nomogram (RMN) predicts the risk of hepatotoxicity after acute acetaminophen (APAP) overdose based on a level obtained ≥ 4 hours post-ingestion. After coingestion of xenobiotics that slow gastrointestinal motility, patients may manifest "line-crossing" with a non-toxic 4 hour APAP and a subsequent level that is above the nomogram treatment line. The aim of this study was to estimate the incidence of line-crossing after acute overdose of APAP combination product (ACP) containing an opioid or diphenhydramine (DPH).

Methods: This was a review of data collected prospectively at a single regional poison center (RPC). Entry criteria included: (1) acute ACP overdose, (2) presentation to a health care facility (HCF) within 4 hours of ingestion, and (3) age > 12 years. Standard RPC recommendations to HCFs after ACP overdose included obtaining a 7–8 hour APAP level if the 4 hour level was detectable but below the RMN treatment line. N-acetylcysteine (NAC) treatment was then recommended if the 7–8 hour level was above the treatment line. RPC records were reviewed for 4 and 7–8 hour APAP levels, initial and repeat aminotransferases, and NAC treatment.

Results: Between January 2011 and March 2014, 68 patients met entry criteria. 70 (73.5%) were female. Mean age was 27.4 ± 12.7 years, and median age was 22.5 years. 29 patients received NAC.

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Three patients (4.4%, 95% CI 0.9, 12.4) were line crossers with nontoxic APAP levels at 4.5, 4, and 4 hours of 88, 145, and 118 mcg/mL, respectively. Their repeat levels at 8.5, 7, and 7.5 hours were 78, 99, and 101 mcg/mL, respectively. ACPs in these cases contained DPH, hydrocodone, and oxycodone. All 3 patients were treated with NAC and none developed liver injury. Two non-line crossers had alanine aminotransferase (ALT) >100 but <200 U/L at presentation that subsequently improved. Both were treated with NAC. An additional 3 patients had 7 or 8 hour APAP levels that were greater than their 4 hour levels, but below the RMN treatment line.

Conclusions: After acute overdose of APAP combination products containing opioids or DPH, a 4 hour APAP level that is detectable but below the RMN treatment line should be followed by a 7–8 hour level. Repeat APAP determination may be unnecessary if the 4 hour level is sufficiently below the treatment line. Larger studies are needed to better define such a threshold.

Keywords: Acetaminophen (paracetamol), Opioid, Anticholinergic

30. A comparison of urine and oral fluid testing for drugs of abuse among emergency department and ambulatory clinic patients

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Background: Testing for drugs of abuse can be done through blood, urine or oral fluid. Collection of oral fluid has the potential to be more efficient and less invasive than collection of urine or blood. Few data exist on the comparison of urine and oral fluid testing for the identification of drugs of abuse. The purpose of this study was to compare urine testing with oral fluid testing for the detection of drugs of abuse.

Methods: This was a prospective, un-blinded study conducted between June 2013 and September 2013 at a tertiary care university hospital. Included were English-speaking subjects 18 years of age or older who presented to an emergency department or ambulatory clinic and reported the use of at least one medication. Excluded were prisoners, subjects for whom both a urine and oral fluid sample were not obtained, and subjects unable to give informed consent. Enrolled subjects provided a urine and an oral fluid sample. The oral fluid was collected using the Quantisal® device. All samples were tested by liquid chromatography-tandem mass spectrometry for the following drugs: opioids, cocaine, tramadol, benzodiazepines, amphetamines, heroin, methamphetamine, methadone and phencyclidine. Agreement and kappa scores for urine and oral fluid detection of these drugs was performed with 95% confidence intervals (CI) (Table 1).

Results: 492 subjects were eligible for enrollment. 252 subjects were included. 161 (64%) subjects were male. Average age was 61 years. 130 subjects (52%) were from the emergency department, and 122 subjects (48%) were from ambulatory clinics. Of these 122 subjects enrolled from ambulatory clinics, 44 (36%) were from the heart failure clinic, 74 (61%) were from the kidney clinic, 3 (2%) were from the cardiology clinic and 1 (1%) was from a transition of care clinic. The results of agreement for urine and oral fluid testing are listed in the Table 1.

Conclusion: Overall, the strength of agreement between urine and oral fluid testing for the detection of drugs of abuse is highly variable. Notably, agreement was very good or good for the opioids. The poor agreement among the other drugs tested may reflect low sample size. Future work should involve a larger sample size.

Table 1. Agreement of urine testing versus oral fluid testing of drugs.

Analyte	Agreement	Kappa	95% CI	Strength of Agreement
Opioids	95.0	0.87	0.80–0.94	Very Good
Cocaine	99.6	0.80	0.41–1.00	Good
Tramadol	94.4	0.71	0.57–0.85	Good
Benzodiazepines	94.8	0.79	0.68–0.90	Good
Amphetamine	98.4	0.49	0.07–0.92	Moderate
Heroin	98.4	−0.01	0	Poor
Methamphetamine	96.0	0	0	Poor
Methadone	98.8	0	0	Poor
Phencyclidine	0	0	0	–

Keywords: Drug of abuse, Laboratory, Opioid

31. Acetaminophen levels prior to 4 hours: Don't just do something. Stand there!

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Background: Consensus recommendations for acute acetaminophen (APAP) exposure include a serum APAP level at ≥ 4 hours and plotting on the Rumack-Matthew nomogram (RMN) to determine the need for N-acetylcysteine (NAC). The RMN was developed to determine hepatic risk in acute APAP exposure and not as a dedicated NAC treatment decision tool. This study was undertaken to determine the rate of pre-4-hour APAP levels, whether patients subsequently have an appropriately timed test, and if the RMN is used properly in making NAC treatment decisions.

Methods: We conducted a retrospective study at 3 regional poison centers of acute APAP exposures between 1/1/13 and 12/31/13. Cases were analyzed for demographics, timing of serum APAP levels and application of the RMN in NAC treatment decisions.

Results: 1,123 cases of acute APAP exposure were reviewed. 523 (47%) presented to a healthcare facility within 4 hours and required an APAP level. Three cases were eliminated for inadequate documentation. There were no significant differences between centers with regard to patient age, gender, exposure reason, timing of APAP levels, or rates of improper use of the RMN in NAC treatment decisions. Of 520 acute APAP exposure cases presenting within 4 hours: 95 (18%) were between 0 and 5 years; 14 (3%) between 6 and 12 years; 185 (36%) between 13 and 19 years; and 226 (43%) ≥ 20 years. Mean age was 21 +/- 14.8 years; 343 (66%) were females; 411 (79%) were coded as intentional and 107 (21%) as unintentional exposures; and 309 (59%) had a pre-4-hour APAP level obtained. Of those 309, 127 (41%) did not have a subsequent APAP level drawn that allowed a RMN-based NAC treatment decision within 8 hours. In 11 (4%) who had a pre-4 hour level obtained, poison specialists documented provider resistance to the recommendation to obtain a properly timed APAP level. Overall, only 85% of patients presenting within 4 hours of exposure had

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an APAP level that allowed proper application of the RMN and 97 (19%) had NAC treatment decisions that were not based on proper application of the nomogram. Ten patients had detectable APAP at ≤ 2 hr, no follow-up and no NAC. One patient, without coingestants, had a 2 hour level of 31 μg/mL and a 4-hour level of 176 μg/mL.
Conclusions: Patients with an acute exposure to APAP and presenting within 4 hours, have pre-4-hour APAP levels obtained 59% of the time and 19% of patients are not managed on the basis of a properly timed APAP level and/or proper application of the RMN. This results in unnecessary tests and unnecessary NAC treatment, and the possibility of non-treatment of at-risk patients. We speculate that a dedicated treatment nomogram may increase the rate of appropriately timed APAP levels and improve NAC treatment decisions.
Keywords: Acetaminophen (paracetamol), N-acetylcysteine, Antidote

32. A descriptive analysis of AST and ALT rise and fall following acetaminophen overdose

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Background: Early risk prediction following acetaminophen (APAP) overdose is based on the interpretation of readily available laboratory tests including serum APAP, aspartate aminotransferase (AST) and alanine aminotransferase (ALT). One recently proposed risk stratification tool, the APAPxAT multiplication product, uses either AST or ALT, whichever is higher, yet the interrelation of AST and ALT is not well known for APAP-induced hepatic injury. Many centres assay only ALT but not AST. The objective of this investigation is to describe the kinetics of AST and ALT release into and clearance from the circulation following APAP overdose.
Methods: A structured, explicit medical record review of patients greater than 16 years of age with both a serum APAP > 100 μmol/L and peak AST or ALT > 100 IU/L (measured within 24 hours of each other), identified using a computerized search of laboratory investigations from a single site from 1987 to 2013. A single reviewer used a standardized data sheet to collect demographic and laboratory information including time of APAP ingestion and antidote administration. Patients were excluded if the aminotransferase elevation was deemed secondary to an alternative cause (e.g. serial AST or ALT measurements stable and serum APAP concentration within therapeutic range).
Results: Among the 80 potentially eligible cases identified, 66 were deemed secondary to APAP overdose and analyzed. Of these, the mean age (SD) was 39 (18) years, 41 (63%) were female, and ethanol was co-ingested in 14 cases (21%). Twenty-six patients (39%) developed hepatotoxicity (peak AST or ALT > 1000 IU/L), 26 (39%) coagulopathy (INR > 2), and 19 (29%) both. Two patients (3%) were referred for hepatic transplant and 4 (6%) others died. During the release phase, AST and ALT appeared in the serum in a closely aligned 1:1 ratio, exceeding a 2:1 ratio in only 4 patients, 2 of whom ultimately died. During the elimination phase, the half-life (IQR) of AST was 15.3 (12.3, 19.4) hours, and of ALT 39.6 (34.6, 47.8) hours. Using an aminotransferase falling to below 50% of peak as the basis for discontinuing acetylcysteine in the 36 patients with relevant data, antidotal treatment would have been stopped 24 (IQR 15, 43) hours earlier (and in no cases later) using AST rather than ALT.
Conclusions: The release of AST and ALT into the circulation appears tightly linked and numerically similar. Therefore, either can be used for early risk stratification tools when only one is known. Once the aminotransferases peak, AST returns to baseline more quickly, allowing earlier discontinuation of antidotal therapy.
Keywords: Acetaminophen (paracetamol), Hepatotoxicity, N-acetylcysteine

33. Do rapid comprehensive urine drug screens change clinical management in children?

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Background/Objectives: Multiple studies conclude immunoassay urine drug screens (UDS) rarely change clinical management. The comprehensive UDS at our institution detects over 300 substances using enzyme immunoassay (EIA) and gas chromatography-mass spectrometry (GC/MS). On average, our rapid comprehensive UDS is resulted within 2.5 hours on weekdays and within 5 hours on the weekend. We sought to determine whether this rapid, expansive UDS altered clinical management in the pediatric population.
Methods: This study was approved by the IRB. All patients > 1 month of age and < 18 years of age in which a comprehensive UDS was obtained from January 1, 2012 to December 31, 2012 were eligible for the study. Assuming that clinical management would not be altered in at least 90% of cases with a confidence interval of 95% and an alpha error of 5%, we calculated a sample size of 122 cases. Four board-certified medical toxicologists reviewed a total of 160 cases (40 cases per toxicologist). Variables and outcomes were determined a priori and data abstraction was performed in a systematic manner. Cases were assigned based on a random-number generator. In addition, each toxicologist reviewed 12 randomly chosen cases from the other 3 toxicologist's cases to determine inter-rater reliability. All toxicologists reviewed any case in which a comprehensive UDS was believed to have changed clinical management.
Results: A total of 908 rapid comprehensive UDS were performed during the study period. 160 out of 908 cases were randomly chosen and reviewed. Of the reviewed cases, average age was 10.5 years (range 1 month to 18 years). Male = 83. Female = 77. Most were ordered from the ED (101/160 = 63%), followed by the floor (36/160 = 23%), outpatient setting (14/160 = 9%), and ICU (9/160 = 6%). 111/160 (69%) had a history of ingestion. Of the 160 randomly chosen cases that were reviewed, only 3 cases were found in which overall clinical management was altered based on the results of the comprehensive UDS. All 3 cases were < 3 years old with a UDS positive for amphetamines. One patient was positive for methamphetamine, 1 positive for phenylpropanolamine, and 1 positive for amphetamine only. In all 3 cases, police, Division of Family Services, and social work were involved based on the results of the comprehensive UDS. In no case did the acute clinical management change due to the results of the comprehensive UDS. Kappa = 1.

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Conclusions: A rapid comprehensive UDS did not change acute clinical management in pediatric patients at our institution. However, the results of the UDS had some social and medicolegal ramifications. Further study is warranted.
Keywords: Laboratory, Pediatric, Ingestion

34. Occult prescription opioid abuse detected by expanded urine drug screening vs. prescription monitoring program query

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Background: Opioid abuse is a growing problem with multiple components including inappropriate pain treatment and prescribing of pain relievers, and addictive behaviors facilitated by the low price of heroin. The rise in accidental opioid deaths, now exceeding other causes of injury-related death, is sometimes exacerbated by multiple drug use or adulterated opioids (e.g. fentanyl derivatives). We report a pilot study comparing the prevalence of unexpected opioid positives in expanded urine drug testing compared with state-based Prescription Monitoring Program (PMP) reports.
Methods: Overdose patients enrolled in a study of a urine acetaminophen and drugs of abuse point-of-care device (Triage® TOX Drug Screen; Alere, San Diego CA) were interviewed and a chart review conducted for evidence of opioid use. They had additional urine screening performed by liquid chromatography-time of flight/mass spectrometry (LC) (LC1200- TOF 6230, Agilent Technologies, Santa Clara CA). These results were compared to a hospital-based multianalyzer immunoassay for common drugs of abuse (cobas 6000, Roche Diagnostics). The presence or absence of "concern" on the state PMP was determined for these individuals.
Results: 54% (13 of 24 individuals) were positive by LC for one or more opioids. Roche immunoassay results were positive in 5 (38%), while the point-of-care TOX was positive in 9 (69%). Medical care providers had no suspicion of opioid use in 5 (38%) of the 13 opioid-positive individuals; only 1 of these would have been identified by accessing PMP data, but the fentanyl use identified would not otherwise have been detected. While 8 patients were suspected of opioid use, the LC results identified unexpected opioids in all of these patients (from 1–3 additional non-metabolite opioid products per patient). Three patient specimens were positive for tramadol; tramadol was the only opioid found in 2 patients. 6-MAM was found in one patient with negative immunoassays for opiates.
Conclusions: Expanded testing reveals a high prevalence of unexpected opioid use in a population of polypharmacy overdose patients. A significant minority have no history of opioid use available to EMS or ED providers. Urine immunoassays vary in sensitivity and PMPs are not likely to identify these individuals, but do sometimes identify otherwise unsuspected use. While many studies have shown that analytic testing identifies unsuspected substances, sometimes of questionable clinical relevance, the finding of multiple unexpected opioids suggests the need for expanded testing and the use of multiple systems to identify patients with the dual diagnoses of mental illness and substance abuse.

Keywords: Opioid, Abuse, Laboratory
Disclosure: Do you or any member of your immediate family have a relevant financial interest or other relationship with the manufacturer(s) of any of the products or providers(s) of any of the services you intend to discuss?

Commercial Interest	What Was Received	For What Role?
Alere	research support	research support

35. Absorption of salicylate powders v. tablets: A poison center observational study

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Background: Salicylate (ASA) absorption following ingestion of tablet formulations can be prolonged for greater than 24 hours due to pill concretions, enteric coating and/or pylorospasm. Accordingly, serial levels are typically recommended to assess for prolonged absorption. However, there is little published information on the absorption characteristics of ASA in powder formulations. It is unclear whether delayed ASA absorption occurs following overdose of powder formulations. The objective of this study was to compare the absorption characteristics of powder and tablet formulations of ASA at a single center.
Methods: Electronic records from a single accredited poison center were searched for single substance acute or acute-on-chronic ingestions of ASA in powder form (2002 – January 2014). Other inclusion criteria were age $>$ 12 years, documented time of ingestion, treatment in a health care facility within 9 hours of ingestion and at least one detectable serum ASA level. An identical search for ingestions of ASA tablet products in 2012 and 2013 was undertaken for comparison.
Results: Sixteen of 25 powder and 22 of 49 tablet cases identified met inclusion criteria for analysis. Excluded cases did not have documented serum levels. Patients who ingested powders were older (median 41 y; range 14–77 y) than those who ingested tablets (median 23 y; range 13–65 y). The gender mix in both groups was similar. The median initial and highest measured serum [ASA] and treatments received in the powder and tablet groups are listed in the Table 1. Median ASA concentrations for tablet ingestions were 22, 23, 23, and 21 mg/dL at 2.3, 7.3, 10.8, and 18.5 hours, respectively. The only patient dialyzed ingested a powder, had an initial level of 96 mg/dL and repeat level of 90 mg/dL prior to hemodialysis.
Conclusions: All serum ASA concentrations following ingestion of powder formulations were declining by 3 hours post ingestion. In comparison, repeat serum ASA concentrations following ingestion of tablets increased in 11 of 22 (50%) cases,

Table 1.

	Powder	Tablet
N	16	22
Initial (range) [ASA], mg/dL	34 (20–96)	22 (1–66)
Time of initial [ASA]	3.0 h	2.3 h
Highest (range) [ASA], mg/dL	37 (20–96)	32 (11–66)
Time to highest [ASA]	2.8 h	5.8 h
Activated charcoal	38%	73%
Sodium bicarbonate (IV)	31%	45%

and median ASA levels in the tablet group remained essentially unchanged for 18 hours post ingestion. These findings suggest that prolonged absorption does not occur following ingestions of ASA powders, even in patients with significantly elevated serum levels.

Keywords: Salicylate, Pharmacokinetics, Decontamination

Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International	honorarium	honorarium

36. Delayed acetaminophen absorption resulting in hepatotoxicity

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Background: Reduced gastrointestinal motility can alter the toxicokinetics of acetaminophen (APAP) poisoning, resulting in delayed or double peak serum concentrations. We report two cases of altered toxicokinetics due to delayed gastrointestinal absorption.

Case Reports: A 17-year-old man, reported a 675mg/kg ingestion of APAP and dextromethorphan with undetectable (< 66 µmol/L) acetaminophen concentration up to 8 hours post-ingestion. Coagulations and liver function tests were normal. He was not treated with N-acetylcysteine (NAC). At 24 hours post ingestion, he complained of abdominal pain and developed altered mental status. A venous gas showed a pH of 7.24, serum bicarbonate11.1 mmol/L, aspartate aminotransferase (AST) = 427 IU/L, alanine aminotransferase (ALT) = 645 IU/L, and APAP at 998 µmol/L. At 72 hours Post ingestion, the international normalized ratio (INR) peaked at 9.86, aspartate aminotransferase (AST) at 7840 IU/L, and alanine aminotransferase (ALT) at 9696 IU/L. Intravenous N-acetylcysteine (NAC) therapy was begun at 24 hours post ingestion. The patient had complete resolution of hepatotoxicity.

A 37-year-old woman ingested an unknown amount of APAP with ethanol and stabbed herself in the abdomen. Her initial APAP concentration was 1285.9 µmol/L. No gastrointestinal decontamination was performed. IV N-acetylcysteine (NAC) protocol was started 2 hours after arrival. She developed an ileus post surgery for the stab wounds. After completion of the 21 hours of N-acetylcysteine (NAC) protocol, her APAP concentration returned < 66 µmol/L and her transaminases were normal. After the resolution of the ileus, repeated acetaminophen serum concentration peaked at 363.3 µmol/L 52 hours post admission. N-acetylcysteine (NAC) infusion was never interrupted. At 76 hours post admission the ileus resolved and APAP concentration returned undetectable (< 66 µmol/L). Transaminases and INR were always normal. N-acetylcysteine (NAC) infusion was stopped.

Discussion: There are few reported cases in the literature with delayed peak APAP concentration or a second peak most often related to co-ingestion of opioids or diphenhydramine. Our cases are unique because we were unable to find any other case of APAP overdose in which the concentration became undetectable then peaked significantly following surgery or with an undetectable concentration up to 8 hours post ingestion.

Conclusions: Reduction in gastrointestinal motility secondary to trauma/surgery and large ingestions with agent known to decrease gastrointestinal transit must be factors to consider when determining whether to initiate or discontinue treatment as well as how long to monitor APAP concentrations.

Keywords: Acetaminophen (paracetamol), delayed absorption, hepatotoxicity

37. Sympathomimetic and dissociative toxicity with end organ damage associated with the use of gacyclidine: A case series

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Background: Over the past decade there has been a sharp increase in the number of newly identified synthetic drugs. These new drugs are often derivatives of previously abused substances but have unpredictable toxicity. One of these drugs is gacyclidine, a derivative of phencyclidine (PCP). Gacyclidine has been studied as a neuroprotective agent in trauma and as a therapy for soman toxicity. There are no previous reports of its use as a drug of abuse.

Case Series: During a two month period in the summer of 2013, a series of patients with severe agitation and end organ injury were identified in an urban academic Emergency Department (ED). A urine drug of abuse screen was performed on all patients and serum samples were sent for comprehensive toxicology analysis. A total of 5 patients were identified as having agitation, rhabdomyolysis, and elevated troponin (Table 1). They reported use of methamphetamine and all five patients had urine drug screens positive for amphetamine. Comprehensive serum analysis identified methamphetamine in 3 cases, cocaine metabolites in 1 case, and a potential untargeted match for gacyclidine in all 5 cases. No other drugs of abuse were identified

Case Discussion: This is the first series of cases describing possible gacyclidine intoxication. The possible source of the

Table 1.

Patient Number	One	Two	Three	Four	Five
Age and Gender	27 y/o Male	49 y/o Male	47 y/o Male	47 y/o Female	47 y/o Male
Initial Heart Rate[a]	167	123	128	162	75
Initial Blood Pressure[b]	141/119	58/26	119/58	137/90	85/44
Initial Temperature[c]	39.2	37.3	37.4	38.1	35.6
Peak Creatinine Kinase[d]	2,413	28,305	13,923	1,780	62,694
Peak Serum Creatinine[e]	1.84	2.07	3.84	1.47	5.9
Peak Troponin I[f]	0.08	8.07	0.21	0.40	not done

[a]beats per minute, [b]mmHg, [c]degrees celsius, [d]units/liter (normal range 0–250), [e]mg/dL (normal range 0.44–1.27), [f]ng/mL (normal range < 0.04)

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gacyclidine is unknown but it may have been an adulterant in methamphetamine as all patients who were questioned reported methamphetamine use. These cases highlight the importance of screening for new drugs of abuse when patients present with atypical or severe symptoms.

Conclusion: Gacyclidine has the potential to become a drug of abuse both by itself and in conjunction with other agents and toxicity from gacyclidine can be severe. It is the role of the medical toxicology field to identify new agents such as gacyclidine early and to attempt to educate the community on the dangers of these new drugs of abuse.

Keywords: Drug of abuse, Phencyclidine, Adulterant

38. Identification and quantification of the reactive metabolite n-hydroxy-para-amino-benzoic acid in a cyanotic patient after benzocaine use

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Methemoglobinemia (MetHb) after exposure to benzocaine (BZC) has been reported for more than 50 years; the mechanism has not been previously established. Direct administration of BZC to blood does not produce MetHb. Due to the lipophilicity and rapid acetylation in the tissue, little BZC reaches the liver for hepatic biotransformation. However, human livers have been shown to produce MetHb forming N-hydroxyl metabolites from BZC. The reactive metabolite has not been specifically identified, but is believed to be N-hydroxy para-amino benzoic acid (N-OH-PABA), which has not yet been identified in man. We report a case of BZC-induced MetHb with the first identification and quantification of the reactive metabolite responsible for the oxidative stress: N-OH-PABA.

Case report: An eight year old male was admitted to a hospital for an appendectomy. Several applications of BZC spray (Cetacaine) were used during multiple attempts at nasogastric tube placement. The patient subsequently became cyanotic with an initial MetHb level of 32.9%. Methylene blue was administered and the patient promptly responded with resolution of cyanosis. MetHb level post methylene blue was 2.3%. Blood taken within 20 minutes of the initial symptoms contained benzocaine (5.2 ug/mL), bupivacaine (740 ng/mL), lidocaine (530 ng/mL), acetaminophen (12 ug/mL), midazolam (60 ng/mL), PABA and N-OH-PABA (35 ng/mL). The patient recovered without incident.

Methods: Serum was analyzed using Liquid Chromatography-Quadrupole Time-of-Flight Mass Spectrometry. Gradient elution chromatography was used to separate analytes in the comprehensive drug panel (320 drugs) used for analysis. Mass spectrometry was done using an electrospray ionization source run in negative and positive polarities. A reference standard for N-OH-PABA was synthesized for confirmation and quantification. The compound is quite unstable so the level measured may be an underestimate.

Discussion: When applied topically the majority of BZC is acetylated by N-acetyl transferases with a small amount converted to PABA. This pathway appears to be a saturable process. Genetic polymorphisms allow for "rapid" and "slow" acetylators. Additionally a portion of BZC undergoes ester hydrolysis to aminobenzoic acid and ethanol by serum pseudocholinesterase. In rare cases with poor acetylators and/or large doses, sufficient BZC may reach systemic circulation and hepatic metabolism, where generation of N-OH PABA may be sufficient to produce MetHb.

Conclusion: MetHb from BZC occurs via a hepatically produced metabolite N-OH-PABA. This is the first identification of N-OH-PABA in man after BZC induced MetHb.

Keywords: Benzocaine, Methemoglobin, N-hydroxy-PABA

39. Free and total digoxin concentrations- hospital laboratory capabilities: Survey

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Background: Monitoring serum digoxin (DIG) concentrations (Cp) after DIG immune Fab (DIF) may help ensure appropriate dosing and duration of therapy. However, historically, the administration of DIF is thought to interfere with the immunoassays by competing with assay antibodies resulting in falsely elevated total DIG Cp (tDIG). The degree of interference is variable and dependent on incubation time, washing/precipitation steps, and antibody affinity for the bound and free DIG. In an 8-year retrospective review of regional poison center (RPC) DIG cases in which DIF was administered, recommendations regarding DIG Cp after DIF were found to be inconsistent. Out of 112 included cases, health care professionals were encouraged to obtain further DIG Cp after DIF in 24 (21.4%) cases, 14 (12.5%) were told to hold all further DIG Cp, and 12 (10.7%) were told to obtain only free DIG Cp (fDIG). Despite these recommendations little is known regarding overall lab capability and types of assays used to measure fDIG and tDIG. As a result, a statewide survey of hospital laboratories was conducted.

Methods: Utilizing Crystal Reports (version 11.0), all DIF coded cases were retrospectively queried from a regional poison center (RPC). Of 112 DIF coded cases from 11/2004 to 10/2012, 62 hospitals who reported patients with DIG toxicity receiving DIF to a RPC were included. Each hospital was contacted and asked to provide the digoxin serum testing capability (free, total, both, or none), type of assays utilized, and whether the lab was aware that the administration of DIF could affect serum DIG Cp.

Results: Out of 62 hospitals, 61 (98%) were able to be contacted. Only 1 hospital (2%) reported the capability to measure tDIG and fDIG in house, 57 (93%) were only able to measure tDIG, and 3 (5%) did not have the capability to measure either. fDIF were available as send outs in 60 laboratories (98%) with a return time ranging from 24 hours to 5 days. In no instance was the tDIG Cp treated differently if the patient received DIF or not. When asked about measuring DIG Cp after DIF administration, 47 of 61 (77%) did not know if DIF had an effect on DIG Cp, 17 (28%) stated that total was affected/elevated after DIF (4 had a policy about not measuring DIG Cp after DIF), and 6 (10%) stated that DIF has no effect on DIG Cp.

Conclusions: The majority of hospitals were only able to measure tDIG with the option of having fDIG as a send out. Few were aware

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and able to educate providers that DIF may have some effect on DIG Cp. Based on these current findings, tDIG should be interpreted with caution and fDIG should not be recommended after the administration of DIF due to the inability to perform the test in house and significant lag time.

Keywords: Laboratory, Cardiac glycoside, Overdose

40. Blood concentrations of hydroxychloroquine and its metabolites in hydroxychloroquine-poisoned patients: Usefulness on admission to the intensive care unit and pharmacokinetics

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Aims: Blood hydroxychloroquine (HQ) concentrations are useful to monitor treatment of autoimmune diseases. Major HQ metabolites are active, but their respective contribution to the efficacy/toxicity of treatment is poorly understood. Despite its wide use and safety, severe HQ poisonings have been reported. Usefulness of HQ concentrations in this setting remains unclear. Our objectives were: 1- to investigate the relevancy of blood HQ concentrations in poisonings admitted to the intensive care unit (ICU); 2- to report the pharmacokinetics (PK) of HQ and its metabolites in blood in one severe poisoned patient.

Methods: The charts of seven HQ poisonings were reviewed, including one massive 6g HQ ingestion case in a 25-year-old woman resulting in refractory cardiovascular failure requiring high-dose vasopressors and extracorporeal life support. All the 7 patients survived. HQ (in 7 cases) and its metabolites (in 1 case) were quantified. For the simultaneous measurement of HQ and its metabolites, we used a sensitive and specific method using liquid chromatography coupled to tandem mass spectrometry. PK was modeled using ADAPT5 software.

Results: There was a significant relationship between blood HQ concentrations on admission, the presumed ingested HQ doses and the severity of cardiovascular toxicity. In the massive poisoned patient, HQ concentration was 19.5 mg/L on ICU admission (4h after HQ ingestion) and decreased to 2.2 mg/L on day 9. Monodesethyl-HQ, desethyl-Q and bisdesethyl-Q, the 3 HQ metabolites, were quantified at 1123, 465 and 91 µg/L, respectively. Based on our two-compartment model, half-lives of 8.7, 88.2, 462.1 and 69.3 h were calculated for HQ and its metabolites, respectively.

Conclusion: Like with chloroquine, blood HQ concentrations on ICU admission are significantly correlated with cardiovascular severity in poisonings, suggesting their usefulness in patient management. Concentrations of HQ metabolites remain low and similar to those found during prolonged treatments. In one severe HQ-poisoned and extracorporeal support life support (ECLS)-treated patient, HQ half-life was shorter than previously reported, supporting indirect ECLS contribution to the drug elimination. Further studies are required to investigate the exact clinical contribution of the simultaneous measurement of HQ and its metabolites to the management of HQ-poisoned patients.

Keywords: Intoxication, Medical toxicology, Pharmacokinetics

41. Comparative assessment of the FED (Fractional Effective Dose) and AEGL (Acute Exposure Guideline Levels) threshold concept on carbon monoxide

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Objective: Carbon monoxide (CO) poisoning is a major cause for concern, where it often happened undetected due to the non-specific nature of its symptoms. According to the World Health Organisation CO poisoning, with an annual death rate of 2.2/100,000 in the European Union, is a health risk which should not be underestimated. CO is a by-product of the incomplete combustion of carbon-containing sources such as gas, oil, coal and wood. This poses a great health risk for humans, especially in closed rooms.

Method: In a BfR cooperation with the Federal Institute for Materials Research and Testing (BAM) systematic fire tests have been carried out. From these results concentration-time curves for CO could be evaluated as the basis for a computer simulation. By entering various measured parameters and using this numeric simulation different fire scenarios could be assessed. First the concept of Fractional Effective Dose (FED) was used in order to establish the entry time of unconsciousness or death. In a further risk evaluation these results were compared with those of the Acute Exposure Guideline Levels (AEGL).

Results: The comparative assessment should clarify, how far existing threshold concepts FED and AEGL can be used for effective CO risk evaluation. Altogether it could be shown, that the use of a charcoal grill in a closed room can rapidly lead to unconsciousness of the people present in the room. For evaluating the entry time of incapacity or death in closed rooms the FED concept proves to be the most convincing. Based on mathematical theory, it includes the most relevant parameters in the process of CO poisoning. In comparison, it became clear that the AEGL concept for monitoring carbon monoxide poisoning in closed rooms is less useful. Where there is a CO emission source in a room, within a short time a much higher concentration of CO can be reached than is foreseen with AEGL. But for rapid assessment of acute hazardous situations outdoors, the concept of AEGL, due to the simplified representation of CO concentrations for exposure time, is the optimal solution and preferable. Due to the CO physico-chemical properties and the great chemical affinity to hemoglobin we feel, that both concepts FED and AEGL are underestimating the real risk.

Conclusion: Extending the fire test findings and the comparative FED/AEGL assessment, it is clear that the risk protection of people is the most important task. The aim is to eliminate health risks which could lead to incapacity or death, by taking various preventative measures. As an additional important regulatory measure gas detectors which could register dangerous levels of CO, should be obligatory in Germany.

Keywords: Carbon monoxide, Laboratory, Surveillance

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42. Lung damage due to low-viscosity lamp oils based on petroleum distillates or paraffins as an example for delayed regulatory toxicological measures to minimize consumer risks in Germany and Europe

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Background: Cases of poisoning involving liquid hydrocarbons in humans have become known since the beginning of the last century. In the 1950s, poisoning of this type constituted the main cause of hospitalization of cases of poisoning in children involving household chemicals in the USA. For the first time in 1989, confirmed indications of a special risk for young children resulted from the first annual report of the German Berlin Poison Information Centre (PIC).
Method: Regular enquiries carried out by the BfR based on the cases of poisoning reported by physicians showed a clear increase in the number of cases due to the ingestion of lamp oils and liquid fuels with severe health effects, also in a retrospective view dating back to about 1970 in the former Federal Republic of Germany.
Results: Based on the results of different German research projects, it was possible, for the first time in 1993 to identify the attractively coloured and scented lamp oils being those posing the highest aspiration risk for children aged between 1 and 3 years. The results of first systematic risk assessments for 1995 suggested that for about 1000 enquiries on lamp oil ingestion recorded at the German PICs in the 1992–1994 period, it had to be assumed that annually, there had been between 250 and 300 cases of chemical pneumonia in young children. It is not possible to present a precise scientific estimate of figures because a sufficient volume of monitoring data is still lacking in Germany, even at the German Federal Statistical Office (DISTATIS). According to a rough analysis, referring an updated socioeconomic analysis, it can be assumed, however, that since 1989, in Germany at least 15 000 children must have suffered minor or major health damage of this type of poisoning in Germany. In a total five children have died during this period. A ban on coloured and scented lamp oils containing liquid petroleum distillates and paraffins had taken effect on 1 January 1999 in Germany, and on 1 July 2000 in the entire EU. A complete risk minimization is required to be achieved by 1 June 2014 through REACH measures.
Conclusion: A sufficient monitoring of cases of poisoning in humans that could have been appropriate to identify new risks or trends in lamp oils or grill lighters was neither established nor envisaged in Germany. The risk posed by liquid hydrocarbons and paraffins involving an aspiration hazard had been absolutely underestimated in standard animal experiments and existing national statistics.
Keywords: Epidemiology, Intoxication, Public health

43. Hypocalcemia associated with 1,1-difluoroethane inhalation

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Background: Fluorinated compounds such as hydrofluoric acid are well known to cause systemic hypocalcemia after ingestion or skin burn involving large body surface areas. We report a case of systemic hypocalcemia associated with 1,1-difluoroethane inhalation from Dust-Off® computer cleaner.
Case Report: 23-year-old female with history of alcoholism presented to the ER after self-medicating for alcohol withdrawal by inhaling Dust-Off® containing 1,1-difluoroethane. The patient experienced a seizure followed by a pulseless ventricular tachycardia arrest in the ER. She temporarily converted back to a sinus tachycardia after treatment with amiodarone and a single defibrillation. Upon return of spontaneous circulation, electrolytes revealed a calcium level of 5.5 mg/dL (normal 8.9–10.3). An electrocardiogram revealed sinus tachycardia at 142 bpm with a QTc of 489 ms. She experienced multiple episodes of recurrent ventricular tachycardia treated with calcium, dexmedetomidine, esmolol infusion, therapeutic hypothermia and eventually cardiac bypass. While the QTc peaked at 517 ms, it responded well to calcium repletion despite a persistently low calcium level for 48hrs (max 7.7 mg/dL). The patient survived but suffered severe neurological impairment. She was discharged to a rehabilitation facility on hospital day 27.
Discussion: Exposure to fluorinated compounds such as hydrofluoric acid has been known to cause severe life-threatening systemic hypocalcemia. The mechanism involves the binding of fluoride anions with calcium ions to form insoluble calcium fluoride. Systemic hypocalcemia may lead to prolonged QTc and fatal dysrhythmias. The fluorinated hydrocarbon 1,1-difluoroethane is described to convert to hydrofluoric acid under certain conditions. Fluoride anions may dissociate in vivo and bind with the calcium and magnesium cations to cause electrolyte abnormalities. In this case no signs of hypocalcemia such as tetany were observed, but the patient decompensated shortly after interfacing with a physician. While we believe the ventricular tachycardia was likely due to catecholamine sensitivity from inhalant abuse, hypocalcemia may have been a contributing factor. Further research is required to determine whether hypocalcemia contributes to the cardiac dysrhythmias observed with inhalational abuse of fluorinated hydrocarbons.
Conclusion: Inhalational abuse of flourinated hydrocarbons such as 1,1-difluoroethane may cause systemic hypocalcemia.
Keywords: Drug of abuse, Inhalant, Huffing

44. An analysis of the abuse and associated deaths of immediate release opioid analgesics as compared to extended release formulations in the United States

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Background: The US market share of the opioid analgesics is 10% extended release (ER) products (including abuse deterrent formulations [ADF]) and 90% immediate release (IR) products. Recently the FDA has proposed limitations and Risk Mitigation and Evaluation Strategies (REMS) for ER formulations. However, there is no requirement for REMS for most IR formulations and there are no published data supporting REMS for IR formulations. Our objective was to compare rates of abuse of ER opioid analgesic formulations to IR formulations in the US in 2013 and to compare deaths from IR and ER opioid analgesics.

Table 1.

RADARS System Program	IR Opioid Population Rate (95% CI)	ER Opioid Population Rate (95% CI)	IR Opioid Prescription Rate (95% CI)	ER Opioid Prescription Rate (95% CI)
College Survey Program	0.265 (0.254–0.277)	0.081 (0.075–0.088)	0.014 (0.013–0.015)	0.047 (0.043–0.050)
Drug Diversion Program	2.407 (2.360–2.455)	0.265 (0.250–0.281)	0.134 (0.131–0.136)	0.161 (0.152–0.171)
Poison Center Program	0.340 (0.329–0.351)	0.076 (0.071–0.081)	0.017 (0.017–0.018)	0.043 (0.040–0.046)
Treatment Center Programs Combined	3.182 (3.139–3.226)	0.996 (0.972–1.021)	0.195 (0.192–0.198)	0.584 (0.570–0.599)

Methods: We compared rates of diversion and abuse of ER to IR opioid formulations using data from the Research, Abuse, Diversion and Addiction Related Surveillance (RADARS®) system. The RADARS System is a real-time surveillance system that measures prescription drug-related misuse, abuse and diversion for specific products across the US. We evaluated data from 2013 and included mentions of opioid misuse from each of the programs and total opioid abuse related deaths in 2013. Average quarterly population and prescription rates are presented with 95% CIs.
Results: Mean population and prescription rates are presented in the Table 1 below. The mean population rate for IR formulation per 100,000 persons for the RADARS programs were significantly greater for the IR as compared to ER in all 4 RADARS System programs. Conversely, mean rates per 1000 prescriptions were significantly greater for ER as compared to IR. In 2013 there were 177 deaths where IR products were mentioned compared to 27 deaths where ER products were mentioned as reported to poison centers participating in the RADARS System.
Conclusion: While ER formulation opioids are associated with higher rates of abuse per prescription dispensed in 2013, IR formulation opioids have higher abuse rates per 100,000 persons and are associated with more deaths than ER formulations.
Keywords: Abuse, Opioid, Death

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45. Four months surveillance of recreational drug use in Europe: First report from the European Drug Emergencies Network (Euro-DEN) project

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Background: Data on recreational drug indicators such as the prevalence of use, problematic drug use and drug related deaths is reported through International agencies including the United Nations Office on Drugs and Crime (UNODC) and European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). Clinical Toxicologists and Poisons Centres frequently report case series of acute recreational drug and new psychoactive substances (NPS) toxicity; however there is limited systematic data available on this issue in Europe. The European Drug Emergencies Network (Euro-DEN) is a European Commission funded project bring together 16 specialist centres in 10 countries (Denmark, Estonia, France, Germany, Ireland, Norway, Poland, Spain, Switzerland, UK) in Europe to collect data on prevalence of use of recreational drugs/NPS and associated acute harms.
Method: The Euro-DEN project has developed a minimum dataset to collect data on all acute recreational drug/NPS toxicity presentations to the Emergency Room using a pre-formatted Euro-DEN Excel sheet. We present here data from the first 4 months (Oct 2013-Jan 2014) of the one year data collection period on the drugs used in these presentations.
Results: There were 1290 cases from 13 (81.2%) of the 16 centres in 8 of the 10 participating countries. The median number of cases reported by each centre was 57 (IQR 33–64, range 6–413). The majority (743, 57.6%) involved the use of one drug; 357 (27.6%) involved two drugs; 133 (10.3%) three; 57 (4.1%) involved four or more drugs. Ethanol was co-ingested in 532 (41.2%) cases, not co-ingested in 308 (23.9%) and not recorded in 450 (34.9%). The most common drugs were heroin (315, 24.4% of cases), cocaine (228, 17.7%), gamma-hydroxybutyrate (GHB)/gamma-butyrolactone (GBL) (211, 16.4%), cannabis (205, 15.9%), amphetamine (175, 13.6%), MDMA (100, 7.8%), clonazepam (85, 6.6%), mephedrone (60, 4.7%), unspecified benzodiazepine (59, 4.6%) and methadone (56, 4.3%). There were 126 (9.8%) NPS cases (UK: 94, Poland: 18, Germany: 10, Spain: 2, Norway: 1, Switzerland: 1). There were 60 mephedrone cases (59 in the UK and 1 in Germany).All 15 methedrone cases were in the UK and all 5 methylenedioxypyrovalerone (MDPV) cases were in Germany. There were 18 cases involving unknown NPS and 31 cases involving brand-identified NPS (e.g. Spice, Clockwork Orange, Pandora's Box, Kosior, Funky and Mocarz).
Conclusion: This initial data from the Euro-DEN project suggests that most presentations with acute recreational drug toxicity to the ER in Europe relate to the use of classical recreational drugs rather than NPS. NPS related presentations were most common in the UK, Poland and Germany.
Keywords: Bath salt, Epidemiology, Drug of abuse

46. An 11-year review of bupropion insufflation exposures reported to a poison control center

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Background: Seizure of both immediate and delayed onset after ingestion of bupropion SR and bupropion XL formulations are well documented but are less well characterized after insufflation. Bupropion is crushed and insufflated to experience a high similar to amphetamines. We sought to characterize the misuse of bupropion via insufflation in cases reported to the Poison Control Center and the incidence of seizures.
Methods: An 11 year retrospective review of insufflated bupropion exposures evaluated in a health care facility (HCF) were reviewed.

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Table 1. Reported adverse effects.

Adverse Clinical Effects*	No.	%
Tachycardia on arrival to HCF (out of 73)	52	71.2
Pre-hospital seizure (out of 73)	23	31.5
Pre-hospital seizure and tachycardia on arrival (out of 23)	21	91.3
No pre-hospital seizure (out of 73)	50	68.5
No pre-hospital seizure but has tachycardia on arrival (out of 50)	30	60.0
No pre-hospital seizure with delayed seizure after presentation (out of 50)	0	0
Tremor/Movement disorder (out of 73)	7	9.6
Agitation (out of 73)	5	6.8
Anxiety (out of 73)	3	4.1
Hyperactivity (out of 73)	3	4.4
Drowsiness/Lethargy	4	5.5
Any Symptom (out of 73)**	63	86.3

*Some patients had > 1 symptom recorded.
**Patient counted once even if experienced multiple symptoms.

Patients with coingestants or age less than 18 were excluded. Data included age, gender, bupropion dose, occurrence of pre-HCF seizure, symptoms and vital signs reported to PCC, treatments, and adverse events that occurred until time of discharge.

Results: 74 cases were identified (1 excluded due to age). The median age was 35 years (range 18–65 years). The total dose of bupropion insufflated was reported in 29 pts; mean dose of 1966 mg (range 100 mg – 6900 mg). Many were staggered doses. Of the 73 patients, 23 (32%) experienced a seizure prior to arrival at the HCF; of these, 21 (91%) presented with tachycardia. Of the 73 patients, 10 patients received benzodiazepines and 6 patients received single-dose activated charcoal.

Conclusion: The misuse of bupropion by crushing and insufflating through the nose is uncommon. Seizures are common but delayed seizures appear to be rare. Tachycardia is present in most who have seizures. Those results are similar to oral exposures to bupropion except that the extended release mechanism is destroyed upon crushing the tablets and a prolonged period of toxicity is not commonly seen. Treatment is supportive. We recommend observation for at least 8–12 hours and until tachycardia resolves. GI decontamination is not necessary for insufflated bupropion exposures.

Keywords: Substance abuse, Seizure, Antidepressant

47. Concomitant use of opioid analgesics and benzodiazepines in U.S. ambulatory clinics and emergency departments

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Background: Over the past decade, there have been mounting concerns regarding rising rates of prescription drug abuse, overdoses and related-fatalities. Benzodiazepines (BDZs) enhance the depressant effects of opioid analgesics (OAs) and have been implicated in nearly a third of OA-related deaths. We describe trends in concomitant use of OAs and BDZs in U.S. ambulatory clinics (ACs) and emergency departments (EDs).

Methods: Retrospective review of the National Ambulatory Care Medical Survey (NAMCS) and National Hospital Ambulatory Medical Care Survey (NHAMCS), 2001–10. Adult visits where an OA and BDZ were concomitantly used (administered during the visit or prescribed at discharge) were identified. The proportion of visits involving each medication type was tabulated and trends analyzed using survey-weighted logistic regression.

Results: In ACs, the estimated number of visits during which an OA was administered or prescribed rose from 21.7 million in 2001 to 44.9 million in 2010 (106.9% increase, $p = 0.001$). Of these visits, a BDZ was concomitantly used in 12.4% (2.7 million) in 2001 and 15.4% (6.8 million) in 2010 ($p = 0.184$). In EDs, there were 16.8 million visits where an OA was administered or prescribed in 2001 compared to 31.0 million in 2010 (84.5% increase, $p = 0.001$). Of these, a BDZ was concomitantly used in 5.0% (0.8 million) of visits in 2001 and 7.1% (2.1 million) in 2010 ($p = 0.018$). The most frequently concomitantly used OA in ACs and EDs was hydrocodone. Alprazolam was the most frequently concomitantly used BDZ in ACs, whereas in EDs it was diazepam (Table). The most common reason for visits in which an OA/BDZ combination was used included back pain, medication management visits and progress visits for ACs and back pain, chest pain and low back pain in EDs.

Conclusion: There was a significant increase in the number of visits involving concomitant use of OAs and BDZs in both ACs and EDs; however, the proportional increase was significant only in EDs. In the setting of rising misuse, abuse, addiction and overdoses of these agents, providers in both settings must exercise caution when using BDZs in combination with OAs. Additional initiatives addressing patient-level and public health concerns will also be required.

Keywords: Benzodiazepine, Opioid, Overdose

Table Most Common OAs and BDZs for Concomitant Use Visits, 2001–2010.

AC OAs (# Visits, % Visits)	AC BDZs	ED OAs	ED BDZs
Hydrocodone	Alprazolam	Hydrocodone	Diazepam
31,355,542 (8.5%)	19,978,140 (6.1%)	4,890,861 (10.7%)	5,846,998 (2.4%)
Oxycodone	Diazepam	Morphine	Lorazepam
16,219,087 (4.4%)	12,727,523 (3.9%)	4,033,301 (8.8%)	6,282,518 (2.3%)
Codeine	Clonazepam	Hydromorphone	Alprazolam
2,851,316 (0.8%)	6,776,028 (2.1%)	3,330,214 (7.3%)	1,183,284 (0.5%)

48. Adulterants in tablets sold as Ecstasy in the US from 2009–2013

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Background: Methylenedioxymethamphetamine (MDMA) is a synthetic drug that is usually sold under the names "Ecstasy" or "Molly." This study aims to describe trends in pharmacologic content of tablets sold as MDMA that were submitted to EcstasyData.

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org for testing over the previous five years. Ecstasydata is a DEA-certified laboratory pill testing program that independently verifies the contents of substances that were bought under the guise of Molly and Ecstasy from members around the world and has been publically publishing their data since 2001.
Methods: A retrospective review of all substances originating in the United States submitted for analysis from 2009–2013 to Ecstasydata.org was performed. The aggregate change in purity over time was recorded and the prevalence of the five most common contaminants for each geographic region (Midwest, Northeast, Southeast, Southwest, and West) was calculated.
Results: The percentage of substances that were pure MDMA in the US were as follows: 2009 (11%), 2010 (35%), 2011 (15%), 2012 (18%), 2013 (29%). Over the 5 years examined, the most frequent contaminants in samples from the Midwest in order of frequency were benzylpiperazine (BZP) (present in 51% of contaminated samples), trifluoromethylphenylpiperazine (TFMPP) (35%), caffeine (29%), methylenedioxypyrovalerone (MDPV) (12%), and 5-methoxy-diisopropyltryptamine (5-MeO-DiPT) (8%). In the Northeast, the most frequent contaminants were caffeine (34%), methylone (17%), TFMPP (16%), BZP (14%) and 5-MeO-DiPT (13%). The most frequent contaminants in the Southeast were caffeine (70%), TFMPP (33%), BZP (23%), methylone (9%), and dibenzylpiperazine (8%), while the most frequent contaminants in the Southwest were caffeine (50%), BZP (17%), TFMPP (15%), ketamine (9%), and methamphetamine (7%). Finally, the most frequent contaminants in the West were caffeine (59%), TFMPP (23%), methamphetamine (22%), BZP (18%), and methylsulfonylmethane (12%).
Conclusions: In this small study, caffeine, TFMPP, and BZP remain the most popular adulterants nationally; however, contaminants differ by region. Notably, samples from the West and Southwest regions are more likely to contain methamphetamines, while samples from the Midwest, Northeast, and Southeast were more likely to contain synthetic cathinones. Public education on the contaminants in products sold as Ecstasy and Molly continues to be necessary as less than 50% of the samples in this cohort were pure MDMA.
Keywords: Drug of abuse, MDMA, Surveillance

49. Cyclic vomiting presentations following marijuana liberalization in Colorado

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Background: A limited number of case reports have described a novel syndrome of cyclic vomiting (CV) associated with marijuana (MJ) use termed cannabinoid hyperemesis syndrome (CHS). To date, there are no rigorous studies describing the clinical characteristics of CHS or its association with MJ use. The objective of this study is to describe the rate and characteristics of patients presenting with CV before and after the liberalization of medical MJ in the state of Colorado (CO).
Methods: This is a retrospective cohort study of patients presenting to two urban academic emergency departments (ED) with a complaint of nausea/vomiting during two separate one-year time intervals: 11/01/08 to 10/31/09 (control) and 06/01/10 to 05/31/11 (exposure). These time periods reflect when federal prosecution of CO medical MJ dispensaries ceased and MJ use increased significantly in the ensuing months. We identified patients who were diagnosed with CV by the treating ED physician or met diagnostic criteria for CV, defined as 3 or more discrete visits for nausea/vomiting without an identifiable pathophysiologic etiology. Medical records were abstracted by the study investigators, and inter-rater reliability was assessed via Cohen's kappa coefficient. MJ use was determined by patient self-report at any point during the ED visit.
Results: A total of 2,529 encounters were reviewed, of which 36 patients were diagnosed with CV over 128 unique visits (Kappa = 0.79 for all variables, 1.0 for MJ use only). The majority of patients were female (64%) and Caucasian (81%), and median age was 31 years (IQR 26–39). During the control period, 11 patients presented with CV over 41 total visits, compared to 25 patients over 87 visits in the exposure period. The standardized rates of CV presentations during these two periods were 36 per 100,000 ED visits (CI 25–47 per 100,000) and 70 per 100,000 (CI 56–84 per 100,000), respectively. In the control period, 3 patients endorsed MJ use over 7 visits, compared to 11 patients over 37 visits in the exposure period. After multivariate adjustment, patients with CV in the exposure period were more likely to endorse MJ than patients in the control period (OR 3.6, CI: 1.4–9.0). Median length of ED stay was 362 minutes (IQR 283–488). After adjustment, patients receiving promethazine therapy in the ED were more likely to be admitted for symptom control (OR 5.1, CI 2.0–13.6).
Conclusion: The rate of CV presentations increased significantly after the liberalization of medical marijuana in Colorado. Patients presenting with CV in the exposure period were significantly more likely to endorse MJ use, although it is unclear whether this effect was secondary to increased MJ use, more accurate self-reporting, or both.
Keywords: Marijuana, Substance abuse, Cyclic Vomiting

50. Uterine body stuffing confirmed by computerized tomography

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Background: "Body Stuffing" is used to conceal illegal drugs from law enforcement by hastily placing substances into a body orifice. "Stuffers" differ from "packers" by utilizing smaller amounts of drug wrapped in poorly constructed packages. Systemic toxicity can occur if the package ruptures. We present a unique case of a woman brought to an emergency department for suspected body stuffing where the packet was located in the uterus by computerized tomography (CT).
Case Report: A 31-year-old woman with a past medical history of hypertension was brought to an emergency department by police with a warrant for a body cavity search. She was suspected of "stuffing" cocaine into her vagina. She was agitated but asymptomatic. She denied abdominal or pelvic pain, vaginal bleeding or discharge, or placing anything in her vagina.

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On physical exam, initial vital signs were blood pressure 148/110 mmHg, pulse 125, respiratory rate 16, and oxygen saturation of 100% on room air. She had no acute distress, a normal pupil exam, was not diaphoretic, and her cardiovascular exam was only significant for tachycardia which was attributed to agitation. Her abdominal and rectal exams were unremarkable. Pelvic examination revealed no vaginal discharge, no cervical or adnexal motion tenderness, and no visible foreign body. The cervical os appeared closed.

Her pregnancy test was negative and abdominal X-ray was concerning for a foreign body in the right hemipelvis. Her transabdominal ultrasound was not diagnostic, and she refused a transvaginal ultrasound. A non-contrast CT scan of her abdomen/pelvis revealed a tablet-like, radiopaque mass within the cervix extending into the uterus.

Gynecology was consulted for foreign body removal, but the patient refused further testing or procedures. Legal was consulted and advised the emergency department that the foreign body could not be removed without patient consent. Without physical evidence, the patient was released by the police, and signed out of the emergency department against medical advice.

Discussion: This case demonstrates a unique event of uterine body stuffing with evidence on CT. To our knowledge, this is the first documented case in the literature. X-rays have varied sensitivity for finding stuffed/packed foreign bodies. Ultrasound has been used to evaluate for interuterine foreign bodies such as intrauterine devices. In this case, ultrasound was not diagnostic. CT scan has been found to be sensitive and specific in intestinal body stuffing cases. This case suggests that CT may be a viable method to evaluate for this rare event.

Conclusion: Body stuffing into the uterus is a rare, but possible event. Diagnostic testing to confirm this should be via CT scan.

Keywords: Abuse, Packing, Imaging

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51. QRS widening from an unrecognized vaginal cocaine stuffer

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Background: Occult body stuffing often coincides with significant diagnostic and treatment challenges. These challenges are further compounded when the patient presents with other distracting symptoms and drug stuffing goes unrecognized.

Case Report: A 29 year old female, under police custody, is transported to the hospital after being found unconscious in the bathroom with blood-soaked pants. She awakens with vital signs: HR 120 Bpm, T: 39.2F. After being examined by gynecology and found to have extensive genital trauma, she is transferred to a trauma center. Prior to departure, the patient sustains tonic-clonic seizure activity for 1 minute but has repeated seizures upon arriving to the trauma center, approximately 6 hours after being arrested.

Patient deteriorates into cardiac arrest. She has successful return of spontaneous circulation (ROSC) after chest compressions, intubation and ACLS therapy. After ROSC, she undergoes cardioversion and requires vasopressor support. QRS prolongation of 144 ms is observed on ECGs and is empirically treated with sequential boluses of sodium bicarbonate which progressively narrow the QRS to 98 ms.

Extensive lacerations of the external genitalia prompt a speculum examination and a foreign body is removed from the vaginal vault—a partially twisted plastic bag leaking a large amount of white powder. She is successfully extubated 24 hours later without apparent cardiovascular or neurologic deficits. Urine toxicology tests return positive for cocaine and PCP metabolites.

Discussion: In this case, cocaine toxicity was not promptly recognized as the cocaine packet was not found by the initial treating facility. Consequently, diagnosis and definitive treatment (removal of the offending agent) were delayed. The patient subsequently developed severe cocaine toxicity with seizures, hyperthermia, and cardiac arrest. Cocaine also inhibits membrane permeability to sodium, hindering action potential initiation and transmission causing QRS prolongation. Sodium bicarbonate combats the blockade and reverses QRS prolongation on ECG analysis.

Conclusion: We report a rare case of an occult vaginal cocaine stuffer with delayed diagnosis of lethal exposure who was successfully resuscitated from cocaine toxicity and cardiac arrest with treatment including empiric sodium bicarbonate administration for QRS prolongation.

Keywords: Cocaine, Foreign body, Cardiac toxicity

52. Hot Molly! Methylenedioxybenzylpiperazine use associated with prolonged encephalopathy

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Background: In last decade there has been a dramatic rise in the use of novel psychoactive substances (NPS). The piperazine class of drugs were previously used as antihelminthics and investigated as antidepressant agents. However, in the late 1990s they began to be described as substances of abuse and are now commonly encountered NPS. 3,4-methylenedioxybenzylpiperazine (MDBZP) is a piperazine analog for which are there no previous reports of human toxicity. We report on a laboratory confirmed case of prolonged encephalopathy associated with MDBZP use.

Case Report: A previously healthy 16-year-old boy presented to an outside hospital with seizures and altered mental status after reportedly using an internet obtained substance called "Hot Molly." He developed tonic seizures on hospital day #3, he was intubated and transferred to a tertiary care hospital. He was extubated the next day but remained encephalopathic for over 14 days. Blood, CSF and multiple imaging studies were unremarkable. A comprehensive urine drug of abuse screen, obtained 3 days after hospitalization, was positive for cannabinoids and benzodiazepines. Serum, urine, and CSF samples were sent for testing using liquid chromatography-time-of-flight mass spectrometry (LC-TOF/MS) (TOF 6230, LC 1260, Agilent). MDBZP was detected with serum levels of 650 ng/mL and urine levels of 850 ng/mL three days post presentation. Remarkably, 25 ng/ml of MDBZP was detected in this patient's CSF obtained 8 days after initial presentation. Due to his prolonged symptoms, cytochrome P450 2D6 genotype was

obtained which was CYP2D6 *2A/*2A and associated with the ultra-rapid metabolizer genotype.
Case Discussion: Piperazine analogs, such as benzylpiperzine (BZP), act as sympathomimetics via reuptake inhibition of monamines, especially dopamine. They are described to cause significant agitation, tachycardia, and hypertension. However, there are no prior reports of MDBZP use or toxicity in the medical literature. Considering the structural similarity it shares with methylenedioxymethamphetamine (MDMA), similar toxicity may be expected. Both BZP and MDMA are metabolized by CYP2D6, CYP1A2 and CYP3AA4. Because of the methylenedioxy bridge in both compounds, CYP2D6 is the most likely enzyme affected and pharmacogenetic variability in this enzyme may contribute to clinical toxicity. Compounds with this structure are "suicide" chemicals that destroy the metabolizing enzyme and, ultimately, prevent its own metabolism (and increasing its half-life).
Conclusion: This case suggests that toxicologists should be aware of MDBZP as a possible NPS, its potential for significant toxicity and the role pharmacogenomics may play in it.
Keywords: Designer drug, MDMA, Drug of abuse

53. Case series of patients treated for cannabinoid hyperemesis syndrome with capsaicin cream

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Background: Cannabinoid hyperemesis syndrome (CHS) is a relatively new diagnosis given to patients who experience cyclic episodes of nausea, vomiting, and abdominal pain in association with heavy frequent marijuana use. Classically, patients describe relief of their symptoms with bathing or showering in hot water. Symptoms are often refractory to anti emetics and opioids in the emergency department and patients are often subjective to repeated imaging, invasive testing, and exploratory surgery.
Case: A series of 5 patients presenting with CHS successfully treated with topical capsaicin cream (0.075%) are presented below.
Patient 1: A 20 year-old male presented to the emergency department (ED) complaining of abdominal pain with nausea and vomiting. He was noted to use marijuana 3 times daily for the last 5 years. Pain and nausea were relieved with hot showers. Initial pain was 8/10. Vital signs and laboratory values were within normal limits. Symptoms were relieved with topical capsaicin cream applied to the patient's abdomen within 30 minutes of application. Patient 2: A 23 year-old male with abdominal pain and cramping presented to the ED after 2 episodes of vomiting. Patient was noted to use THC concentrates 4 times daily for the past 8 months. Symptoms were noted to resolve during hot showers. Vital signs and laboratory screening was unremarkable. The patient's pain and nausea completely resolved (10/10–0/10) 45 minutes after a single topical application of capsaicin cream. Patient 3: 24 year-old man presenting with nausea and vomiting associated with his daily marijuana use. Pain and severity of symptoms decreased from 9/10 to 1/10 within 45 minutes of topical capsaicin cream. Patient 4: A 32 year-old female presented with abdominal pain and vomiting associated with daily marijuana smoking. She was noted to have had several episodes of the same symptoms in the past. She noted relief with hot baths and reported taking as many as 10 baths daily for relief of her symptoms. ED screening work up was negative and the patient had complete relief of her symptoms 30 minutes after capsaicin cream application. Patient 5: 23 year-old male with previous diagnosis of irritable bowel syndrome presented to the ED with nausea and vomiting associated with marijuana use. His symptoms improved from 9/10 to 2/10 22 minutes after topical capsaicin administration.
Discussion: Topical capsaicin treatment appeared to be effective for the treatment of CHS in these 5 patients. Efficacy of topical capsaicin suggests the involvement of the TRPv1 receptor in CHS.
Conclusion: Topical capsaicin therapy for CHS has potential as both a therapeutic modality and mechanistic probe that merits further investigation.
Keywords: Abuse, Marijuana, Substance abuse

54. An unexpected course and late complication of cocaine-related ANCA vasculitis

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Background: Cocaine adulterated with levamisole has been implicated in anti-neutrophil cytoplasmic antibody (ANCA) vasculitis previously (Pendergraft 2014, Alvarez-Diaz et al 2013). We present a cocaine-related ANCA vasculitis with an unexpectedly severe clinical course.
Case report: A 66-year old male with limited prior exposure to medical care presented with new onset shortness of breath, profound anemia, and renal failure. Extensive work-up including renal biopsy revealed anti-myeloperoxidase (MPO) and antiproteinase-3 (PR3) + ANCA vasculitis with crescentic glomerulonephritis (image 1). Nephrology, rheumatology, and hematology were consulted, and collaborative work-up revealed only hepatitis C and a history of cocaine abuse without active use. No emergent indication for hemodialysis was present.

On hospital day (HD) #9 pulse methylprednisolone was initiated; rituximab was deferred absent evidence of systemic vasculitis. On HD #13 he became dyspneic over the morning hours. Peripheral oxygen saturations remained normal. Hemoglobin returned that morning at 10.6 g/dL and chest radiograph was unchanged. His abdomen became progressively distended and firm.

Bi-level ventilation failed to alleviate his symptoms. Obtundation ensued and he was emergently intubated for airway protection. Hemoglobin dropped over 10 hours from 10.6 to 4.6 g/dL. Paracentesis revealed 700,000 red blood cells. In the operating suite, an actively bleeding aneurysmal omental vessel was excised and 3.5 L of blood evacuated. Pathology revealed acute necrotizing vasculitis (image 2). HD #14 urine cocaine metabolite returned positive, suggesting active in-hospital use.
Discussion: Cocaine-mediated ANCA vasculitis rarely presents with severe late complications. In this case, ongoing in-house cocaine use coupled with renal failure and hypertension conspired to result in delayed life-threatening intraperitoneal hemorrhage. In the setting of cocaine use, levamisole-mediated ANCA vasculitis was strongly suspected by consulting rheumatologists. Serum levamisole, although drawn three days after his acute event, returned negative. Markedly positive MPO and PR3 strongly suggested drug-induced vasculitis (McGrath et al 2011).
Conclusion: We present a rare complication of cocaine-associated ANCA vasculitis. Although serum levamisole returned negative,

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this was expected, in light of the relatively short serum half-life (5.6 hours). Clinicians should be aware of potential late complications of this disease process, particularly among patients with ongoing cocaine use.

Keywords: Cocaine, Renal toxicity, Adulterant

55. Age differences in intentional abuse cases mentioning hydrocodone products versus Schedule II opioids

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Background: In October 2013, the FDA announced they would formally recommend hydrocodone combination products, such as Vicodin, be reclassified from Schedule III to a Schedule II. This move comes despite the FDA's past concerns regarding the added hardship the stricter scheduling will cause pain patients such as a reduction in the number of refills per prescription. However, a concern prompting the change is the impact hydrocodone is having on the national drug abuse epidemic, particularly among youth, due to its increased availability as a Schedule III. The purpose of this analysis is to examine age differences in mentions of hydrocodone products and Schedule II opioids by intentional abuse cases.

Methods: Data from the RADARS® System Poison Center Program were used. Mentions of hydrocodone products by intentional abuse cases from 1Q2009–4Q2013 were compared to mentions of oxycodone and to other Schedule II opioids used in the treatment of pain (fentanyl, hydromorphone, morphine, oxymorphone, and tapentadol). Abuse was defined as the intentional improper use of a drug in order to gain a high or euphoric effect. Differences in drug group by age group were compared using Poisson regression analyses.

Results: There were 8182 mentions of hydrocodone products by intentional abuse cases from 1Q2009–4Q2013. During this same period, there were 7859 mentions of oxycodone products and 5114 mentions of other Schedule II opioids. The most common age of intentional abuse cases mentioning hydrocodone was 17 years compared to 23 years for oxycodone and 21 years for other Schedule II opioids. There were 1796 (22.0%) product mentions for hydrocodone compared to 1462 (18.6%) for oxycodone and 679 (13.3%) for other Schedule II opioids among cases 19 years or younger. Hydrocodone was significantly more likely to be mentioned than both oxycodone and other Schedule II opioids among cases 19 years or younger ($p < 0.001$). These differences were not as great among adults over 19 years of age (6307 mentions of hydrocodone products, 6288 mentions of oxycodone products, and 4381 mentions of other Schedule II opioids). While hydrocodone abuse accounts for 39% of product mentions when compared to oxycodone and other Schedule II opioids among all age groups, it accounts for 46% of product mentions among those under the age of 19 years.

Conclusion: Mentions of hydrocodone by intentional abuse cases are greater than oxycodone and greater than other Schedule II opioids. These differences are greater among individuals 19 years or younger, potentially due to the widespread availability of hydrocodone. Stricter scheduling of hydrocodone could possibly impact its accessibility, particularly among adolescents.

Keywords: Hydrocodone, Schedule II Opioids, Abuse

Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

56. Cardiogenic shock from a novel phenethylamine: 3,4-methylenedioxybutanphenamine (MDB, aka BDB) intoxication

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Background: Phenethylamines are an evolving class of illicit substances. We report a life-threatening BDB intoxication with quantified levels.

Case Report: A 40 year old woman with a history of ecstasy, alcohol and tobacco abuse presented to the ED with vomiting, abdominal pain, and palpitations. She endorsed drinking 3 glasses of whiskey and ingesting what she thought was ecstasy 24 hours prior to arrival. BP 147/94, HR from 130–150, RR 18, T 36.5C, O_2 98% on room air. EKG showed sinus tachycardia of 143, nonspecific T wave changes (leads II, III, aVF, V4, V5), and normal intervals. Her pain resolved after intravenous morphine and hydromorphone. Notable lab values included WBC 28.2, HCO3 15, BUN 22, SCr 2.8, glucose 308, ALT 107, AST 151, lactate 10.8 and troponin 10. Urine drug screen was positive for MDMA, barbiturates, and opiates. Approximately 4.5 hours after presentation, the patient was agitated and combative, then suddenly became hypoxic and hypotensive to 60/30. She was emergently intubated, and then suffered a cardiac arrest with pulseless electrical activity (PEA) requiring 6 minutes of cardiopulmonary resuscitation and 2 doses each of epinephrine and atropine before return of spontaneous circulation. A chest X-ray revealed pulmonary edema and a right lower lobar infiltrate; CT showed an adrenal hematoma only. An echocardiogram revealed global hypokinesis with an ejection fraction of 20–25%.

She required infusions of epinephrine, dobutamine and norepinephrine for persistent hypotension, but was weaned off of pressors over the next 12 hours; her hospital course was complicated by hypertension requiring an esmolol infusion and a cerebellar infarction. She was extubated approximately 30 days after presentation and had significant muscle weakness requiring prolonged physical therapy.

Serum and urine analyses were performed using Liquid Chromatography Time of Flight Mass Spectrometry; BDB levels (in ng/mL) were 233 and 3853 in serum and urine, respectively.

Also present was morphine, acetaminophen, lidocaine, cotinine, caffeine and theobromine but not MDMA or barbiturates.

Case Discussion: BDB is a phenethylamine entactogen; it inhibits reuptake and potentiates release of dopamine, norepinephrine and serotonin. Cardiogenic shock is a rare complication of amphetamines and related compounds, but has not been associated with BDB to date.

Conclusions: Novel synthetic phenethylamines continue to be synthesized and sold, sometimes under disingenuous guises such as "for research purposes". This case report further illustrates the potential risks associated with these compounds.

Keywords: Abuse, Amphetamine, Cardiac toxicity

57. Seizures and rhabdomyolysis with a novel phenethylamine: 2,5-dimethoxy-4-chloroamphetamine (DOC)

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Background: Phenethylamines (PEAs) are increasingly popular recreational drugs, sometimes sold online with the euphemism "research chemicals". Detection is difficult, and their clinical effects remain largely unknown. We report two ingestions of DOC, their clinical course, and identification of DOC in their biological samples.

Case Reports: Emergency medical services (EMS) were called for two 17 year old males 4 hours after ingestion of a white powder. Patient 1 (P1) reports calling EMS after Patient 2 (P2) had been seizing for >30 minutes. In the field, P2 was in a generalized tonic-clonic seizure, which resolved with 5mg intranasal midazolam. Vital signs (VS) on emergency department arrival: HR 108; BP 131/54; T 38.5°C; blood glucose 117 mg/dL. He had dilated pupils, agonal respirations, and a Glasgow Coma Score of 7 (E2M1V4). He was sedated, paralyzed and intubated for airway protection. His course was complicated by agitation and hyperthermia requiring sedation, paralysis and external cooling; rhabdomyolysis (creatinine kinase peak of 2193 IU/L); and aspiration pneumonia. Urine toxicology showed benzodiazepines and tetrahydrocannabinol (THC). He was extubated Day 2 with full recovery; he endorsed ingesting DOC from P1.

On presentation, P1 described a sense of euphoria and clarity; he was alert and oriented without complaints. His pupils were 8 mm and reactive. VS: BP 152/89, HR 113, RR 28; afebrile. Urine toxicology was positive for THC. He endorsed ingesting ~2 mg of white powder, which he used 4 times in the previous 2 weeks without adverse effects. He was observed overnight and discharged without sequelae.

Qualitative and quantitative serum and urine analyses were performed with Liquid Chromatography-Quadrupole Time-of-Flight Mass Spectrometry (Agilent LC1200- QTOF6550).

DOC levels (ng/mL): Plasma 2.1 (P1) and 13.9 (P2); urine 2928 (P1) and 1727 (P2).

P2's urine also contained 2,5-DMA (202).

Case Discussion: DOC is a substituted phenethylamine structurally similar to amphetamine. Co-ingestion of DOC with methylenedioxymethamphetamine (MDMA) has been associated with seizures; however this is the first report of clinical effects of DOC alone, with quantification in serum and urine. The 2,5-DMA in P2's urine shows polydrug experimentation described in online user reports; absence of this substance in the patient's serum indicates that is unlikely to have contributed to his symptoms.

Conclusions: Abuse of DOC and other PEAs is inevitable; their range of clinical effects is unknown. We illustrate the utility of expanded testing in confirming novel PEA ingestions; such assays also support epidemiological study of these drugs.

Keywords: Abuse, Amphetamine, Laboratory

58. Lysergic acid diethylamide (LSD) causing grand mal seizures: A case report with xenobiotic quantification.

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Background: LSD is an ergotamine derivative known to cause hallucinations, hyperthermia, tachycardia, and agitation. Seizures associated with LSD were reported in 1967, but not since then, and no laboratory confirmation has been reported in patients with seizures. We present a case of LSD causing seizures, with laboratory analyses confirming the ingestion.

Case Report: A 19 year old female with a history of bipolar disorder had a 1-minute generalized tonic-clonic seizure 2.5 hours after ingesting 2 "tabs" (blotter paper squares) of what she purchased as LSD. Home medications: lithium, quetiapine, and bupropion. Vital signs revealed BP 140/79, HR 135, RR 17, O_2 99% on room air, rectal temperature 36.7°C, blood glucose 153mg/dL. On arrival to the emergency room (ER) she was agitated and thrashing on the bed, unable to speak, with a Glasgow Coma Score of 6 (E2V2M2) but protecting her airway. Pupils were dilated to 6mm, equal, round and reactive; she had lower extremity inducible clonus and hyperreflexia in all 4 extremities. Labs were notable for a sodium of 142, lactate of 13, lithium level of 0.46 mmol/L. The patient became less agitated after 3mg of midazolam and 4mg of lorazepam intravenously. An EKG showed sinus tachycardia at 132 beats per minute, QRS 100msec, QTc 430msec, with a terminal R in aVR. 6 hours post-arrival the patient's confusion had resolved; she was observed for an additional 12 hours before being discharged to home without permanent sequelae.

Serum and urine analyses were performed using Liquid Chromatography Time of Flight Mass Spectrometry (Agilent

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LC1200- QTOF6550). Serum levels of LSD (ng/mL): 1.96, 1.04, and 0.91 at 0, 7.5, and 10 hours post-presentation. The blotter paper was found to contain 166 ug of LSD (83ug per hit). Samples also revealed quetiapine in low concentrations (10.5 ng/mL, therapeutic 100–500ng/mL), no bupropion, but 80ng/mL hydroxybupropion, which is below the combined therapeutic range of bupropion/hydroxybupriopion.
Case Discussion: To our knowledge, LSD has been reported to cause seizures in a single case to date, and no biologic samples were analyzed to confirm exposure. We present a case of LSD ingestion with a generalized tonic-clonic seizure, with laboratory confirmation of the presence and levels of LSD. Our analyses also revealed the presence of quetiapine and bupropion—which are known to cause seizures—however levels detected indicate that although these drugs may have lowered the patient's seizure threshold, they are unlikely to have caused her seizure.
Conclusions: We report the first case of LSD ingestion causing seizures with confirmatory quantification of LSD levels.
Keywords: Laboratory, Seizure, Drug of abuse

59. K2 and K9s

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Background: K2, or synthetic cannabinoids, have become increasingly prevalent in the United States in the past 2–3 years. Healthcare providers for humans have become more familiar with the clinical and psychoactive effects associated with these substances; however, little information is known regarding the clinical experience of K2, or synthetic cannabinoids, in companion animals, especially dogs. Understanding the presentation of K2 exposures from other drugs affecting the CNS or pathologies could be useful in confirming a diagnosis of K2 exposure, assessing the potential severity of the exposure, and directing patient management.
Case Series: Since December 2010 the Pet Poison Helpline has received 23 cases involving synthetic cannabinoid ingestion in dogs. All of our cases involved Spice, K2 or another synthetic cannabinoid. Thirteen calls (59%) were received directly from veterinarians. Of the remaining 10 cases (41%) reported by pet owners, 5 (22%) received follow-up from the veterinarian. The most common reported symptoms were ataxia (48%) and drowsiness (48%). The next most common symptoms reported were vomiting (30%), twitching (26%), mydriasis (26%) and agitation/hyperesthesia (17%). Three cases reported a dog that was down (recumbent) and unable to rise. Tremors (9%), disorientation (9%), and bradycardia (9%) were also reported, but not as common. Most cases reported 2–4 symptoms.
Case Series Discussion: The symptoms reported in these cases we have received involving dogs exposed to synthetic cannabinoids are similar to symptoms reported in humans. Human cases have reported symptoms including, but not limited to, anxiety, paranoia, agitation, hallucinations, and hypertension. While it is difficult to determine if an animal is hallucinating, their agitation, ataxia and hyperesthesia can potentially be indicative of this. Not all cases will include all symptoms, but may include several of the symptoms which can make it difficult for a diagnosis without a confirmed exposure.
Conclusion: There is no specific toxidrome for dogs exposed to synthetic cannabinoids. Dogs presenting with ataxia, vomiting, drowsiness, mydriasis, hyperesthesia/agitation or tremors/twitching without a known exposure should have K2 or synthetic cannabinoids included on their differential. Owners should be questioned regarding possible exposure to these compounds. A diagnosis of an exposure to K2 or similar compounds without a good history is difficult and confounding for a veterinarian. Dogs, like humans, should be treated symptomatically, which has generally involved the use of benzodiazapines.
Keywords: Cannabinoid, Synthetic, Drug of abuse, Poison center

60. A confirmed case of in utero levamisole exposure

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Background: Cocaine and other street drugs are commonly adulterated with other xenobiotics. Levamisole is a drug previously used in the United States as an adjunctive treatment for colon cancer, an immunomodulator for rheumatoid arthritis, and is FDA approved as a veterinary antihelminthic. Human use was restricted by the FDA in 2000 due to agranulocytosis, vasculitis, and leukoencephalopathy. Levamisole was first detected in cocaine samples in 2003; Levamisole has been found in 80% or more of cocaine seized by the US DEA. Reports of adverse effects associated with levamisole-tainted cocaine first appeared in 2008. The incidences of agranulocytosis and vasculitis in patients with a history of levamisole-tainted cocaine use is believed to be low based on the relative rarity of such reports as compared to the high prevalence of cocaine use. No previous case of in utero exposure to levamisole has been reported.
Case Report: A 38 2/7 week gestation baby girl was born in an ambulance en route to the hospital. The amniotic fluid was meconium was stained and the mother reported possible premature rupture of membranes for five days. The patient was transferred to a children's hospital for evaluation and treatment of respiratory distress. The mother had a remote history of heroin use and was being treated with methadone. The mother had scant prenatal care. The patient's urine gas-chromatography-mass spectrometry qualitative comprehensive drug screen demonstrated: cocaine, levamisole, oxycodone, nicotine, caffeine, and methadone. The patient was weaned to room air on day of life two. Her hospital course was complicated by neonatal abstinence syndrome that required treatment with morphine beginning on day of life four. Her WBC was initially normal (19,700/mcL), but dropped on day of life three (8,100/mcL). No rash or other evidence of vasculitis was noted. She was discharged to foster care on day of life 16.
Discussion: The neonate had a precipitous drop of her WBC and ANC on day of life 3. The cause of the decrease was not determined, but is suspicious in the context of levamisole exposure. The cause of her thrombocytopenia was not determined.
Conclusion: The complications of cocaine use in pregnancy may include the risks due to levamisole. Newborn infants whose mothers abuse cocaine should be screened for agranulocytosis and vasculitis.
Keywords: Adulterant, Cocaine, Pediatric

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61. Abuse and intentional misuse of promethazine reported to U.S. Poison Centers: 2000–2012

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Background: Promethazine is commonly used for allergic reactions, motion-sickness, and as an antiemetic. Abuse and misuse have been documented in the U.S. and internationally.
Objective: To investigate promethazine abuse and misuse in the U.S.
Methods: A retrospective review was conducted of promethazine cases coded as abuse or intentional misuse reported to the National Poison Data System from 2000 to 2012. Data were stratified by product type, promethazine alone (PA) or in a co-formulation (PC), and evaluated for demographics, clinical effects, treatments, management site, and medical outcomes. Multi-substance exposures were excluded.
Results: There were 365 single product abuse or misuse exposures documented between 2000 and 2012, of which 101 were PA and 264 were PC cases. Over the 13 year timeframe, the annual exposure rate per 100,000 population to PA and PC doubled. Exposures were most prevalent among teen-agers and adults in their twenties, accounting for 62.4% of PA cases and 54.9% of PC cases. Clinical effects due to PA and PC respectively included drowsiness (43.6%, 53.4%), tachycardia (7.9%, 20.8%), agitation (12.9%, 12.9%), confusion (12.9%, 11.4%), slurred speech (11.9%, 10.2%), hallucinations (6.9%, 9.9%), dizziness (6.9%, 7.2%), hypertension (5.0%, 7.2%), vomiting (5.9%, 4.2%), and ataxia (4.0%, 4.2%). Common treatments administered for PA and PC exposures included IV fluids (22.8%, 23.1%), activated charcoal (10.9%, 11.0%), benzodiazepines (7.9%, 6.1%), and naloxone (1.0%, 6.8%). The most frequently reported management site for PA and PC exposures was the emergency department (38.6%, 56.1%), followed by non-health care facility (33.7%, 14.8%), intensive care unit (7.9%, 11.0%), general medical floor (6.9%, 7.2%), and psychiatric unit (2.0%, 4.2%). Patients refused treatment or left against medical advice in 10.9% of the PA group and 6.4% of the PC group. The majority of exposures to PA (57.4%) and PC (53.8%) led to minor clinical effects. PA exposures resulted in no effects (21.8%), moderate effects (18.8%), and major effects (2.0%). PC exposures led to no effects (12.9%), moderate effects (31.4%), and major effects (1.9%).
Conclusions: Abuse or intentional misuse of promethazine most frequently resulted in minor clinical effects and with management in the ED or a non-health care facility. Abuse or misuse of PC had more serious consequences with a higher frequency of moderate outcomes and treatment at a health care facility. The differences in effects are most likely attributed to toxicity associated with the co-formulant as opposed to promethazine alone.
Keywords: Abuse, Drug of abuse, National Poison Data System

62. Retrospective evaluation of quetiapine abuse reported to the national poison data system

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Background: Quetiapine is an atypical antipsychotic FDA approved for use in schizophrenia and bipolar disorder. The medication is also commonly prescribed for generalized anxiety disorder and major depression. Case reports and poison center experience suggest there is a significant potential for abuse for this widely prescribed medication, but there is scant literature describing the potential burden of this phenomenon. Our goal was to conduct a large retrospective cohort study characterizing demographic and clinical data regarding intentional abuse of quetiapine, utilizing the National Poison Data System (NPDS).
Methods: A 10-year retrospective analysis of the NPDS was conducted, selecting single-substance quetiapine exposures coded as intentional abuse. Demographic and epidemiological data were collected, as well as data on clinical effect and therapies on cases with known outcomes.
Results: There were 2134 cases of quetiapine exposures coded as intentional abuse. Of these cases 1451 had known outcomes, including major (n = 24, 1.1%, 95%CI 0.7–1.5), moderate (363, 17%, 15.4–18.6), minor (760, 35.6%, 33.6–37.6), no effect (303, 14.2%, 12.7–15.7) and death by indirect report (1, 0.04%, -0.04–0.12). Route of exposure included ingestion (2004, 93.9%, 92.9–94.9), inhalation (120, 5.6%, 4.6–6.6), and parenteral (16, 0.7%, 0.4–1.0). Notable dispositions included critical care admission (220, 10.3%, 9.0–11.6), non-critical care admission (137, 6.4%, 5.3–7.4), and psychiatric admission (152, 7.1%, 6.0–8.2). Of cases with known outcomes, the most common clinical effects included drowsiness/lethargy (792, 54.6%, 52.0–57.2), tachycardia (334, 23.0%, 20.8–25.2), slurred speech (114, 7.9%, 6.5–9.3), hypotension (81, 5.6%, 4.4–6.8), and agitated/irritable (79, 5.4%, 4.2–6.6). The most common therapies included IV fluids (368, 25.3%, 23.0–27.5), charcoal (218, 15.0%, 13.1–16.8), and benzodiazepines (47, 3.2%, 2.3–4.1). Other notable therapies included intubation (20, 1.4%, 0.8–2.0). Other notable clinical effects included respiratory depression (14, 1.0%, 0.5–1.5), seizures (13, 0.9%, 0.4–1.4), ECG change (10, 0.7%, 0.3–1.1), conduction disturbance (17, 1.2%, 0.6–1.8), hallucinations/delusions (24, 1.7%, 1.0–2.4), and dystonia (8, 0.6%, 0.2–1). There were no cases of vasopressor or physostigmine use.
Conclusions: Based on NPDS data, quetiapine abuse appears to be a very common phenomenon. While the majority of these exposures lead to minor or no effects, a clinically significant number resulted in moderate or major effects. Clinicians should be aware of the abuse potential of quetiapine as well as the severity of clinical effects that may occur.
Keywords: Antipsychotic, Abuse, National Poison Data System

63. The change in perceived risk associated with marijuana use in the United States from 2002 to 2012

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Background: Over the last decade there has been considerable public debate over legalization of medical and recreational marijuana, increasing use of marijuana among residents of the United States, and increasing depictions of marijuana use on television and in the movies. We sought to determine whether there has been a change in the perceived risk associated with marijuana use over that same period of time.

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Methods: The National Survey on Drug Use and Health (NSDUH) is a questionnaire administered to a multistage probability sample of residents of the United States. For the purposes of this study, risk perception was defined as the response to: "How much do people risk harming themselves physically and in other ways when they smoke marijuana once a month [occasional use]/once or twice a week [regular use]?" Respondents to the NSDUH 2002–2012 surveys were asked to classify the risk as "no risk", "slight risk", "moderate risk", or "great risk". We performed regression analysis to determine whether a temporal trend existed for the perceived risk of marijuana use, while controlling for age and gender. Secondary analyses included regression analysis and Mann-Whitney U test to determine whether age or gender, respectively, were associated with marijuana use risk perception. All analyses were performed using SPSS version 20 (IBM, Somers, NY, USA).
Results: A total of 614,579 respondents were identified. From 2002–2012 the percent of respondents who characterized regular marijuana use as being associated with "great risk" decreased from 51.3% to 40.3%, while the percent who characterized it as being associated with "no risk" increased from 5.7% to 11.7%. The percent of respondents who characterized occasional use as "great risk" decreased from 38.2% to 30.7%, while the percent who characterized it as "no risk" increased from 10% to 16.3%. There was a significant negative temporal trend in the perceived risk for both occasional and regular use of marijuana from 2002 to 2012 after controlling for age and gender ($p < 0.001$ for both). Increasing age was significantly associated with increased perceived risk for both occasional and regular marijuana use ($p < 0.001$). Males have a significantly lower perceived risk for both occasional and regular marijuana use as compared to females ($p < 0.001$).
Conclusions: Over the 10-year study period, there was a significant decrease in the perceived risk associated with occasional and regular marijuana use. Younger age and male gender were also associated with decreased perceived risk.
Keywords: Marijuana, Epidemiology, Drug of abuse

64. Thrombotic microangiopathy due to intravenous oxymorphone er abuse with variable findings on kidney biopsy

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Background: Intravenous (IV) abuse of the tamper-resistant formulation of extended-release (TR-ER) oxymorphone has been associated with thrombotic microangiopathy (TMA) and kidney failure based on clinical findings. Currently, only three reported cases document kidney biopsy findings. The cause and pathophysiology of TMA in these patients is currently unknown. This is a review of two cases with TR-ER oxymorphone-induced TMA with concurrent kidney biopsies.
Case reports: A 52 year-old man with Hepatitis C presented with nausea and vomiting; he was found to have acute kidney injury, anemia with schistocytes on blood smear, and thrombocytopenia. He admitted to repeated IV abuse of TR-ER oxymorphone, and was started on hemodialysis. A subsequent kidney biopsy revealed findings of acute arterial damage consistent with malignant hypertension and focal segmental glomerulosclerosis (FSGS). He was treated with plasma exchange with no improvement in kidney function, and discharged on hemodialysis.

A 23 year-old male with a history of IV abuse of TR-ER oxymorphone presented with fatigue and dyspnea; he was found to have anemia with schistocytes on blood smear, thrombocytopenia, and acute kidney injury. He had had an episode of pancytopenia with schistocytosis one month previously, which improved with corticosteroids. A kidney biopsy revealed acute changes of TMA. He was treated with IV immunoglobulin without improvement, and discharged on hemodialysis. During both presentations, parvovirus B19 viremia was found, but immunohistochemical staining for parvovirus B19 on the kidney biopsy was negative.
Discussion: Two cases of TMA based on clinical and laboratory parameters associated with intravenous abuse of TR-ER oxymorphone are described, but with very different findings on kidney biopsy. One case demonstrated classic findings of TMA, similar to that reported previously; the other case demonstrated findings that did not reveal TMA-induced kidney damage, despite clinical evidence of TMA. While parvovirus B19 has been associated with TMA, given the negative staining on biopsy, its role in our case is unclear. FSGS has been associated with many causes, such as infection, IV drug abuse, medications, idiopathic causes, and others. It is not certain whether the FSGS in our case is a manifestation of IV TR-ER oxymorphone-related kidney damage, or whether it is related to other causes.
Conclusions: IV abuse of TR-ER oxymorphone is associated with TMA. Questions remain as to whether other factors, such as viral infection or other types of kidney damage caused by IV TR-ER oxymorphone, may play a role in the kidney failure affecting some patients who abuse this drug intravenously.
Keywords: Opioid, Renal toxicity, Hemolysis

65. Extreme hyperglycemia, hyperlactemia, and myocardial ischemia from clenbuterol use by a body builder

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Background: Clenbuterol is a beta-2 adrenergic agonist abused by bodybuilders for its lipolytic, anabolic, and sympathomimetic properties. Acute clenbuterol toxicity results in numerous adverse cardiovascular and metabolic effects. We report a case of severe hyperglycemia, hyperlactemia, and myocardial ischemia resulting from clenbuterol ingestion.
Case Report: A 41-year-old male bodybuilder with a history of anabolic steroid and ephedrine use reportedly ingested clenbuterol 80 mcg at the gym. Within minutes he developed palpitations, flushing, tremors, chest pain, tinnitus, and malaise. He presented to the Emergency Department 3 hours post-ingestion, where he was found to be flushed and diaphoretic with emesis and ankle clonus. Initial vitals: HR 122/min, BP 127/94 mmHg, RR 25/min, T 37.4°C. Multiple laboratory abnormalities included potassium 2.6 mEq/L and Cr 2.5 mg/dL on arrival, peak glucose 575 mg/dL, peak lactate 13.0 mEq/L, and peak high-sensitivity troponin 575 ng/L (normal

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< 14 ng/L). An ECG showed sinus tachycardia and marked ST depression. He was treated with benzodiazepines, IV fluids, and IV metoprolol, with no improvement. Esmolol and insulin infusions were initiated, along with heparin, ticagrelor and multiple doses of potassium chloride. Transient hypotension was treated with norepinephrine. Coronary angiography showed normal coronary arteries. Urine testing revealed presumed clenbuterol, though definitive confirmation was unavailable. The patient's symptoms and metabolic abnormalities improved significantly over several hours, but moderate hyperglycemia, intermittent tachycardia, and ECG changes remained 4 days post-ingestion.

Case Discussion: Ingestion of clenbuterol, a potent, long-acting beta-2 adrenergic agonist, results in characteristic tachycardia, vasodilation, hypokalemia, hyperglycemia, and lactic acidosis. Myocardial ischemia and tachydysrhythmias have been described. In this case, ingestion of a reportedly small dose of clenbuterol resulted in myocardial ischemia and extreme elevations in serum lactate and glucose. To our knowledge, this severity of hyperglycemia and hyperlactemia have not previously been reported in association with clenbuterol. It is unclear if insulin hastened the resolution of hyperglycemia in this patient with no prior history of diabetes. The etiology and clinical significance of lactate elevation in the absence of hypotension remains uncertain.

Conclusion: Abuse of clenbuterol may result in myocardial ischemia in the absence of coronary artery disease, severe hyperlactemia, and extreme hyperglycemia. Beta-adrenergic receptor blockade remains the mainstay of treatment.

Keywords: Clenbuterol, Stimulant, Ingestion

66. Dust-Off the ECMO, my patient just inhaled 1,1-difluoroethane

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Background: Dust-Off® computer cleaner containing 1,1-difluoroethane (DFE) is frequently cited in cases of inhalation abuse. Malignant cardiac dysrhythmias are a well-recognized complication of DFE toxicity. We describe a patient with prolonged ventricular irritability following DFE inhalation, who was successfully treated with a central α-2 agonist and extracorporeal membrane oxygenation (ECMO).

Case Report: A 23-year-old alcoholic with symptoms of ethanol withdrawal, self-medicated by inhaling Dust-Off®. She had a witnessed seizure followed by a pulseless ventricular tachycardia (VT)arrest. She temporarily converted to a sinus tachycardia after treatment with amiodarone and a single defibrillation. The patient demonstrated severe ventricular irritability with frequent recurrent VT. Echocardiography (Echo) demonstrated an ejection fraction (EF) of 5%. The patient was sedated with dexmedetomidine (DEX), a central alpha-2 agonist, in preparation for rapid sequence induction. She was also treated with an esmolol infusion and therapeutic hypothermia. She was transferred to the intensive care unit shortly before beginning ECMO. After one week her EF was 65% and ECMO was discontinued . On hospital day 27 she was discharged to a rehabilitation facility.

Discussion: Fatal dysrhythmia secondary to inhalational abuse of hydrocarbons is often described as "sudden sniffing death". It's postulated that inhaled hydrocarbons may cause a profound sensitization of the myocardium to catecholamines. Often sudden cardiovascular collapse is precipitated by an abrupt surge in endogenous catecholamines as in the case of startling by law enforcement. In our case, the patient's GABA withdrawal syndrome could explain both her seizure activity as well as her hyperadrenergic tone that led to the ventricular dysrhythmias. Peripheral sympatholysis using β-blockers has been described as an acceptable treatment option. Central α -2 agonists (e.g. clonidine) have been used to reduce sympathetic tone in opioid withdrawal. Unlike clonidine, DEX is a central α -2 agonists that has an indication for sedation. Thus, a single agent was used to both reduce sympathetic tone and provide sedation. Mortality may be reduced if a patient's cardiac output can be bridged with cardiac bypass until the DFE cardiotoxicity resolves. To our knowledge, this is the first described case of hydrocarbon inhalant associated-cardiac arrest to be successfully treated with both DEX and ECMO.

Conclusion: Central α-2 agonism may be considered as a treatment option to decrease sympathomimetic cardiac irritability. ECMO is a consideration in the treatment of cardiotoxicity secondary to inhalant use.

Keywords: Huffing, Inhalant, difluoroethane

67. Methanol inhalation leading to serious toxicity

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Background: Methanol is found in a variety of commercially available products, including windshield washing fluid, gas line antifreeze, solid fuel for stoves, and carburetor cleaner. The parent compound leads primarily to a syndrome of inebriation, with subsequent toxicity related to its metabolism to formic acid. We present a case of serious CNS depression, profound metabolic acidosis and death following inhalation of a solvent containing methanol.

Case Report: A 62 year-old male was brought to the emergency department by his son for increased agitation. The patient admitted to inhalant abuse earlier that day, using the product Strypeeze Original (methanol 25–30%, methylene chloride 25–30%, toluene 15–20%, acetone 15–20%). Aside from the agitation, the physical exam was unremarkable. The emergency department staff was able to calm the patient, but later found him unresponsive, at which point he was promptly intubated. Results of laboratory testing are shown in the table. The patient was given sodium bicarbonate and fomepizole, and underwent emergent hemodialysis. Despite improvement in laboratory values, the patient remained comatose. Computed tomography of the head revealed cerebral edema with ischemic changes involving more than 50% of the brain. Electroencephalography showed global encephalopathy. The patient was extubated on day 9 of hospitalization and was transferred to hospice care where he expired within 24 hours.

Case Discussion: Methanol is a volatile substance (although it is not as volatile as gasoline). It has a vapor pressure of 125 mm Hg at 25 degrees Celsius along with an odor threshold of about 2,000 ppm. The greatest body of clinical experience is with ingestion, but systemic absorption may also occur via dermal exposure or inhalation. Controversy exists over the actual risk of significant toxicity occurring from these latter routes of administration, as several case

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Table 1. Laboratory values before and after hemodialysis.

	Before hemodialysis	After hemodialysis
Arterial pH	6.61	7.57
Anion gap (mEq/L)	21	7
Serum bicarbonate (mmol/L)	<10	24
Methanol (mg/dL)	72	5
Carboxyhemoglobin	2.9%	2.3%
Ammonia (mcmol/L)		24

reports and series purport no serious sequelae, while others have documented vision loss and even one death (although other co-ingestants were present). In none of the cases we reviewed was the acidosis as profound as that seen in our patient, and rarely were the clinical sequelae associated with an inhalation exposure as severe as demonstrated by our case.

Conclusion: Physicians should remain vigilant in evaluating for significant methanol poisoning in patients with inhalational exposure. This case highlights the serious morbidity and mortality that is possible with this route of exposure.

Keywords: Methanol, Acidosis, Inhalant

68. NBOMes lost in translation: What you see is not what you get

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Background: The NBOMes (N-Benzyl-Oxy-Methyl derivatives of known 2C phenylethylamines) are one of the newest classes of potent synthetic hallucinogens, described by EROWID as "the defining psychedelics of 2013." Despite schedule 1 status for three drugs in this class (25I-, 25C- and 25B-NBOMe), cases of NBOMe abuse by adolescents are reported to Poison Control Centers. We report the first case of 25C-NBOMe intoxication confirmed via mass spectrometry.

Case Report: A 16-year-old girl with a history of bipolar disorder presented to the ED after having a witnessed seizure. Thirty minutes earlier, she self-administered "25I-NBOME" via blotter paper placed on her tongue. On examination, she was tachycardic with a heart rate of 146 beats/minute and increased muscle tone in both upper and lower extremities. She had altered mental status, garbled speech, and visual hallucinations, repeatedly stating, "Look! Everyone is speaking Russian!" Within minutes of arrival, she had a second tonic-clonic seizure, which resolved after lorazepam 8 mg IV. The patient was admitted to the Pediatric ICU for further monitoring. Within 24 hours from exposure, her mental status had returned to baseline, but she complained of persistent stiffness in her arms and legs. On examination, she had increased rigidity in her bilateral thighs and 2–3 beats of ankle clonus bilaterally. Creatine phosphokinase (CPK) was elevated at 6042 units/liter (u/L) on hospital day (HD) 1 and peaked by HD 3 at 47,906 u/L despite continuous IV fluids with sodium bicarbonate and diazepam IV. The patient's CPK level dropped transiently to 36,884 u/L and then again rose to 44,093 u/L on HD 5. She was discharged with a down-trending CPK on HD 8. A serum specimen obtained 7 hours post-admission and urine collected ~9 hours post-admission, analyzed by triple quadrapole mass spectrometry, contained 25C-NBOMe present at >0.025 nanograms/milliliter (ng/mL) and 1.0 ng/mL, respectively.

Case Discussion: The NBOMes are sold in microgram doses on blotter paper and marketed as "legal" or "natural" LSD. These agents have both sympathomimetic and serotonergic effects. Adverse effects of reported NBOMe intoxication have included hypertension, tachycardia, tonic-clonic seizures, persistent agitation, violent combative behaviors, rhabdomyolysis, cerebral hemorrhage and even death. 25C-NBOMe is the chlorinated derivative of 25I-NBOMe.

Conclusion: We report the first confirmed case of 25C-NBOMe intoxication in a patient with prolonged serotonergic effects and rhabdomyolysis. The drug was sold as "25I-NBOMe." This case serves to further highlight, not only the harm these new substances pose, but also the inconsistency between a product's actual content and how it is sold.

Keywords: Drug of abuse, Hallucinogen, Serotonin syndrome

69. Jail house blues: Pharmaceuticals abused and misused by prison inmates

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Background: Callers to the State's Poison Center (PC) have indicated that some of state's prison inmates have the privilege of self-administering medications as a reward for good behavior, as well as a cost-saving strategy.

Research Question: What medications have been reported to the PC as misused or abused by inmates in the state?

Methods: We performed a retrospective chart review of PC calls that occurred from the state's correctional facilities. The following parameters were abstracted: age, gender, exposure substances and final disposition. Cases were excluded if there were therapeutic errors, non-pharmaceutical exposures, or exposures that occurred prior to the arrest.

Results: 30 calls met criteria. Average age for the entire population was 34.9 of which 70% were males. Since inmate populations are secluded by gender, analysis was done independently for each gender.

In regards to females, the average age was 32 years old, 11% were managed at the facility, 56% were admitted, 11% were observed and 22% were discharged from the Emergency Department (ED). The drug classes encountered were: acetaminophen (22%), salicylates (44%), anti-depressants (11%), anti-histamines (11%) and beta-blockers (11%).

In contrast, the average age of males was 36 years old, 29% were managed at the facility, 5% were admitted, 19% were observed and 48% were discharged from the ED. Encountered agents included: acetaminophen (29%), salicylates (5%), non-steroidals (36%), anti-depressants (24%), anti-histamines (14%), beta-blockers (5%), diuretics (5%), supplements (10%), anti-epileptics (5%), ophthalmic solutions (5%), anti-coagulants (5%), thyroid supplements (5%) and triptans (5%).

Discussion: We report the pharmaceuticals used by inmates during prison-initiated self-harm attempts. Our findings help elucidate

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what pharmaceuticals are being misused by prisoners. This data can aid in establishing guidelines for classes as well as maximum dosages that may be safely kept by inmates in their cells. Given their incarcerated status, most of these exposures may be preventable. Limitations include retrospective data and reporting bias.
Conclusion: In this retrospective study, inmates were given access to misuse multiple pharmaceuticals while in prison. Further research into pharmaceutical availability as well as establishing controls on types and quantities may reduce the number of events requiring medical intervention.
Keywords: Abuse, Poison center, Prison

70. Prolonged respiratory depression from heroin overdose

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Background: Heroin, or diacetylmorphine, is a commonly used illicit opioid with a short half-life. The lipid-soluble diacetylmorphine is transported to the brain and metabolized to 6-monoacetylmorphine (MAM) and 3-MAM, then to morphine, all of which have short half-lives. The clinical effects of heroin typically last 2–4 hours. We report a case of prolonged respiratory depression and CNS effects for 36 hours after a single heroin injection.
Case: A 18yo man was a 750mg per day heroin user (250 mg IV TID). In an attempt to end his life, he injected 1.5g of heroin intravenously and left a suicide note. He was found unconscious. He was treated with 2mg IM naloxone and 2 mg IV naloxone in the pre-hospital setting with awakening. In the ED, he was treated with a total of 12mg IV naloxone in 1–2 mg IV increments approximately every 1–2 hours over a 12 hour period. At 12 hours, he remained somnolent and had an elevated pCO2 (50). He was started on a 0.5mg/hr naloxone infusion and admitted to the PICU. He again became somnolent and had an O2 saturation (sat) of 90%. He was treated with another 1mg IV naloxone and the infusion increased to 1.5mg/hr. At 20h after injection, he became obtunded and was treated with 1mg naloxone IV bolus. After 36 hours of observation after his injection, he was weaned from naloxone infusion and boluses and remained awake. Urine immunoassay was positive for opioids only. A comprehensive screen of his urine which includes over 300 pharmaceuticals was negative for any co-ingestants. A comprehensive opioid confirmatory screen detected morphine (> 5000ng/mL) and codeine (65ng/mL) and was negative for all other opioids including methadone, hydromorphone, oxycodone, oxymorphone, and hydrocodone. GC/MS of a spoon that was found in his pocket (and later confirmed to be his "cook spoon") revealed only heroin.
Discussion: We report a case of a confirmed single injection of heroin that resulted in prolonged (36 hour) respiratory depression and required a total of 43.5mg of IV naloxone over 36 hours. Other ingestions were ruled out by negative comprehensive tests for pharmaceuticals and opioids and by the patient's history and evaluation of his spoon used for 'cooking' his drug. His prolonged clinical effects may be due to the mass of his injection (1.5g), though altered metabolism may have contributed.
Conclusion: The pharmacokinetics and pharmacodynamics of heroin may be unpredictable. Clinicians should be aware that heroin injection may lead to prolonged clinical effects.
Keywords: Heroin, Abuse, Substance abuse

71. Acute intoxication following dimethyltryptamine ingestion

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Background: Ayahuasca is a tea used in South America for medical and sacramental purposes. In the last decade, there have been reports of use in North America. N,N-dimethyltyptamine (DMT) is a tryptophan derivative that produces hallucinogenic effects and is often a component of Ayahuasca. This co-administration is beneficial to the user because DMT, administered orally, undergoes extensive first-pass metabolism by monoamine oxidases (MAO) and Ayahuasca is a MAO inhibitor. Therefore, the concentration of DMT in the systemic circulation is increased.
Case Report: A 25 year-old male presented to the emergency department (ED) under mental health arrest for acting strangely. At 11:00 the patient reportedly ingested an Ayahuasca tea he purchased from the internet. He became agitated and was hallucinating and "fighting with a cat in his front yard," which prompted neighbors to call police. He had broken several windows, was bleeding, and when police arrived at 16:00 he was tasered due to severe agitation. Upon presentation to the ED, he was not agitated but still required restraints. He endorsed hallucinations but was able to describe the ingestion. He did not recall breaking windows, fighting with a cat or the police arriving. He endorsed previous Ayahuasca, psilocybin and LSD use. On exam he had multiple lacerations to the back, chest, face and all extremities. Pupils were dilated to 4–5 mm. He had increased tone with several beats of clonus, 3 + patella reflexes but no overt rigidity. He was flushed but not diaphoretic. Admission vitals were: temperature 37.2°C, heart rate 88 beats per minute, respiratory rate 18 breaths per minute, blood pressure 116/71 mmHg. He had leukocytosis (20,000/μL) and mild rhabdomyolysis (creatinine kinase 895 units/L). Urine drug screen was positive for amphetamines (confirmation negative). A urine tryptamine screen confirmed dimethyltryptamine present at DMT screen from arrival and subsequently resulted > 2000 ng/mL. The patient was given intravenous fluids, did not require pharmacologic therapy and was discharged three days later.
Case Discussion: Our patient experienced hallucinations and amnesia to some events following DMT ingestion augmented by Ayahuasca. He developed rhabdomyolysis likely from a mild serotonin syndrome. Symptoms from his intoxication dissipated 6–7 hours from the time of ingestion. He did not require treatment with benzodiazepines and only received fluid resuscitation.
Conclusion: Acute DMT ingestion may result in agitation, delirium and hallucinogenic effects as well as serotonin syndrome. Management of the patient's symptoms with intravenous fluids and benzodiazepines, when necessary, should be utilized to prevent sequelae.
Keywords: Hallucinogen, Drug of abuse, Intoxication

72. Pemphigus foliaceus – A dermatologic manifestation of heroin use

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Background: Pemphigus foliaceus (PF) is a rare autoimmune blistering disease that presents with recurrent erythematous patches and shallow erosions with crusting in a seborrheic distribution (areas rich in sebaceous glands) including the face, scalp, central chest, upper back, axillae and groin, typically sparing the mucous membranes. Patients can develop shallow blisters on healthy-appearing skin with applying pressure and rubbing (Nikolsky sign). The circulating IgG auto-antibodies in PF are directed against adhesive cadherin proteins including desmoglein 1, found in the desmosomal cell junction in suprabasal layers of the epidermis. Binding of the desmoglein 1 antibodies results in loss of cellular adhesion (acantholysis) in the granular layer of the epidermis and formation of superficial erosions and fragile blisters. Drug-induced pemphigus foliaceus is a well-established etiology and most commonly linked to calcium channel blockers and angiotensin converting enzyme inhibitors.
Case Report: A 56 year old African American male with a long-standing history of daily heroin use (primarily insufflation) presented with 2 years of worsening painful skin eruptions, erosions and crusting on the face, trunk, and extremities. The patient was seen multiple times in the ED and had been treated with prednisone tapers, topical steroids and doxycycline and demonstrated some improvement, but symptoms recurred after cessation of oral corticosteroids. Dermatology performed an extensive evaluation including multiple biopsies and direct immunofluorescence (DIF) that was negative for eczematous dermatitis. An ELISA showed elevated antibodies against desmoglein 1 of 105.8U (reference range $<$ 14U) and normal Desmoglein 3 of 1U (reference range $<$ 9U). Repeat DIF demonstrated intraepidermal, intracellular IgG and complement 3, diagnostic of PF.
Case Discussion: Heroin users can have many dermatological manifestations that are mostly associated with IV/IM/SQ routes. This patient denied any use of injection but admitted to daily heroin insufflation (with sporadic use of marijuana, cocaine, and PCP). Although other subtypes of PF exist, they are mostly associated with other systemic findings such as systemic lupus erythrematous, neoplastic process, IgA mediated, or dermatitis herpetiformis. The patient had no clinical or laboratory findings consistent with these other subtypes and therefore we concluded that the patient had a drug-induced PF secondary to chronic heroin use.
Conclusions: Heroin and other illicit drugs (including adulterants) can present with a variety of previously un-reported dermatologic manifestations as in this case of heroin-induced PF.
Keywords: Heroin, Pemphigus foliaceus, Dermal toxicity

73. Drug use pattern among staffers at a University Medical Center

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Background: Most employers of labor require potential employees to undergo mandatory urine drug screen (UDS). Though UDS is not regarded as a medical exam, it is often done post offer pre hire. Other reasons for UDS in the workplace include, post-accident, reasonable suspicion, random testing among others. This study looks at the pattern of drug use at a university medical center in comparison to the general US work force.
Methods: We reviewed drug testing results reported by a toxicology laboratory and reviewed by a medical review officer (MRO) from January, 2011 to December 2013 for a University Medical Center. We also reviewed the drugs listed by the donor prior to donation of the urine samples. The samples were collected in accordance with the federally mandated guidelines for urine drug screen and a copy of the custody and control form for each patient was reviewed. The laboratory methods of detection are immunoassay for screening and gas chromatography for confirmation. The results were then compared to data from Quest Diagnostics urine drug test results over the same period. The medical Center used a 9 drug panel which includes amphetamines, barbiturates benzodiazepines, benzoylecgonine, THC, methadone, opiates, phencyclidine and propoxyphene while Quest diagnostics data reported a 10 drug panel with the addition of oxycodone. The general opioid screen used by the medical center does not detect synthetic opiates such as oxycodone and methadone.
Results: A total of 4166 urine drug screens (UDS) were done during the study period with 98 returning positive results for one or more drugs (2.3%). Within the same period the combined US work force positivity rate was 3.5% (Quest Diagnostics). Nationally, marijuana metabolite (2.0%) was the predominant drug of abuse followed by oxycodone (1.0%), amphetamine (0.87%), opiates (0.44%) and barbiturate (0.25%). At the University, amphetamine (1.3%) was the predominant drug reported followed by marijuana metabolite (0.56%), opiates (0.27%), barbiturate (0.21%), and benzodiazepine (0.07%). 54% of the 98 positive results from the medical center were due to amphetamine.
Conclusion: There is discordance between the predominant drug found in the US work force and the University Medical Center. While Marijuana was the number one drug of abuse nationally from the Quest data; amphetamine was the predominant drug found in the UDS of the university medical center. All of the employees who tested positive for amphetamine were either on dextroamphetamine or lisdexamfetamine for ADHD and this may account for the discordance seen in the study. This study suggests drug use pattern may vary from state to state.
Keywords: Amphetamines, Drug of abuse, Urine drug screen

74. Integration of multiple external data sources with poison center (PC) patient and educational data to allow for predictive analytical surveillance and documentation of program effectiveness

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Background: The PC merged multiple data sets (emergency and inpatient hospital data, census, PC patient and educational program data, and public health related twitter feeds) to: A) develop predictive analytics for public health surveillance utilizing historical data as a method to predict trends, B) more adequately characterize the impact of PC services and poison prevention education, and C) determine the effectiveness of prevention activities by analyzing impact on hospital admissions for toxic exposures.
Methods: The PC requested 12 years of statewide emergency/inpatient routine hospital data specifically requesting masked

SSN, admit Date, discharge date, medical record number be included. Using ICD-9 to AAPCC generic code cross walk, the hospital data set was merged with PC patient and educational program data. Data de-duplication efforts were used in linking cases appearing in both data sets. A subset of 368,310 unique "tweets" generated from a list of rules occurring in the 50 day Twitter feed was obtained from G-Nip. These 18,051 individual "tweets" were initially placed into 9 categories including "Bites (snake, spider, and insect related), poison, drugs, food poisoning, and inhalants.

Results: Combined and de-duplicated hospital/PCC patient data allowed for more accurate reporting on toxic exposures. Analysis of current outreach strategies success was performed using contiguity to a home county, and age groups. In home counties, negative correlations are found between the number of poison-related hospital admissions for a given month and the number of outreach events in the three prior months (). By examining the odds ratios associated with Twitter feed segmentation methodology, we observe that rule-based classification methods offered by G-Nip, provided insight into identifying snake or spider bites and instances of food poisoning.

Conclusions: Combining historical PC data with hospital patient data allows for enhanced reporting and the possibility that educational program outcome success can be measured. Once Twitter data is filtered it allows real-time insight into public communication about poison related events with specific geolocation information, public reach counts and user information. Historical Twitter data may also be used to identify optimal times to convey information about each topic by tweet frequencies.

Keywords: Hospital patient data, Public health, Enhanced reporting

75. Increasing rates of anomalous bupropion prescribing

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Background: The antidepressant bupropion is structurally related to amphetamines, and bupropion abuse is an increasingly recognized public health concern. We hypothesized that prescription claims data might provide evidence of growing misuse of the drug.

Methods: We conducted a longitudinal study using outpatient prescription claims in Ontario, Canada from April 1, 2000 to March 31, 2013. Study subjects were community-dwelling patients younger than age 65 who received publically-funded prescriptions for bupropion. Every calendar quarter, we determined the number of potentially inappropriate prescriptions for bupropion, defined in the primary analysis as refills dispensed more than twice as early as expected based upon the preceding prescription. A secondary analysis examined overtly duplicitous prescriptions – similarly early refills originating from both a different prescriber and different pharmacy than the immediately preceding prescription. We replicated these analyses for citalopram, an antidepressant not especially prone to abuse.

Results: We examined 2,131,566 prescriptions for bupropion and 4,106,305 prescriptions for citalopram. Early refills for both drugs were relatively common, but by the final quarter of the study period were significantly more common with bupropion (odds ratio 2.40; 95% confidence interval 2.30 to 2.49.) Overtly duplicitous prescriptions for bupropion were less common, but increased steadily beginning in 2008. By the end of the study period, these were almost 4 times more common with bupropion as with citalopram (odds ratio 3.78; 95% confidence interval 3.03 to 4.70).

Conclusions: Anomalous bupropion prescribing is increasingly common, consistent with growing reports of misuse. Health care professionals should appreciate the abuse potential of bupropion and remain vigilant for inappropriate prescriptions.

Keywords: Antidepressant, Abuse, Epidemiology

76. Factors associated with non-medical use of stimulants among college students

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Background: Stimulant prescriptions (Rxs) filled by US pharmacies have risen dramatically in the past 2 decades. The National Institute on Drug Abuse states stimulants are one of the most commonly abused drugs, along with tobacco, alcohol, and opioids. Studies suggest that stimulant abuse in young adults has become widespread throughout the US. Factors associated with non-medical (NM) stimulant use among college students are described.

Methods: The RADARS® System College Survey Program collects data from approximately 6000 college students annually throughout the US during the spring, summer, and fall semesters. College Survey is an online survey inquiring about NM use of Rx drugs, defined as use of a Rx drug without a doctor's Rx or for any reason other than what was recommended by *their* prescribing doctor during the last 3 months. NM stimulant use was first modeled using univariate logistic regression to determine the unadjusted associations with year quarter, gender, age, race, college length, college type (public or private), college size ($<10{,}000$, $\geq 10{,}000$), college housing (on or off campus), Greek (fraternity/sorority), illicit drug use, and non-stimulant, NM Rx drug use. All statistically significant predictors were included simultaneously in a multivariate model. Backward selection was used to remove non-significant predictors from the model. Adjusted odds ratios (OR) were estimated for each significant predictor.

Results: Applying multivariable adjustment to data collected 2009Q1–2013Q4, several factors were associated with NM stimulant use (Table 1), including self-identification of male gender, white race, attendance at a 4 year college, living on-campus, Greek membership, endorsement of illicit drugs, and non-stimulant, NM Rx drug use. Year quarter, age, college type, and college size were not significantly associated with self-reported NM stimulant use.

Conclusion: Several factors associated with NM stimulant use among college students were identified, most striking is the finding that students who endorse illicit drugs are 3 times more likely to report NM Rx stimulant use and students who endorse non-stimulant, NM use of Rx drugs are almost 5 times more likely to report

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Table 1. Adjusted OR for factors associated with NM use of stimulants among college students.

Estimate	p-value	Adjusted OR (95% CI)
Male Gender	<.001	1.16 (1.08, 1.25)
White Race	<.001	1.20 (1.10, 1.30)
4 year College	<.001	1.18 (1.08, 1.29)
Living On Campus	<.001	1.17 (1.08, 1.27)
Greek Membership	<.001	1.27 (1.17, 1.38)
Illicit Drug Use	<.001	3.17 (2.90, 3.47)
Non-Stimulant, NM Rx Drug Use	<.001	4.91 (4.42, 5.46)

NM Rx stimulant use. Knowledge of these risk factors can advise targeted prevention efforts.

Keywords: Stimulant, Risk Factors, College

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Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

77. The importance of patient education, two cautionary tales

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Background: Patient education (PE) is an essential part of drug therapy initiation. Though compliance is essential for effective therapy, emphasis on safety is also critical. The Food and Drug Administration reports medication errors cause at least 1 death per day. Calcium channel blockers (CCBs) are known to cause significant morbidity and mortality in overdose (OD) and have narrow therapeutic indices. Complicating this further is CCBs are used not only for hypertension, but for the prevention of pain, including angina and headache (HA). We present here 2 patients who suffered accidental fatal ODs of CCBs that may have been preventable with proper medication education.

Case 1: A 36-year-old woman presented to the emergency department (ED) at approximately 0300 in the morning, complaining of chest pain (CP) since 1900 the evening before. She reported taking up to 20 diltiazem SR 120mg for CP in a 6-hour period. She was under the impression this was an "as needed" medication for CP. Two hours after ED arrival her blood pressure (BP) was 80/40 mmHg and heart rate (HR) was 59 beats per minute (bpm). Over the next week the patient was treated with calcium (Ca), vasopressors (VP), high dose insulin (HDI), intravenous fat emulsion (IFE), methylene blue, continuous veno-venous dialysis, and extra corporeal membrane oxygenation. Despite these heroic measures, the patient died on hospital day 8.

Case 2: A 41-year-old woman called the poison control center (PCC) reporting she took up to 30 verapamil ER 120 mg in a 5-hour period. She was prescribed verapamil for HA and when her HA did not resolve she took more. She was under the impression verapamil was an "as needed" medication for HA. The PCC referred patient to the ED. Upon ED arrival her vitals revealed a HR of 57 bpm and a BP of 80/37 mmHg. She was treated with Ca, VP, glucagon, HDI and IFE. In spite of all these interventions, the patient continued to deteriorate and expired 20 hours after ED presentation.

Discussion: Though these 2 cases involve a tragic misunderstanding about the role of pharmacotherapy for acute vs. chronic pain, they highlight a potential pitfall with CCBs and the need for PE and effective communication between healthcare providers and patients. As these CCBs were prescribed for "pain," it is unlikely the patients received proper education regarding the drugs' effects. Discussion of the disease state, rationale for drug therapy, specific medication labeling, and effective medication counseling are a few strategies that can be employed to help prevent these errors, particularly with high risk medications like CCBs.

Conclusion: PE is essential for safe and effective drug therapy. Regardless of why CCBs are prescribed, patients should be educated on their hemodynamic effects.

Keywords: Calcium channel blocker, Death, Education

78. Impact of implementing an integrated voice response (IVR) system to manage drug identification requests while preserving prevention services in one US Poison Control Center

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Background: Many US Poison Centers have been forced to cut non-essential public services such as Medication Identification Requests (MIR) in response to staffing and funding cuts. While previous PCs have demonstrated integration of automated Interactive Voice Response (IVR) technology to automate public MIRs, implementation resulted in significant reductions or near elimination of the MIR services provided. We describe a stepwise approach to IVR MIR system implementation which enabled a sustainable service delivery model while preserving key public health benefits (surveillance, abuse-prevention) and associated Poison Center (PC) staffing resources.

Method: A stepwise project plan was initiated in June 2009 consisting of two major phases including phone tree integration and IVR MIR design validation and deployment. Focus groups, consisting of community volunteers, were recruited to perform scenario driven test calls and feedback through the design phase. In order to preserve real time call surveillance, technology requirements included automation of the written medical record for immediate auto-upload to the National Poison Data System (NPDS). IVR system design incorporated the collection of standard demographic information (age, gender, zip) and reporting of all verbal interactions (caller and system messaging) into the written case narrative. Imprint verification, including medication attributes such as color/shape/type were used to validate the caller MIR. Each unique medication was associated with messaging that included the medication name, strength, typical clinical use and common brand names. Design incorporated the ability to speak with a PC specialist for additional assistance as needed and produced a fully automated documented case report in the local PC database (Toxicall) in near real-time for all calls associated with a successful medication ID.

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Results: Proof of concept and full system implementation occurred in Oct 2010. Since implementation, the IVR MIR system continues to process 150–200 calls per day, with a success rate for medication ID and full case documentation in 50% of calls handled. Within three years of implementation, the IVR MIR system has generated over 86,000 cases which have been uploaded to NPDS. Additionally, system implementation was associated with improvements in customer and staffing satisfaction scores.
Conclusions: This unique IVR MIR demonstrated successful integration of automated technologies that facilitated a sustainable service deliver model.
Keywords: Drug of abuse, Education, Public health

79. Expansion of an ED prescription naloxone program with SBIRT: A pilot program

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Background: Heroin and prescription opioid abuse are major public health concerns, surpassing motor vehicle accidents as the leading cause of preventable death. Prescription naloxone programs have empowered laypersons to help prevent death from overdose. After years of success by community-based programs, emergency departments (EDs) are offering ED-based prescription naloxone program. This naloxone training intervention at a large county hospital identified time, just 10–15 minutes, as a major barrier to reaching a large number of patients. In the State of Illinois patients must receive education on identifying an overdose, rescue breathing, administering naloxone and calling 911 prior to being given a prescription for naloxone. Missing a teachable SBIRT moment was another concern in addressing the epidemic of opioid use disorders. We sought to describe the process of developing a partnership between a hospital-based SBIRT program and an ED-based outpatient prescription naloxone program.
Methods: A partnership was developed between directors of the ED prescription naloxone program and SBIRT. Departmental support was secured for to use SBIRT resources to dedicate to this project. Operational logistics were developed with input from the directors of the ED naloxone program and SBIRT, and counselors. SBIRT counselors were trained on the goals and logistics of the program, and how to provide the naloxone training that must be completed for each patient receiving a prescription. Each counselor observed at least one training session. An order was created in the electronic system allowing ED providers to place an SBIRT counselor order to provide training to a patient. When this training is complete, the counselor notifies the provider who then writes the prescription. This information was disseminated to providers.
Results: Four SBIRT counselors were trained along with 35 community partners as trainers in naloxone education. Our ED-based program has prescribed naloxone 25 times. Data collection for the ED/SBIRT partnership is ongoing. A local action grant from the Emergency Medicine Resident's Association was secured to support the formation of the partnership.
Conclusions: We describe the expansion of an ED-based prescription naloxone program to include SBIRT counselors not only as a way to offer this life saving treatment but to take advantage of brief intervention opportunity and lay the groundwork for access to care. The time required for ED providers to prescribe naloxone has been greatly reduced and we now have an additional intervention geared toward cessation in our ED. Further study will be focused on assessing improved ability to train appropriate individuals for prescription naloxone.
Keywords: Naloxone, Opioid, Education

80. Derivation of a checklist score for evaluation of trainee performance in a toxicological medical simulation scenario

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Background: Medical simulation is a tool to evaluate trainee skills in resuscitation of poisoned patients. In contrast to live patients, simulated patients provide a standardized environment where trainees can commit error without causing patient harm. There is currently no validated checklist score to evaluate trainee performance in the management of a critically ill poisoned patient.
Objective: We used a two-step process to derive a checklist score for evaluation of trainee management of simulated opioid-poisoned patients.
Methods: In phase I, we reviewed simulation literature, OSCE scoring scales, and consulted with a medical toxicologist, emergency physician, and emergency medicine trainees. We generated a list of 28 management actions to constitute a "preliminary checklist." In phase II, a "skilled" resident cohort ($n = 10$) and an "unskilled" cohort ($n = 11$) managed a standardized simulated opioid-poisoned patient. The skilled cohort consisted of experienced third-year emergency medicine residents. The unskilled participants were between medical school graduation and start of residency. Each participant managed an identical unknown, standardized simulated opioid-poisoned patient. Participant performances were recorded and a trained reviewer measured performance of preliminary checklist items by all participants. We calculated point estimates for index of discrimination (ID) for all preliminary checklist items. Preliminary items that did not adequately differentiate skilled from unskilled trainees were dropped from the final scale. Six items failed to discriminate or were negative discriminators ($ID \leq 0$): Cardiac monitoring, IV placement, making a disposition, pulse-oxygen determination, temperature assessment, and obtaining a urine tox screen. Eight items were good discriminators ($ID \geq 0.25$): Airway assessment within 3 min, naloxone administration within 3 min, pupil exam within 3 min, glucose check, pupil exam (ever), respiratory rate exam, and skin exam. These 8 items became the final checklist. Using the final checklist, scores were compared with unpaired t-test. Skilled trainees performed 72.50% of checklist items and unskilled trainees performed 42.05% of checklist items. The difference in means was 30.45% (95% CI: 11.94–48.97) ($P < 0.05$).
Conclusion: Our 8-item checklist scale differentiates skilled from unskilled trainees in our derivation group. Subjectively, the checklist has face validity for measuring resuscitation performance in a simulated opioid-poisoned patient. However, the checklist must be validated in a separate group before we consider it to be a truly valid performance assessment tool.
Keywords: Simulation, Opioid, Education

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81. Comparison of knowledge and performance assessments of trainee resuscitation skills in a simulated poisoned patient

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Background: Medical toxicology (MT) programs will be required by ACGME to assess MT fellows' competency using the "Milestones" program. For emergency medicine (EM) trainees, ACGME has identified emergency stabilization (ES), and focused physical examination (PE) as milestones. Traditionally, knowledge-based assessment (written exam) has been used to evaluate acquisition of clinical knowledge and skills. Medical simulation is an ideal modality for performance-based assessment.
Objectives: In a cohort of EM interns, we compared knowledge-based and performance-based assessment to evaluate the execution/performance of ES and focused PE in a standardized poisoned patient scenario.
Methods: We enrolled all EM interns at an academic residency program. The experimental group ($n = 12$) performed a brief online training on toxicologic coma and completed post-training MK test. Participants then completed identical simulated patient scenarios. The case involved an unknown patient with opioid-induced coma. A trained reviewer assessed participants' performance. A priori definition of appropriate ES was naloxone administration. A priori definition of complete PE was completion of toxicologic physical exam: pupil exam, skin exam, bowel sounds auscultation, assessment of respiratory rate. The 'adequate' physical exam was defined as performance of at least three of those items.
Results: All participants performed the online training. In a post-training validated MK written test, 100% of residents successfully identified all elements of the toxicologic physical exam. In the subsequent simulation scenario, 66.67% of residents performed an "adequate" PE (3 of 4 elements) and 41.67% performed complete PE. Using either measure of PE, the difference between proportion of participants with good MK of the exam and performance of the exam was statistically significant ($p < 0.05$). All participants in the MK test correctly identified the indication for naloxone administration and 91.67% administered naloxone during the simulated scenario. The difference was not statistically significant.
Conclusion: In our cohort, residents who completed an online training scored perfectly on knowledge-based assessment of ES and PE. However, subsequent performance-based assessment agreed for ES but not PE. Knowledge assessments may not be ideal for measurement of PE skills. Further research should compare experiential modes of learning to online learning and should work to identify barriers that prevent clinical application of MK.
Keywords: Medical simulation, Education, Opioid

82. A multilingual medication safety campaign

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Background: It can be challenging for those with limited English proficiency (LEP) to take, store and dispose of medicines safely. Lack of awareness along with language and cultural barriers may contribute to medication errors and improper disposal. Research has shown that visual aids, translated materials and patient teaching are the most effective ways to educate this population. The goals of this project were to help those with LEP manage and dispose of their medications safely by identifying language and culture barriers regarding medication safety and to provide educational tools to help pharmacies and physicians address these issues with patients.
Methods: Refugees and immigrants in one county were the focus of an ongoing medication safety awareness campaign starting in November, 2013. These included members of newly resettled as well as established populations. Languages were chosen for translated materials based on the most common languages seen by pharmacists, pediatricians and refugee agencies: Arabic, Burmese, French, Nepali, Somali, Swahili and Vietnamese. A poster was developed to address common medication errors seen among this population. Images were selected to accompany each safety message. A brochure on how to dispose of medicine safely was also developed. Safety messages and images were reviewed for health literacy and field tested. Sixteen organizations including pharmacies, refugee agencies and health centers partnered with the poison center to display and disseminate the information. Follow-up for implementation and documentation is ongoing.
Results: Fifteen out of 16 targeted organizations are displaying the poster. All 7 targeted pharmacies agreed to distribute the brochures. Five pharmacies reported difficulty selecting the correct brochure to disseminate with prescriptions due to language barriers. Six pharmacies reported patient teaching is minimal. One of the 4 targeted health centers is highlighting patients' primary languages on prescriptions to alert pharmacy staff. A pediatric clinic is distributing the brochures during 9-month well-baby visits. Materials are being distributed by peer educators at community events and by organizations that previously received multilingual prevention kits.
Conclusion: Medication safety is important to prevent poisonings among LEP populations, but there are barriers. Pharmacists have difficulty distributing the appropriate brochures due to the inability to identify patients' primary languages. Partnerships with pharmacists and physicians are essential to overcoming these barriers. Highlighting patients' languages on prescriptions may be beneficial. Pharmacists may also need to take a more active role in education.
Keywords: Education, Medication safety, Multilingual

83. Somebody's watching me

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Background: Quality assurance (QA) programs are developed to ensure the quality of services provided by an organization. A survey of poison center (PC) websites shows that PCs are performing QA and monitoring charts but details are lacking. While all PCs say they participate in a QA program, what these evaluations entail, and who performs them, is not published. How often and how closely charts are looked at is an individual center's decision. This survey sought to answer more specific questions.

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Methods: US PCs were surveyed about auditing practices of exposure cases. Surveys were sent electronically through Survey Monkey to one randomly chosen certified poison information specialist (CSPI) at each of the 55 PCs. CSPIs were asked 14 auditing questions. Data were analyzed to determine how uniformly PCs audit charts and what their minimum requirements are.
Results: 23/55 (41.8%) PCs responded. 22/23 (95.6%) of the PCs audit charts. Of the 22 PCs that audit, only one audits all charts. 8/23 (34.7%) PCs audit 50% or more of their charts. Of the charts that are audited 87% are audited by CSPIs, 52.1% by medical directors, 47.8% by managing directors, 39.1% by SPIs, and 4.35% by poison information providers (PIPs). A record is kept of the number of charts a CSPI audits 91.3% of the time. 65.2% of respondents said that this was part of their evaluation. 78.3% of CSPIs audit charts during their regular shifts while 30.3% are given time off from taking calls to audit. 86.9% of the PCs have auditing guidelines. 82.6% of the PCs do not audit all calculations. In the case of a calculation error 39% of managing directors would be notified and 13% of medical directors would be notified. 52% of the time the error would be reviewed with the specialist. 52% of the CSPI's state they use an identifier on the chart to designate that it was audited.
Conclusions: Of the 23 PCs that responded to the survey only one didn't audit charts. 65.2% of the PCs audit less than half of their charts. CPSIs audit a majority of the charts and most perform audits while taking calls. If there is a calculation error 52% of the time it will be reviewed with the specialist. While 86.9% of the PCs have auditing guidelines there are no standard guidelines for charting. The minimum amount of written information required on a chart varies from center to center.
Keywords: Poison center, Documentation, Quality assurance

84. The medical toxicology pipeline – residents and medical students who have rotated on a medical toxicology service and subsequently became toxicologists

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Background: Little is known about the influence of rotating on a Medical Toxicology Service and subsequent training our specialty. Our training service began in 1988 with the goal of training fellows, students, and residents. In 1988, our pioneer year, there were 2 fellows and 6 preceptees {attending board-certified physicians in internal medicine or Emergency Medicine (EM) seeking Medical Toxicology training}. Our student rotation began in 1999. We sought to determine the number of rotating residents and medical students who chose to complete fellowships in medical toxicology since we began accepting residents and students on our 4-week clinical toxicology rotation.
Methods: Records from all rotating residents (1991–2013) and medical students (1999–2013) were reviewed and tallied. Rotating residents and students were analyzed to determine which individuals subsequently did a medical toxicology fellowship. These individuals were identified either by recognition of the authors, or by confirmation in a medical toxicology specialty society directory.
Results: There have been 1536 residents on our medical toxicology rotation from July 1991 through June 2013. There have been 522 senior medical students who have rotated on our Medical Toxicology service. A total of 45 individuals who rotated on our service went on to complete a medical toxicology fellowship. 27 rotators (23 residents 1 fellow, 3 students) trained in our medical toxicology fellowship. 18 rotators completed a fellowship at other programs (16 resident, 2 student). Overall 2.6% of rotating residents or fellows went on to complete a toxicology fellowship, compared to only 1% of rotating medical students.
Conclusion: A higher proportion of our rotating residents pursued fellowship than rotating medical students. Medical toxicology service rotations for residents and medical students are a critical resource for capturing and the interest of trainees and promoting their desire to pursue paths in medical toxicology. This rotation provides a venue for mentorship. Further study of other programs should be undertaken to determine fellowship training rates. Characteristics of resident and student training programs will be important for the future of our specialty.
Keywords: Education, Medical toxicology, Rotation

85. Ability of physician trainees to identify common serotonergic agents when treating serotonin syndrome

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Background: Serotoninergic agents have become ubiquitous throughout medical care. Despite the frequent prescribing pattern of these xenobiotics, housestaff trainees (resident and fellow physicians) have often been unable to identify serotoninergic medications during their Medical Toxicology rotation. The object of this study is to determine if housestaff are cognizant of drugs with high serotonergic activity that could worsen a patient with Serotonin Syndrome.
Methods: A clinical vignette regarding an adolescent male who was on several serotoninergic medications for control of underlying psychiatric disease and who presented with fulminant Serotonin Syndrome (SS) after abusing dextromethorphan was distributed to the entire housestaff at one institution. Participants were given a list of drugs used commonly in the ICU setting and asked to identify which of the agents were known to increase serotonergic activity and should be avoided in the patient's management. The survey was distributed using the house staff email listserv. Response to the survey was entirely voluntary. Year of training and department were also recorded for each response.
Results: 156 participants replied out of a housestaff of 760 for a 21% response rate. The departments with the highest response rates were Emergency Medicine 84% (n = 26), Obstetrics and Gynecology 62% (n = 10), Pediatrics 58% (n = 19), Internal Medicine 43% (n = 42), Anesthesia 26% (n = 15), and General Surgery 22% (n = 11). Across all respondents, the following agents were correctly identified for their potential to increase serotonergic activity and exacerbate SS: sertraline, 94%; meperidine, 56%; linezolid, 44%; fentanyl, 38%; lithium, 24%. The following agents were incorrectly identified as worsening serotonin syndrome: quetiapine, 59%; dexmedetomidine, 19%; propofol, 10%; midazolam, 8%, and cefepime, 6%. Respondents from Anesthesia and Emergency

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Medicine correctly identified meperidine as having serotonin activity more than 80% of the time; however, Internal Medicine identified it as a serotonergic agent in only 38% of the responses. Participants more advanced in their training were not more likely to correctly identify meperidine than their junior colleagues.
Conclusion: Our results demonstrate significant gaps in understanding of SS and serotonergic agents. While 94% were able to identify that sertraline would worsen the syndrome, only 56% identified meperidine as serotonergic despite the historical implications of this interaction. Further concerning was the belief that quetiapine had serotonin agonist activity reflecting failure to understand the mechanism of this very commonly prescribed xenobiotic.
Keywords: Serotonin syndrome, Education, Drug interaction

86. The prevalence of modifiable parental behaviors associated with inadvertent pediatric medication ingestions

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Background: Children are at risk of ingesting elderly caregivers' medications due to the frequent medication use in this population and unsafe storage and medication administration practices. Few have examined whether these risk factors are present in younger caregivers, such as parents or guardians. We sought to examine the prevalence of modifiable parental behaviors which have been associated with inadvertent pediatric medication ingestions.
Methods: This prospective, observational study of parents and guardians of all pediatric patients between 2–10 years was conducted in an academic pediatric ED over 3 months in 2013. Research assistants collected data on a standardized data form 7 days a week, 15 hours daily. Data included demographics, annual household income, caregiver education level, ability to name medications and location of where they are stored and taken. Data are presented as means (SD) and proportions. Chi^2 was conducted for associations with medication knowledge.
Results: Of 338 participants, 287 (85%) reported being the mother, 42 (12%) reported being the father and 9 (3%) reported being the guardian of the child. Mean caregiver age was 30.4 (7.5) years and mean age of enrolled children was 5.6 (2.6) years. Of caregivers, 153 (45%) reported taking either a prescription or non-prescription medication on a daily basis. The most common medications are noted in the Table 1. Of those taking a prescription medication, 25% reported not knowing the names of all their medications yet, when asked to list them, 35% listed at least one medication as "unknown". Medication knowledge was not associated with education level or annual household income of the caregiver ($p > 0.05$). Common sites of prescription medication storage included: medicine cabinet (27%), pocketbook (25%), kitchen cabinet over countertop (24%), a bedroom drawer (10%) or on a nightstand or dresser (7%). The majority, 57%, admitted to taking medications at mealtimes, with breakfast being the most common (42%). Most caregivers kept medications in the original bottle (96%) and/or in a pill box (5%).
Conclusion: Nearly half of caregivers take medications on a daily basis. While medication storage was satisfactory, administration during mealtimes could increase risk of inadvertent poisoning. Incomplete medication knowledge may make patient triage and management more challenging post ingestion.

Table 1.

Parental prescription medications(n = 104)	n (%)
antihypertensive	16 (15.4)
antidepressant	14 (13.5)
oral diabetic	9 (8.7)
birth control pills	7 (6.7)
narcotic	6 (5.8)
Parental non-prescription medications(n = 70)	**n (%)**
multivitamin	28 (40)
NSAID	17 (24.3)
acetaminophen	15 (21.4)

Keywords: Inadvertent, Pediatric, Ingestion

87. Prevalence of prior inadvertent pediatric medication ingestion attempts and caregiver management in a general pediatric ed population

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Background: Inadvertent pediatric medication ingestion may result in severe illness, but often may be managed safely at home with reliable caregiver observation. Poison Control Centers (PCCs) offer free assistance to families to determine the need for medical evaluation after such ingestions. We aimed to describe the caregiver management of inadvertent pediatric medication ingestion and caregiver knowledge of PCC contact information.
Methods: This prospective, observational study of parents or guardians of all pediatric patients between 2–10 years was conducted in an academic pediatric ED (PED) over 3 months in 2013. Research assistants collected data on a standardized data form 7 days a week, 15 hours each day. Data collected included demographics, prior experience with attempted or completed accidental medication ingestion by the child and knowledge of PCC contact information. Data presented as means and proportions.
Results: Of 338 participants, 329 (97%) reported being either the mother or father of the child. Mean age of caregivers was 30.4 (7.5) years and mean age of enrolled children was 5.6 (2.6) years. Thirty-one (9%) caregivers noted that the child presenting to the PED had tried to reach for a pill, 15 (4%) expressed a concern that their child may have accidentally swallowed a pill and 14 (4%) noted that their child placed a pill in their mouth in the past. Following these incidents, 33% brought the child to the ED, 27% called the PCC, 27% observed the child at home, 7% brought the child to the pediatrician and 7% did nothing. Of those who observed the child at home, none had been given instructions by a healthcare provider or PCC to do so. Essentially, 34% of caregivers did not seek medical attention after a suspected ingestion. When asked how they would contact a PCC, the majority of caregivers were able to provide a reliable source for assistance (Table 1). For those who stated they would obtain the telephone number from the prescription bottle, we were unable to confirm that this information was actually listed as reported.
Conclusion: Prior attempted ingestions were infrequent in our general PED population. Of caregivers who expressed a concern

Table 1.

Means of obtaining assistance to contact PCC (N = 338)	
Method of contact	n (%)
Call 911	106 (31)
Look up on line	89 (26)
Posted on refrigerator	41 (12)
Posted on prescription bottle	24 (7)
Call 411 or 211	16 (5)
Number in cellphone	13 (4)
Call doctor, pharmacy or hospital	9 (3)
Unsure or call family or friends	8 (2)
Look up in phonebook	7 (2)
Other	24 (7)

for potential inadvertent ingestion, nearly one third did not attempt to contact a medical professional even though the majority had appropriate contact information.

Keywords: Poison center, Ingestion, Pediatric

88. Pediatric laundry detergent pod exposures: Report from the Toxicology Investigator's Consortium (ToxIC registry)

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Background: In 2010 laundry detergent pods (LDPs) were introduced into the US market. Since that time, the incidence of LDP exposures in young children reported to poison centers continues to increase. Symptoms after ingestion range from mild GI upset to corrosive injury, as well as including cardiovascular and neurologic compromise. It is not clear why certain cases develop obtundation and coma while others manifest only aerodigestive tract injuries. We sought to evaluate the cases reported to the ToxIC registry to further elucidate the variability in these presentations.

Methods: We accessed the ToxIC registry for cases in which "Detergent Pod" was identified as a Primary Agent of exposure. Upper level data was reviewed for demographics, circumstances of exposure, clinical manifestations, treatment, and outcome.

Results: From 2010-present (April 2014) there were 50 cases, 62% male, with 68% under 2 years of age and only 2 cases over 6 years old. 96% were unintentional exposures. 84% of cases (n = 42) had signs or symptoms reported which included: Coma/CNS depression (38%), aspiration pneumonia (14%), respiratory depression (n = 5), metabolic acidosis (n = 3) and corrosive injury (n = 1). 16% of cases listed intubation and/or ventilator management as a treatment. There were no deaths reported.

Conclusion: Since the introduction of LDPs there have been unexpectedly severe clinical consequences in some patients after ingestion. It is not clear what the contents of the pods are which bring about symptoms such as coma and metabolic acidosis. However, this study and other case series demonstrate that these effects do occur with some frequency. LDP exposures can have unexpectedly severe consequences including coma, respiratory depression, and acidosis, and require ventilator support in a significant proportion of cases. Efforts towards responsible packaging if not removal of these products from the market are worthwhile to prevent these cases from occurring in young children. Meanwhile the clinician should be alert to the possibility of significant morbidity in these cases.

Keywords: Pediatric, Detergent, Pod

89. A buzz for a buck anyone?

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Background: A concerning trend among teens is the abuse of over the counter (OTC) medications. In adolescents aged 13–19 years, cough and cold products accounted for 21% of all misuse and abuse exposures reported to our Regional Poison Center between 2005–2012. Potential reasons for this phenomenon are the widespread availability of OTC products and a perceived safety over illicit substances. Furthermore, many OTC medications are not restricted to the pharmacy shelf – and as we all know, these products can be purchased in a variety of retail locations. While contributing to a segment for a local ABC news affiliate, our poison center was alerted to an interesting anecdote from a parent regarding her teen's OTC drug acquisition. To our surprise, dollar discount establishments appear to be a common outlet for teens to purchase these medications. The current review showcases the availability of OTC medications at non-pharmacy discount retail locations with minimal oversight and potential ease of access for adolescents.

Methods: The authors visited five different discount stores in our greater metropolitan area and recorded the availability and prices of several OTC medications. Retailers were selected for having "dollar" in their name. This data was then compiled and assessed using descriptive statistics.

Results: All five of the selected locations carried OTC medications. Available medications included analgesics, antitussives, decongestants, and antihistamines. Several of the products were available for $1.00, and virtually all could be found for under $5.00. There was no minimum age or identification required to the purchase these products at any location visited.

Conclusions: By obtaining these products at non-pharmacy locations, teens are able to easily obtain several OTC medications without age requirement, bypassing the watchful eyes of the pharmacist. As a result of our findings, this poison center began the process of incorporating this new-found knowledge into our poison prevention programs, as well as into existing promotional brochures and flyers. Additionally, by reaching out to local print and digital media outlets, we were able to share these concerns to the general public. Poison centers should remain cognizant of this fact as we educate the public about poison prevention and safety.

Keywords: Education, Adolescent, Poison center

90. Pediatric exposures to methadone and buprenorphine: Developing prevention strategies

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Background: A growing number of in-home pediatric unintentional exposures to both methadone and buprenorphine are reported on the national level. There is a clear need for increased parent education regarding the dangers of even small ingestions, safe storage, and proper disposal. Both written and verbal instructions should be used to deliver this information to parents. A review of PCC cases was conducted to understand how and why unintentional poisonings from these substances occur and to develop key messages for a parent education program.
Methods: A prospective study of calls to the PCC during 2013 was conducted. Inclusion criteria were any exposure to buprenorphine or methadone that occurred in children under age 5, and was outside of the health care environment. For each case, a data abstraction form was used to collect the following information: age of patient, exposure site, caller site, qualitative information regarding the exposure, product information and medical outcome.
Results: A total of 17 cases were reviewed (8 methadone, 9 buprenorphine). The majority of cases involved girls (65%). Ages ranged from 16 months to 5 years. Most calls came from a doctor (71%) at a health care facility although exposures always happened in a home, primarily the patient's residence (93%). Review of qualitative scenarios showed that 2 cases involved methadone liquid stored in a drinking glass or beverage container and accessed by the child. Approximately 53% (n = 13) involved ingestion of liquid/tablets (either methadone or buprenorphine), however the circumstances surrounding the exposures were not fully described. The remaining cases involved ingestion of half of a film strip (n = 1) and a transdermal patch (n = 1). Approximately half of patients were admitted; 35% to critical care units, and 12% to non-critical care units. About one quarter of the patients were treated and released (29%), and 12% were managed on site not requiring hospital visit. The remaining 12% were lost to follow-up. Medical outcomes were no effect (18%), minor effect (41%), moderate effect (18%), judged as non-toxic (5%) and unable to follow but judged as potentially toxic (18%).
Conclusions: All of the exposures occurred in the home setting. The majority of the calls originated from a physician, with approximately half of these children admitted to the hospital. These findings are consistent with the key messages in the literature directed at the caregivers of young children. A printed safety card for parents in multiple languages has been developed to emphasize the danger of ingestion and includes recommendations for safe storage and disposal.
Keywords: Education, Buprenorphine, Methadone

91. Missed opportunities? An evaluation of potentially preventable poisoning deaths

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Background: Although most poisoning deaths may be inevitable given current technology and resources, some deaths may be preventable. The goal of this preliminary study is to identify scenarios in which a fatal outcome might have been averted by different medical decision-making.
Methods: Two authors screened all fatality abstracts published in the 2008–2012 NPDS Annual Reports for cases in which a different medical decision might have changed the medical outcome. Screened cases were independently reviewed by 3 medical toxicologists. Preventability was graded by using a Likert scale of 1 (definitely non-preventable) to 6 (definitely preventable). Cases with score 4 to 6 were defined as "at least probably preventable" and the type of decision-making involved (diagnosis, treatment, monitoring, other) was characterized. Differences were resolved by panel discussion.
Results: Of 385 published abstracts, 78 (20%) were identified for panel review. Of these, 57 (15%) deaths were determined to be at least probably preventable. Inter-observer agreement was good (weighted $\kappa = 0.58$ for screening, 0.27 for causality, and 0.42 for specific aspects of care). The most common scenarios included poisoning with salicylates, toxic alcohols, opioids, acetaminophen, metformin, and fluorine-containing products (Table 1). The most common issues involved treatment and monitoring. Example opportunities included more frequent measurement of salicylate levels, early hemodialysis in salicylate, atypical alcohol, and metformin poisoning, prolonged monitoring in extended-release opioid overdose, and aggressive calcium administration in hydrofluoric acid exposure.
Limitations: Only 4% of poisoning deaths are reported to poison centers, and of these about 5% result in published abstracts; it is unlikely that these data proportionately represent poisoning deaths overall. Panel members came from a single institution. Published fatality abstracts do not contain complete clinical data. This study was not designed to evaluate quality of care or compare care to a standard.
Conclusions: Based on an analysis of published NPDS data, the most common scenarios involved in potentially preventable poisoning fatalities involve monitoring and treatment decisions in salicylate, atypical alcohol, opioid, and acetaminophen poisoning.
Keywords: Preventable death, Toxicity, NPDS
Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

Table 1. Substances associated with potentially preventable death.

Substance	Number of Cases	Diagnosis	Treatment	Monitoring	Other
Salicylate	11	1	10	8	0
Toxic alcohol	8	0	8	1	0
Opioids	5	0	1	4	2
Acetaminophen	5	0	5	0	0
Metformin	4	1	2	2	0
Fluorine-containing products	3	0	3	3	0
Cholinesterase inhibitors	3	0	1	2	0
Bupropion	2	0	1	0	1
Others	16	2	15	5	1
Total	57	4	46	25	4

92. Proximal muscle weakness in severe lead poisoning from retain bullet fragments

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Introduction: Lead poisoning commonly causes distal motor weakness. We describe a case of proximal motor weakness leading to respiratory failure caused by lead poisoning from retained bullet fragments.

Case report: A 31 year old male was shot by a shotgun, with retained lead bullet fragments in his left scapula, lung, pleural space, and ribs. Six weeks later he developed symptomatic lead poisoning, beginning with abdominal pain and progressing to weakness, anemia, encephalopathy, and respiratory failure. Clinical examination showed proximal but not distal motor weakness (Table 1). Nerve conduction studies and electromyelography showed axonopathy without significant demyelination or myopathy. His pre-chelated blood lead level was 126 mcg/dl. A workup for other causes was negative except for mildly elevated free T4 (2.19 ng/dL (normal range: 0.70–1.48)) with normal TSH that resolved within 7 days.

The patient was treated with BAL, calcium disodium EDTA, d-penicillamine, and debulking of his lead burden. After transient worsening, the patient's condition gradually improved to totally independent active living with his blood lead stable around 40 mcg/dl.

Discussion: The peripheral neuropathy from lead poisoning is well characterized as a motor axonal neuropathy, predominately affecting the distal upper limbs. Only one prior case (Liden, 1982) describes proximal muscle weakness from lead; which also involved transient hyperthyroidism.

Conclusion: Severe proximal motor axonopathy can occur in association with lead poisoning.

Keywords: Lead poisoning, Retained bullet and projectiles, Proximal muscle weakness

Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

Table Motor power from physical examination.

Motor group	Right side	Left side
Shoulder abduction, adduction, flexion, extension	II	II
Elbow flexion, extension	IV, III	IV, III
Wrist flexion, extension	IV+, IV	IV+, IV
Grip	IV+	IV+
Hip flexion, extension	III, III	III, III
Knee flexion, extension	IV, IV	IV, IV
Ankle dorsiflexion, plantar flexion	IV+, IV+	IV+, IV+

93. A railroad disaster with acrylonitrile: Beware of the sewer system

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Background: On May 4th 2013 at 2.00 a.m. a freight car transporting acrylonitrile derailed and caught fire in Wetteren (Belgium, Europe). Other cars with butadiene and triethylaluminium were cooled with water to prevent explosion. People living within a perimeter of 500 metres were evacuated and residents were advised to stay indoors and close doors and windows. An advanced medical post with mobile intensive care units was installed with ambulances, logistic equipment and personnel from the Belgian Red Cross and led by a medical director. Air measurements of cyanide were reassuring and the collection of cyanide antidotes (hydroxocobolamine and sodiumthiosulfate) was started.

Case reports: At 8.30 a.m. an emergency call was received for residents living outside the danger zone. A woman of 76 yrs was found comatose in the bathroom on the second floor with 4 other inhabitants complaining of mucosal irritation, nausea, headache and reporting a strange smell. The woman had to be intubated, ventilated and was in shock. Upon arrival in the hospital she went into cardiac arrest. Resuscitation was immediately started and hydroxocobalamine and sodium thiosulphate were administered and she eventually fully recovered. Measurements of acrylonitrile and cyanide in the streets were negative but very high concentrations were detected in the sewer system. Evacuation of residents living in houses along the suspected sewer system was started. At 12.30 a.m. another woman (50 yrs) was found comatose by her husband who came home after a walk and complained of mucosal irritation. The patient was intubated and ventilated and immediately treated with hydroxocobalamine and sodium thiosulphate. She was transported to the hospital and made a full recovery. At 3.00 p.m. an elderly man living in the evacuation zone was missing and found deceased in his house together with his dead dog. An autopsy revealed severe cyanide poisoning in both.

Furthermore in total 646 citizens presented either directly to an emergency department (n = 271) or to the medical post (n = 375); 160 of the latter were sent to an emergency department. A point of care lactate test was used for triage. Most frequent complaints were headache, mucosal irritation, numbness and anxiety of which some may have been induced by inappropriate media attention for the carcinogenicity of acrylonitrile. Cyanide antidote therapy was given in six more patients.

Case discussion and conclusion: The present case report illustrates that toxicity of the cyanogenic molecule acrylonitrile can originate from contamination of sewers systems. Although acrylonitrile is heavier than air it can ascend in the sewer system of houses that have either no or a failing isolation from the main sewer system.

Keywords: acrylonitrile, Cyanide, Hydroxocobalamin

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94. Scorpion stings during pregnancy: A large case series

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Background: Approximately 3,000 individuals contact the University of Arizona Poison and Drug Information Center annually due to a scorpion sting. Information concerning the effects of scorpion stings during pregnancy are limited.
Case series: We report the outcomes of 344 pregnant women who called the University of Arizona Poison and Drug Information Center due to a scorpion sting during pregnancy. 18.9% were in the first trimester, 34.9% in the second and 43% in the third. Gestational age was unavailable in 3.2%. All callers were advised to recontact the Poison and Drug Information Center if symptoms did not resolve in 24–48 hours or had any additional pregnancy related concerns. Of the total group, none called back after 48 hours to report any additional scorpion or pregnancy related concerns. Eighty-six cases occurred between January 1, 2011 and April 15th, 2014. Active follow up was attempted in 13 cases in which telephone information was available. Six exposed pregnant women were contacted. All reported resolution of symptoms in 24–48 hours, delivery at term, average birth weights and no additional adverse pregnancy or infant outcomes. One patient at 20 weeks gestation was treated with 3 vials of Anascorp® for neurotoxic symptoms (opsoclonus, involuntary muscle movement, slurred speech, paresthesias, respiratory distress and hypersalivation). In addition, she was given 2mg of lorazepam and 50mcg of fentanyl. At one hour, symptoms were markedly reduced and resolved within 2 hours. She was discharged from the emergency room after observation for 4 hours. Fetal ultrasound after antivenom therapy showed normal fetal movement and heart tones. In this one case, no adverse effects of the antivenom were noted.
Case discussion: Pregnant women who were stung by scorpions did not report any additional symptoms compared the non-pregnant population. In this large series, pregnancy or infant outcome was not affected by the evenomation.
Conclusion: Clinicians should be alert to scorpion stings during pregnancy, as some individuals may require antivenom therapy. However, this study concurred with previous reports that scorpion stings during pregnancy are unlikely to result in adverse pregnancy and/or infant outcomes.
Keywords: Envenomation, Scorpion, Pregnancy

95. Indoor firing range as a source of lead in a school

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Background: Small arms indoor firing ranges are known to result in exposure to a number of metals and metalloids as a result of their presence in ammunition. Lead exposure is the primary health concern associated with indoor firing ranges. In children, elevated lead exposure has been associated with adverse effects on intelligence; elevated lead exposure has also been associated with adverse cardiovascular, renal, neurological, and neuropsychological effects in children and adults. Recently, a Montana middle school that once housed an indoor firing range requested a preliminary environmental assessment for lead. Initial wipe samples collected from surfaces in the vicinity of the former firing range, which was dismantled in the early 1990s to make way for classrooms, revealed lead levels as high as 1,300 micrograms per square foot, prompting a comprehensive building-wide environmental assessment for lead.
Methods: Air, wipe, MicroVac and soil samples were collected and analyzed for lead; some samples were also analyzed for barium and antimony, as the collocation of these substances has been used to suggest the presence of gunshot residue. Clearance wipe samples were collected from the basement area after undergoing lead abatement and analyzed for lead. Samples were analyzed by graphite furnace atomic absorption spectroscopy and inductively coupled plasma mass spectrometry. Sample results were compared to USEPA-derived and environmental media specific health-based screening criteria.
Results: Air samples, wipe (including MicroVac) samples of surfaces possibly contacted by building occupants, and crawlspace soil samples did not reveal the presence of lead above screening criteria. Wipe (including MicroVac) samples of surfaces generally not accessible to building occupants including those from 2 HVAC systems did reveal the presence of lead above the screening level. Clearance wipe samples collected from the basement area post abatement were below the screening level except for 3 samples collected from ductwork present when the firing range was in use. Lead, barium, and antimony were collocated in air, wipe, and soil samples collected throughout the school, suggesting that the source of lead in the school was the former firing range.
Conclusion: Indoor small arms firing ranges can be a source of lead contamination in buildings that contained them years after their use has ceased. The collocation of lead, barium, and antimony in samples from such buildings suggests the firing range as the source of lead contamination. Abatement of lead in this school has or is scheduled to take place, and until such time periodic air and wipe testing has been recommended to ensure the building remains safe for occupancy and use.
Keywords: Lead, Decontamination, Occupational

96. Playing with fire – A volatile case of a circus fire-breather

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Background: Aspiration lipoid pneumonia has been reported in adults and children from a variety of exposures including mineral oil therapy for constipation, exploratory or intentional ingestion of lamp oils, siphoning of vehicle or heating fuels, etc. We describe a severe case of aspiration pneunonitis associated with the exotic practice of "fire-breathing."
Case Report: A 25-year-old male circus performer unintentionally aspirated a paraffin-based lamp oil during a fire-breathing exhibition. He had acute onset of cough, hemoptysis, shortness of breath, and pleuritic chest pain. The next morning he was noted to have labored breathing. A chest radiograph was notable for bilateral patchy opacities, and computed tomography performed 11 hours after aspiration demonstrated lobar infiltrates. He was endotrache-

ally intubated and mechanically ventilated for hypoxic respiratory failure, and his PaO_2 was 103 mmHg breathing 100% O_2. Flexible bronchoscopy was performed on hospital day #2 and demonstrated the bloody secretions of alveolar hemorrhage. A waxy-appearing mucous plug was suctioned from the right middle lobe and right lower lobe orifice, and bronchoalveolar lavage (BAL) was performed of the right middle lobe. Supplemental oxygen was weaned quickly after the procedure, and ventilatory pressures decreased. Cytological study of BAL fluid showed lipid laden macrophages with a lipid laden macrophage index of 112, consistent with aspiration lipoid pneumonia. The man had intermittent fevers, was treated with empiric antibiotics and corticosteroids, and the trachea was extubated on hospital day #3. He was discharged to home on hospital day #6. Respiratory and blood cultures were negative during hospitalization.

Case Discussion: Aliphatic hydrocarbons, such as paraffin-based lamp oils, are typically used for fire-breathing exhibitions as their relatively high flash point helps to prevent burn injury. Aspiration lipoid pneumonia is an occupational hazard of the practice of such fire-breathing and may be complicated by pneumatoceles, pleural effusion, pneumothorax and death. Reports of "fire-breather's pneumonia" appear to be uncommon from within the United States. Published international cases typically involve young males.

Conclusions: We report an unusual case of fire-breather's pneumonia from Pennsylvania. Lipoid pneumonia should be considered among practitioners of "fire breathing" or "fire eating" who present with lung injury. Clinicians in this case believed significant clinical improvement was noted after bronchoscopy/BAL.

Keywords: Fire-breathing, Hydrocarbon, Pneumonitis

97. Cytopenia and exposure to pesticides: 13 years of poison control experience

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Background: Our regional Pediatric Environmental Health Specialty Unit (PEHSU) and Poison Center (PC) collaborated with clinicians caring for a 3 yo boy with hepatitis and pancytopenia, later formally diagnosed as aplastic anemia, associated with his exposure in an apartment in which deltamethrin, piperonyl butoxide, indoxocarb, and isofluorane had been applied 3 days previously. All viral and infectious disease studies were negative. AST/ALT enzymes were >3000 although synthetic function was normal. Liver biopsy showed activated sinusoidal macrophages with hemophagocytosis and spotty hepatocyte necrosis with admixed eosinophil infiltration consistent with toxic insult. Bone marrow biopsy confirmed hypocellularity without evidence of malignancy. A single RBC cholinesterase was normal. Marrow regeneration still not evident 6 weeks later; a bone marrow transplant is anticipated. We questioned whether other cases of cytopenia in which pesticides were mentioned had been reported in the U.S.

Methods: We queried the AAPCC's National Poison Data System (NPDS) for all single substance closed human exposure calls in which cytopenia (aplastic anemia is not coded per se) was reported during 2000–2013. Variables reviewed for each call included generic codes, age, gender, site, route, and medical outcome.

Results: 116 cases (0.00033%) were retrieved in the NPDS dataset of more than 33 million exposures over 13 years. 75 cases (65%) were male. 12% (N = 14) were children <5 yo; 2% (N = 2) involved 6–19 yo; 86% (N = 100) involved adults. Ingestions (39%), inhalations (35%), and dermal (26%) were most common routes. There were 11% of exposures in which workplace was coded as site of exposure. In 29 cases (25%), medical outcomes were coded as moderate or major effect. 8 deaths (6.7%), all in adults, were recorded. Of 188 chemical or drug mentions involving 60 different products in these cases, 131 mentions (70%) involving 20 products were categorized as pesticides. The top 8 pesticide categories mentioned were: pyrethroids/pyrethrins (N = 28), organophosphates (N = 20)), glyphosphate (N = 15), chlorphenoxy herbicides (N = 10), other herbicide (N = 8), unknown insecticide (N = 8), carbamates (N = 6), and unknown rodenticide (N = 5).

Conclusions: Cytopenia is a rare finding in calls reported to U.S. poison centers. Males (65%) predominated; most cases occurred at home. Pesticides comprised 70% of all chemicals mentioned. Pyrethrins, pyrethroids, OP, glyphosphate, chlorphenoxy herbicides, and carbamate pesticides were over-represented. 31.7% of these PC-followed cytopenia cases resulted in moderate or major medical outcomes or death.

Keywords: Pesticide, Epidemiology, Environmental

98. Prolonged, reversible neurologic symptoms after carpet sea anemone envenomation

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Background: Neuromuscular toxicity due to marine envenomation from the phylum Cnidaria has been well documented, most frequently in the setting of jellyfish stings. Few cases of sea anemone envenomation have been reported. We report a case of prolonged, reversible neurologic symptoms in a patient who experienced giant carpet sea anemone (*Stichodactyla gigantea*) envenomation while working in a local pet store.

Case Report: A 25-year-old right hand dominant female presented to the Emergency Department for evaluation after a giant carpet sea anemone envenomation while at work. She was retrieving the anemone from an aquarium tank for when its tentacles curled around her right second and third fingers. She noted immediate onset of severe pain, swelling and numbness to her hand, particularly in the affected fingers. She was treated with pain medications, corticosteroids, and antihistamines. She noted that while the swelling and pain decreased, she had persistent numbness and paresthesias to her right second and third fingers several months after the event. She also complained of associated weakness. On exam, she had no objective motor weakness or tenderness in her right hand. Sensation was decreased to light touch and pinprick in the C6 to C7 median nerve distribution on the right hand. Electromyography (EMG) revealed reduced recruitment of motor units at lower firing frequencies. The patient was treated conservatively with anti-inflammatories and occupational therapy. Six months after the injury she is asymptomatic and has full function of her right hand.

Case Discussion: The giant carpet anemone is a species of sea anemone native to the Indo-Pacific area. Their care is notoriously difficult. They are large, spanning up to meter in diameter. Like

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other cnidarians, carpet anemones contain nematocysts contained in finger-like projections. Venom contains multiple components, including neuromuscular toxins. Usually described after jellyfish envenomations, most common effects include immediate local reactions: burning pain, swelling, pruritis and local tissue inflammation. Sequelae including paresthesias and neuritis have been reported. Few studies have examined the neurotoxic components of anemone venom, but effects are thought to at least in part be due to enhancement of sodium currents in dorsal root ganglia.
Conclusions: While Cnidaria envenomations are known to cause neuropathic symptoms, few cases of sea anemone envenomation have been reported. We report a case of a patient with six months of local paresthesias, weakness and numbness following carpet sea anemone envenomation with eventual resolution following conservative management.
Keywords: Marine, Envenomation, Environmental

99. From hookah to hyperbarics: Carbon monoxide toxicity due to hookah smoking

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Background: Hookah smoking has recently become a recognized cause of carbon monoxide (CO) toxicity. We report a case series of two young adult females who experienced nonspecific symptoms and syncope after hookah smoking and were found to have elevated carboxyhemoglobin (COHb) levels. Both were treated with 100% oxygen and hyperbaric oxygen therapy (HBO).
Case Reports: *Case 1:* An 18-year-old female was brought to the Emergency Department (ED) after a syncopal episode. She had been smoking tobacco via a hookah for four hours. She complained of lightheadedness, headache, nausea and vomiting. Vital signs revealed sinus tachycardia. Physical exam, including cerebellar exam, was normal. Initial evaluation included a normal EKG, negative pregnancy test, unremarkable baseline blood work and a normal head CT. An arterial blood gas revealed a COHb 23%. She was started on 100% oxygen via nonrebreather mask and transferred to our facility. She was treated with HBO for 120 minutes and her symptoms improved.

Case 2: A 20-year-old female had a syncopal episode after smoking tobacco via a hookah on an outside porch. In the ED she waited for four hours, breathing room air, to see a physician. She complained of a headache and nausea. Initial vital signs were normal. Her neurologic exam revealed mild dysmetria on finger to nose bilaterally. Initial evaluation included a normal EKG, negative pregnancy test, unremarkable baseline blood work, and a normal head CT. An arterial blood gas, five hours after arrival, revealed a COHb 18.5%. She started on 100% oxygen via nonrebreather mask and transferred to our facility. She was treated with HBO, after which her symptoms resolved.
Case Discussion: Hookah smoking has emerged in recent years as a cause of CO toxicity. Compared to cigarette smoking, hookah smokers absorb higher concentrations of CO due to larger volumes of inhalation and prolonged exposure. In addition, use of charcoal to burn the tobacco in a hookah pipe leads to higher concentrations of CO in the inhaled vapors. Toxicity increases with smoking intensity and duration. This is one of the first case series describing elevated COHb concentrations following hookah use in symptomatic patients treated with HBO. Both patients were treated with HBO therapy due a presenting complaint of syncope.
Conclusions: While hookah smoking is publically perceived to be less harmful than cigarette smoking, there is significant potential for adverse effects, including CO toxicity. This case series describes two patients who experienced syncope and elevated COHb levels after hookah smoking. Both were treated with oxygen and HBO. Emergency practitioners should have a high index of suspicion for CO toxicity in patients who participate in hookah smoking.
Keywords: Carbon monoxide, Adolescent, Hyperbaric Oxygen

100. Successful chelation of pediatric lead encephalopathy with extremely elevated blood lead concentrations

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Background: Childhood deaths and significant toxicity associated with lead exposure are extremely uncommon, and the majority of elevated lead concentrations from pediatric screening range from 10 to 20 mcg/dL. Chelation has been suggested to lower lead levels and decrease mortality but controlled clinical trials are lacking. We report a case of successful chelation of pediatric encephalopathy with significantly elevated blood lead concentrations.
Case Report: A developmentally normal 2-year-old (12.3 kg) male, with recent diagnosis of a small subdural hematoma from a fall, returned to the hospital with his mother after a screening lead concentration of >160 mcg/dL resulted. Since discharge, he had developed vomiting and mental status depression. New neuroimaging revealed a resolving subdural hematoma with no cerebral edema. Initial labs included a serum lead concentration of 168 mcg/dL, hemoglobin 7.5 g/dL, basophilic stippling on peripheral smear, transaminitis and zinc protoporphyrin 158 mcg/mL. Abdominal radiograph was negative for radiopaque objects and long bone radiographs revealed dense metaphyseal lines consistent with plumbism. The patient was admitted to the intensive care unit. He was administered dimercaprol (BAL) 75 mg/m^2, followed by BAL 75 mg/m^2 every 4 hours for 3 days and calcium EDTA infusion of 1000 mg/m^2 per 24 hours for 5 days. He demonstrated dramatic clinical improvement starting on hospital day 2, and by day 5 he was awake, tolerating oral intake and back to baseline per mother's account. The patient's home was cleared via government investigation for lead sources. The source, still a subject of investigation, is hypothesized to be an exposure, possibly candy, from the time spent at father's home in Mexico. He was discharged on a course of oral succimer with a lead concentration of 32.7 mcg/dL. No acute complications were noted with chelation.
Case Discussion: This case describes a successful outcome after chelation of lead encephalopathy in a pediatric patient with markedly elevated lead concentrations. Concentrations greater than 70 mcg/dL in the United States are extremely rare. Between 2000 and 2011, the Centers for Disease Control and Prevention reported that only 0.008 to 0.035% of pediatric patients screened have concentrations greater than 70 mcg/dL. This patient presented with profound encephalopathy and was markedly improved after chelation. He did not experience a rebound in his lead concentrations after chelation.

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Conclusions: While rare, pediatric cases of lead encephalopathy still occur in the United States. This case supports the successful use of BAL and calcium EDTA to treat pediatric lead encephalopathy.
Keywords: Lead, Chelation, Pediatric

101. Venomous snake bites at work reported to poison centers

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Background: Venomous snake bites can result in serious injury and even death. They may occur under a variety of circumstances, including while the victim is working. The intent of this study was to describe venomous snake bites at work that were reported to poison centers.
Methods: Cases were all bites by venomous snakes native to the US reported to a state-wide poison center system during 2000–2013. Bites not followed to a final medical outcome were included. Cases were grouped into those where the exposure site was coded as "workplace" (Work) and all others (Other). The distribution of cases by selected factors was determined for the 2 groups. Comparisons were made by calculating the rate ratio (RR) and 95% confidence interval (CI).
Results: Of 5,684 total venomous snake bites, 104 (2%) occurred at work. The type of work was recorded in 33 cases, of which the most common were oil field worker (6), gardener/landscaper (5), and water meter reader (3). The distribution by type of snake for Work and Other cases, respectively, were copperhead (38% vs 56%, RR 0.67, 95% CI 0.52–0.86), rattlesnake (43% vs 28%, RR 1.52, 95% CI 1.22–1.90), cottonmouth (12% vs 9%, RR 1.30, 95% CI 0.76–2.23), and coral snake (8% vs 7%, RR 1.17, 95% CI 0.60–2.30). The patients were 20 years or older in 98% of the Work and 77% of the Other cases (RR 1.28, 95% CI 1.24–1.32). Of these adult patients, 98% of Work and 70% of Other were male (RR 1.41, 95% CI 1.36–1.45). The season in which the bite occurred for Work and Other cases, respectively, was December-February (7% vs 3%, RR 2.50, 95% CI 1.20–5.21), March-May (34% vs 32%, RR 1.05, 95% 0.80–1.38), June-August (32% vs 41%, RR 0.78, 95% CI 0.58–1.03), and September-November (28% vs 24%, RR 1.15, 95% CI 0.84–1.57). The patient was already at/en route to a healthcare facility in 85% of both groups (RR 0.99, 95% CI 0.91–1.08). The medical outcome was moderate effect, major effect, death, or unable to follow-potentially toxic in 64% of Work and 68% of Other cases (RR 0.95, 95% CI 0.83–1.10). The most common clinical effects for Work and Other cases were puncture (86% vs 86%, RR 1.00, 95% CI 0.92–1.08), dermal edema (70% vs 72%, RR 0.98, 95% CI 0.86–1.11), dermal pain (66% vs 65%, RR 1.02, 95% CI 0.89–1.17), and ecchymosis (22% vs 27%, RR 0.81, 95% CI 0.56–1.16). The most common treatments were antivenin (53% vs 50%, RR 1.05, 95% CI 0.88–1.26) and IV fluids (53% vs 50%, RR 1.06, 95% CI 0.88–1.27).
Conclusion: Only a small proportion of the venomous snake bites occurred while working. Venomous snake bites that occurred while working were more likely that all others to involve rattlesnakes, occur during March-May, and involve adults and males. However, the management, clinical effects, and outcome of bites that occurred while working were similar to all others.
Keywords: Snake bite, Poison center, Work

102. Comparison of Molly and methylenedioxymethamphetamine exposures reported to poison centers

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Background: In the last several years, a drug called Molly has gained popularity among recreational drug users. Molly is the powder or crystal form of methylenedioxymethamphetamine (MDMA). Considered by users to be "pure" MDMA, it often contains MDMA cut with other drugs or other drugs entirely, such as synthetic cathinones. Given the little information on the pattern of Molly use in the US, this study describes Molly exposures and compares them to MDMA exposures.
Methods: Molly and MDMA exposures reported to a statewide poison center network during 2009–2013 were identified. Molly exposures were classified as those where Molly was recorded in the substance or notes fields. MDMA exposures were classified as those exposures to MDMA where there was no mention of Molly in the record. Exposures involving additional substances 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 61 Molly and 923 MDMA exposures. The number of Molly exposures was 1 in 2009, 0 in 2010, 11 in 2011, 8 in 2012, and 41 in 2013; the annual number of MDMA exposures declined from 232 in 2009 to 115 in 2013. 61% of Molly and 61% of MDMA patients were male; 51% of Molly and 53% of MDMA patients were 20 years or more. The most common routes of exposure for Molly and MDMA were ingestion (90% vs 91%) and inhalation (11% vs 10%). The most common exposure site for Molly and MDMA, respectively, was own residence (83% vs 80%) and public area (15% vs 11%). The distribution by management site for Molly and MDMA cases was, respectively, 0% vs 6% managed on site, 85% vs 71% already at/en route to a healthcare facility, and 15% vs 22% referred to a healthcare facility by a poison center. Serious outcomes were reported in 82% of Molly and 68% of MDMA cases. Common adverse effects in the Molly and MDMA cases were tachycardia (49% vs 34%, RR 1.43, 95% CI 1.09–1.87), agitation (28% vs 23%), drowsiness (25% vs 18), hypertension (21% vs 14%), confusion (16% vs 9%), vomiting (13% vs 9%), hallucinations (16% vs 8%, RR 2.02, 95% CI 1.10–3.70), and nausea (15% vs 7%, RR 2.10, 95% CI 1.10–4.00). The most common treatments for Molly vs MDMA were IV fluids (61% vs 49%), benzodiazepines (41% vs 25%, RR 1.66, 95% CI 1.20–2.29), activated charcoal (8% vs 10%), and oxygen (10% vs 9%).
Conclusion: As might be expected, the demographics and circumstances of Molly and MDMA exposures were similar. Molly exposures were more likely to already involve healthcare facilities when the poison centers were contacted. Moreover, reported Molly exposures were more likely to have serious outcomes and report the more commonly noted adverse effects.
Keywords: MDMA, Molly, Poison center

103. Cobalt toxicity from hip joint replacement

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Background: In July 2012 Stryker, a worldwide producer of surgical devices, issued a voluntary recall of its Rejuvanate and ABG II Modular-Neck Stems hip system less than 2 years after this design reached the market. By the date of the official recall, unfortunately, over 20k individuals had received such implants by that time. These were metal-on-metal implants made with an alloy of chromium and cobalt designed to last longer than 20 years. Many failed because of the impact of the metal on metal causing erosion and failure of the graft. In addition, there were reports of elevations in either or both chromium or cobalt levels. The literature suggested that the preferred approach is watchful waiting and replacement of the joint only when clinically needed. We report the case of one individual who received such a joint replacement and required 2 procedures to eliminate the exposure to cobalt.
Case presentation: MR, a 55 year old presented for a toxicological evaluation in June 2013. He had his original hip replacement surgery in 2/2011. He received a letter regarding the recall in 7/201. He developed pain in the affected joint and underwent revision in 11/2012. The femoral portion was replaced, with a non-metallic device but the "cup" was left in place. Subsequent to this surgery, he developed a loss of hearing, a peripheral neuritis, evidence of hypothyroidism and a rash. Blood concentrations of cobalt were monitored and demonstrated some erratic behavior. Contrary to the published literature, there was a major difference found between total blood cobalt and serum cobalt levels. Because of his apparent symptomatology and the cobalt level failing to drop, he underwent a further revision with removal of the cup. At the time of surgery, there was evidence of discoloration of tissue with a metallic color and extensive debridement was performed. The patient refused any chelation therapy at the time of hospitalization. Blood testing 6 weeks post-op revealed a significant drop in his cobalt levels.
Discussion: Although the literature seems to indicate a relatively benign course for individuals who received these implants, our patient seems to have suffered from clinical illness consistent with the exposure. Further, partial removal of the implant did not result in remission of either clinical symptoms or elevated cobalt levels. Complete removal of the involved joint produced a dramatic decrease in the levels of circulating cobalt. Cases of metal on metal hip replacements must be carefully evaluated both for clinical and laboratory findings and careful surgical revision performed as indicated.
Keywords: Epidemiology, Heavy metals, cobalt

104. Acute aluminum toxicity following bladder irrigation successfully treated with hemodialysis

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Background: ALUM (aluminum potassium phosphate) has been used since 1982 to treat difficult to control hemorrhagic cystitis. Treatment is generally well tolerated, but case reports of death due to aluminum toxicity in the setting of impaired renal function have been reported.
Case Report: An 80 year old male with radiation induced hemorrhagic cystitis refractory to standard therapy was started on 1% ALUM bladder irrigation at a rate of 30L continuous irrigation per day. On day 20 of therapy he was thought to be fluid overloaded, and IV lasix was begun. Within two days his creatinine rose from 0.96 to 2.89 mg/dL and his BUN from 27 to 77 mg/dL. He became increasingly confused and weak, and was unable to ambulate on his own or perform his baseline activities. Nephrology and Medical Toxicology consults were placed over concern for aluminum toxicity. An aluminum level was drawn, but was not available promptly to guide therapy. ALUM bladder irrigation was stopped, and a single four hour hemodialysis session was performed followed by gentle rehydration. The patient improved significantly over the next 24 hours, with return to normal mental status and strength. Aluminum level eventually returned elevated at 18 ng/mL (reference range 0–6 ng/mL).
Case Discussion: Aluminum containing fluids have been used as an astringent in cases of refractory hemorrhagic cystitis. Some amount of aluminum is undoubtedly absorbed through the damaged bladder wall, but with normal renal function is cleared. In this case, lasix diuresis led to dehydration, and the inability to clear aluminum efficiently. Hemodialysis is effective at clearing aluminum, as demonstrated in this case. Deferoxamine chelation was considered, but was not performed as the patient improved rapidly with other therapies.
Conclusions: Aluminum containing solutions are generally safe for bladder irrigation, but toxicity can occur in the setting of dehydration and renal insufficiency. Safe effective treatment with rehydration and hemodialysis, without chelation can be performed.
Keywords: Adverse drug event, Aluminum, Hemodialysis

105. Succimer vs CaNa2 EDTA for lead encephalopathy in two individuals exposed to lead-contaminated moonshine

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Background: Lead encephalopathy is a severe manifestation of lead toxicity requiring aggressive treatment. FDA-approved therapy for both children and adults uses dimercaperol (BAL) and edetate calcium disodium (CaNa2 EDTA). Succimer is FDA-approved for use in chelating lead toxicity in children with levels $>$ 45 mcg/dL but is not typically used in lead encephalopathy. We present a case of lead encephalopathy treated with BAL and oral succimer due to regional shortages of CaNa2 EDTA, compared to a related case treated with BAL and CaNa2 EDTA.
Case Reports: This case series describes two related patients with lead encephalopathy who presented to two different hospitals about 3 weeks apart after a history of long-term moonshine abuse. The first patient was a 66 year-old woman who presented with confusion and weakness. She required intubation and had an extensive metabolic work-up showing a whole blood lead level of 148.2mcg/dL on hospital day #13. Due to regional shortages of CaNa2 EDTA, she was given one dose of BAL and started on nasogastric succimer. Her lead level decreased to 47.2mcg/dL after 10 days of treatment. Her mental status returned to baseline, with discharge home on hospital day #20. She completed a full course of succimer therapy (five days of 10mg/kg PO TID and fourteen days of 10mg/kg PO BID) as an outpatient.
The second patient was a 73-year old man who presented 3 weeks later to another hospital in status epilepticus. His initial whole

blood level was > 160mcg/dL. On hospital day #1, he was given one dose of BAL then started on CaNa2 EDTA. His lead level on day #9 was 48mcg/dL. Succimer was then added. Despite this chelation, benzodiazepines, antiepileptic medications, proprofol, and aggressive care, he remained in status epilepticus. His family withdrew care on hospital day #10, at which point he expired.

Case Discussion: Both patients presented with lead encephalopathy after consuming the same lead-contaminated moonshine. Due to regional shortages of CaNa2 EDTA, succimer was used for chelation therapy in one patient. Both patients demonstrated rapid reductions in whole blood lead levels and by days #9 and #10 had nearly the same whole blood lead level (48mcg/dL and 47.2mcg/dL). Succimer therapy was effective in decreasing blood lead concentration, similar to CaNa2 EDTA in our patients.

Conclusions: In this case, succimer in combination with BAL was an effective regimen for treating lead encephalopathy. Succimer + BAL may be considered in the treatment of lead encephalopathy when standard therapy with CaNa2 EDTA + BAL is unavailable.

Day	Succimer Patient Lead Level (mcg/dL)	CaNa2 EDTA Patient Lead Level (mcg/dL)
0	148.2	> 160
2	–	95
3	164.4	–
4	101.6	–
5	–	61
7	–	45
9	56	48
10	47.2	–

Keywords: Lead, Encephalopathy, Succimer

106. Parachuting a compounded transdermal analgesic cream: A leap of faith

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Background: "Parachuting" is a drug abuse technique whereby one swallows crushed pills or tablets in a tissue or small amount of paper and swallows the wrapped powder in order to avoid an unpleasant taste. Topical analgesic products made by compounding pharmacies may contain drugs with a strong potential for abuse, such as ketamine, baclofen, clonidine, and gabapentin. We present an unusual case of a female who recreationally parachuted a transdermal analgesic cream.

Case Report: A 25 year-old woman with a history of poly-substance abuse presented to an ED with lightheadedness, altered mental status, and bradycardia. The patient had parachuted two pumps of a compounded transdermal analgesic cream that was prescribed for another individual. The cream contained clonidine 0.2% (w/v), ketamine 15%, baclofen 3%, gabapentin 6%, prilocaine 7%, and diclofenac 2%. Initial vital signs were HR 45, BP 127/78, R 12, and SpO2 100% on room air. EKG showed sinus bradycardia with a rate of 36, QRS 84 ms, and QTc 423 ms. Comprehensive metabolic panel was normal except for a glucose of 200mg/dL. APAP, salicylates, ethanol, and UDS for common drugs of abuse were undetectable. She received activated charcoal, atropine, and glucagon. Two hours post-ingestion, her mental status decompensated, and she required intubation. She received a dopamine infusion for hypotension and bradycardia. The patient was extubated, and discharged home at her baseline within 12 hours. Serum testing upon arrival using GC/MS and LC-MS/MS demonstrated a clonidine level of 17ng/mL (therapeutic range 0.5–4.6), ketamine level 37ng/mL (therapeutic value 40–200), norketamine level 410ng/mL (therapeutic levels not established), baclofen level 0.9mcg/mL (therapeutic range 0.08–0.4), and gabapentin level 2.6mcg/mL (therapeutic range 2–10).

Case Discussion: Compounding pharmacies are producing customized analgesic creams that contain several potent components with demonstrated abuse potential. As the prevalence of these creams increases, the potential for abuse also increases. In our patient, clonidine and baclofen appear to be quantitatively and clinically the components most responsible for her symptoms, although there are no standard components or concentrations for these preparations at this time.

Conclusions: Clinicians should be aware of the potential for abuse of patient-specific compounded transdermal analgesic creams and of alternative routes of exposure such as parachuting.

Keywords: Parachuting, Transdermal Cream, Compounding

107. Is Haff disease palytoxin poisoning?

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Background: Although the health benefits of fatty-acid rich seafood include protection from heart disease and stroke, fish and shellfish may infrequently bioaccumulate toxins causing foodborne illnesses. Periodic epidemics of Haff disease, a syndrome of severe myalgia and rhabdomyolysis following consumption of cooked brackish and freshwater fish, have been reported from Europe since the 1940s. Since 1984, 26 cases of Haff disease have been reported in the US.

Methods: A retrospective epidemiological investigation of all US Haff disease cases was conducted to identify the most common seafood vectors, to describe the most commonly recurring clinical and laboratory manifestations, and to compare the Haff disease toxidrome with other known seafood-borne toxidromes. Continuous variables were compared for statistically significant differences by unpaired t-tests; categorical variables were compared by chi-squares (X^2). Statistical significance was defined by P values < 0.05.

Results: A significant number of cases followed consumption of cooked buffalo fish, Ictiobus cyprinellus, ($n = 15$, $P < 0.0001$, X2) in California (11), Missouri (2), Texas (2), and New York (1). Other cases followed consumption of boiled crayfish in Louisiana (9) or baked salmon in North Carolina (2). California and Louisiana accounted for most cases ($P < 0.0001$, X^2). The mean age of cases was 54.8 years with no gender difference. Following a mean incubation period of 8 hours, the most common presenting manifestations were myalgia, muscle rigidity, nausea or vomiting, chest pain, diaphoresis, dyspnea, and brown urine indicating myoglobinuria. The mean admit creatine kinase (CK) level was 9,661 IU/L ($N = 150–300$) which peaked significantly within 24 hours to a mean of 29,630 ($P < 0.0001$, t-test). Myocardial infarction was excluded in all cases by normal electrocardiograms and CK-

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myocardial band (MB) levels (mean = 2.7%; N < 4%). Although there were no deaths after supportive therapy with urinary alkalinization and intravenous fluid loading, 1 patient suffered prolonged muscle weakness and cognitive disturbances which resolved after 8 months.

Conclusions: Haff disease in the US may follow consumption of buffalo fish most commonly, but also salmon and crayfish. The disease may be defined by clinical and laboratory evidence of rhabdomyolysis of striated muscle with cardiac muscle sparing. Although Federal labs have not identified a heat-stable myotoxin, mice fed samples of contaminated buffalo fish have developed histopathological evidence of rhabdomyolysis with renal tubular myoglobin. The poison toxidrome most closely resembles marine palytoxin poisoning. Bioaccumulation of an algal myotoxin similar to palytoxin is suspected, but remains unconfirmed.

Keywords: Food poisoning, Environmental, Epidemiology

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108. Something fishy about rhabdomyolosis

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Background: Haff disease is a syndrome of myalgia and rhabdomyolysis following consumption of fish. It is thought be caused by a heat stable toxin that has yet to be identified. Symptom onset occurs within 24 hours of consumption of affected fish. Implicated fish include buffalo fish, crawfish, eel, pike and turbot. Haff disease is a challenging public health issue to manage due to the lack of information about whether multiple fish in a lot might be affected or whether there are individual susceptibilities to this toxin.

Case Series: In the winter of 2014, four persons with compatible symptoms and history were reported to a regional poison center. The first two cases consumed buffalo fish purchased at a neighborhood store. A few hours after ingestion, both patients developed nausea, vomiting, myalgias, and marked chest, back and neck pain. One patient was admitted to the hospital with a CPK value of 30,549 IU/L. The other patient did not seek immediate medical attention. Six days later, two more individuals presented with similar symptoms after ingestion of buffalo fish that was purchased at a store approximately 30 miles away from the initial case purchase site. Peak CPK in the second two cases was 993 and 10,120 IU/L, respectively. The regional poison center notified public health authorities on all four cases.

Case Discussion: The three hospitalized patients were treated supportively with IV fluids. None developed acute kidney injury and improved by day 3 post exposure. The patient who did not initially seek medical attention was evaluated 3 days later and had normal laboratory values for CPK and was not admitted.

The state and local health departments coordinated an investigation with the CDC and FDA. It was determined that both stores used the same fish distributor. The buffalo fish were caught in the same region of the Mississippi River. All suspect fish from the same lot remaining for sale were removed from potentially affected stores. Notice was sent to hospitals in the area and to other states to identify any other cases and no others were identified. A press release was sent out to alert the public to the risk from consumption of buffalo fish. No further cases of Haff Disease were reported to the regional poison center after the public health intervention.

Conclusions: Haff disease is a rare syndrome characterized by myalgias and rhabdomylosis 24 hours after ingestion of certain fish. Limited information on this disease and the fish that cause it make it difficult to diagnose the condition and to determine the best public health approach to minimize risk to consumers and yet allow for sale of this type of fish in an area. Collaboration between poison control centers and public health agencies is critical in responding to this public health threat.

Keywords: Food poisoning, Public health, Poison center

109. Dietary supplement exposures and adverse reactions reported to a Poison Control Center

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Objective: The Dietary Supplement Health and Education Act (DSHEA) of 1994 defines a dietary supplement (DS) as a vitamin, mineral, herb or other botanical, amino acid, metabolite, extract, or combination thereof, which does not represent a conventional food and is intended to be ingested in a pill, capsule, tablet or liquid form. The objective of this study is to characterize DS exposures and trend adverse reactions (AR), defined as events occurring with normal, prescribed, labeled or recommended use of the product reported to a single poison control center.

Methods: Exposure cases were obtained from a single poison center's database, Toxicall® from 2002 through 2013. Exposure calls coded as dietary supplements, vitamins, herbal, diet aids, energy products, homeopathic or cultural remedies were included. Informational calls and animal related exposures were excluded from analysis. Preliminary data was analyzed for exposure characteristics including class of substance, reason for exposure, medical outcome, and population characteristics, including age and gender of the patient. Exposure calls coded as adverse reactions were further analyzed by substance class, symptoms, and incidence.

Results:

- There were 26,501 cases that met the inclusion criteria for this 12 year study.
- The majority of DS exposures were in children ≤ 5 years old and were unintentional while adults had more intentional exposures and reported over 80% of the AR.
- Around 75% of exposures were vitamin and mineral related and 4% of all exposures were coded as adverse reactions.
- More males reported dietary supplement exposures to both vitamins and other supplements, however more females reported adverse reactions.
- The average percentage of DS calls coded as AR was 4.2% over the study period which is higher than the overall percentage of AR (2.1%) of all exposure calls reported to the Philadelphia PCC over the same timeframe.

- The most common AR symptom reported with DS exposure was flushing followed by dermal manifestations, including rash, pruritus, irritation, or pain.

Conclusion: Reports of exposures and adverse reactions involving dietary supplements to a single poison control center occurs with relatively high frequency and consistency, which may challenge the perceived safety of these supplements and help to identify a need for safer storage and greater caution with use. Future research directed towards evaluating the safety of dietary supplements particularly in young children may be beneficial.
Keywords: Dietary supplement, Adverse drug event, Poison center

110. Treatment of ventricular tachydysrhythmia from caffeine-containing weight loss product with metoprolol

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Background: 1,3,7-trimethylxanthine (caffeine) can cause tachydysrhythmias. The most common dysrhythmia is a sinus tachycardia. However, as the serum caffeine levels increase, atrial dysrhythmias, such as atrial fibrillation/flutter and multifocal atrial tachycardia can manifest. Ventricular dysrhythmias, although rare, have been reported.
Case Report: We present a case of a 14 year old girl with an intentional overdose of a caffeine- containing nutritional supplement (PhD Fat-Catalyst); a total of 9 grams of caffeine was ingested. When the patient presented, she had sinus tachycardia with multiple premature ventricular complexes. Over the span of 3 hours the patient had a seizure, which was aborted with lorazepam, and she progressed into a ventricular tachycardia. After cardioversion the patient went asystolic and CPR was started. Within minutes, return of spontaneous circulation occurred; however, the patient continued to have multiple runs of ventricular tachycardia. Magnesium sulfate was given because of the appearance of torsades. The patient finally stabilized with 2.5 mg of IV metoprolol, the QRS narrowed and the rate slowed. As the effect of the metoprolol waned, the patient had several further episodes of ventricular ectopy and widening of the QRS, which again settled with intravenous metoprolol.
Case Discussion: Structurally, caffeine is similar to adenosine, however at adenosine receptors in the heart and central nervous system, it acts as an adenosine antagonist. The cardiovascular effects of caffeine toxicity are mediated by this adenosine antagonism, which results in the release of endogenous catecholamines, causing the stimulation of β1 and β2 receptors. A secondary mechanism by which patients could be predisposed to ventricular arrhythmias is through severe hypokalemia as a result of β2 adrenergic stimulation. Previous case reports have suggested the use of beta-blockers for caffeine toxicity associated hypotension as well as treatment of supraventricular tachycardias with good effect. Metoprolol is a β1 antagonist, which preferentially blocks cardiac β1 receptors. This patient's ventricular tachycardia was successfully treated with the use of metoprolol. This can be explained by the cardioselectivity of metoprolol, which inhibits the effects of circulating catecholamines.
Conclusion: We recommend the use of beta blockers such as metoprolol for the treatment of wide complex tachydysrhythmias associated with caffeine-containing products. Though the product in this case was a weight loss supplement, this may also apply to other products containing high amounts of caffeine such as energy drinks.
Keywords: Stimulant, Overdose, Beta blocker

111. Persistent bilateral carpal tunnel syndrome following severe canebrake rattlesnake envenomation

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Background: Canebrake rattlesnake envenomation can result in severe systemic toxicity and anaphylactoid reaction. Rattlesnake envenomation can cause carpal-tunnel syndrome (CTS) in an envenomated limb as a consequence of localized tissue destruction and edema. We present a case of persistent bilateral CTS resulting from systemic effects after a lower extremity canebrake rattlesnake envenomation.
Case report: A 49 y/o male sustained an envenomation to the left mid tibia. Within minutes he had paresthesias and perioral edema. Pre-hospital treatment consisted of 1mg intramuscular epinephrine. Initial ED vital signs were BP 80/60 mmHg, HR 170 bpm with tachypnea. Exam included wheezing with severe respiratory distress, fasciculations and anasarca. The trachea was intubated and he was subsequently treated with IV diphenhydramine, corticosteroids, famotidine, and infusions of norepinephrine and epinephrine. After initial stabilization a 4 vial bolus and three maintenance doses of Crotalidae Polyvalent Immune Fab antivenom (FabAV) were given. The initial fibrinogen was 14 mg/dL, platelets 228,000/mm^3, INR 1.1, CPK 8,906 U/L and serum creatinine 2.4 mg/dL. The fibrinogen improved after FabAV, but on the third hospital day his INR increased to 18.5, fibrinogen decreased to < 50 mg/dL and platelets decreased to 145,000/mm^3. He was treated with a total of 31 vials of FabAV. He was discharged on hospital day 15 but continued to have bilateral hand pain, paresthesias and weakness. Forty-eight days after envenomation bilateral EMGs demonstrated no response from either median nerve. An epidural steroid injection was ineffective. The patient declined surgical release. Six months later after occupational and physical rehabilitation, he had improvement in hand strength with residual sensory and motor deficits in the distribution of the median nerves.
Case discussion: CTS has resulted from localized soft tissue injury proximate to the site of crotaline envenomation. No published cases of CTS in non-envenomated limbs have been identified. However, our patient developed bilateral CTS remote from the bite site due to severe systemic anasarca despite antivenom and aggressive supportive care.
Conclusion: Extremity edema remote to an envenomation site resulted in bilateral compression neuropathy following a canebrake rattlesnake envenomation. Persistent sensory and motor deficits were documented at six months following envenomation.
Keywords: Rattlesnake, Anaphylactoid, Neuropathy

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Commercial Interest	What Was Received	For What Role?
BTG	Honorarium	Honorarium

112. No taste at all: Just say no to Bufo eggs

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Background: All species of the Bufo toad genus have parotid glands on their backs and produce a number of different substances, including the indolealkylamine, bufotenine. Used by the toad as chemical defense against predation, this toxin has also been exploited by humans in folk medicine and for abuse to produce hallucinations. Absorption of the venom has also been shown to produce digitalis-like poisoning, along with local anesthetic actions, especially on oral mucosa. We report a case of Bufo toad egg ingestion with subsequent and persistent loss of taste.
Case Report: A 50-year-old male was drinking alcohol with friends in his backyard when his daughter brought a 'lawn toad' to them. In their intoxicated wisdom, they decided to cut open the pregnant toad and extract eggs from it, and he ingested an estimated 2 TBL of them. He began to experience numbness in his mouth and throat that descended to the sternal notch. Following this was difficulty with breathing and wheezing, and by the time he arrived at the ED, the pt. was in full bronchospasm. He was treated with diphenhydramine, famotidine, methylprednisolone, and bronchodilator aerosol treatment. He further experienced nausea, which was treated with ondansetron. His vital signs and ECG were unremarkable, and a digoxin level drawn was 0.3. He remained stable, and except for complaint of numbness of his tongue, was discharged after approximately 6 hours. Later that day upon follow-up at home, the patient reported experiencing disorientation, visual and auditory hallucinations while he was in the ED. He reported ageusia and persistent anesthesia, concluded after eating a jalapeno pepper, tasting and feeling no heat, the only complaint coming from his stomach. One week later he was beginning to "taste around the edges of his tongue" but nothing in the center. One month later he still reported having no ability to taste anything in the center portion of his tongue.
Case Discussion: The skin and eggs of Bufo species contain various chemical compounds, including cardiac glycosides, catecholamines, indolealkylamines, and noncardiac sterols. The development of toxins facilitates survival of the eggs and hatchlings in the environment, especially to marine and animals species having limited ability to detect the presence of toxins. There are case reports of ingestion of Bufo eggs producing digoxin-like toxicity, but none that describe loss of taste sensation beyond perioral numbness.
Conclusion: To our knowledge this is the first report of persistent loss of taste associated with ingestion of Bufo species eggs.
Keywords: Abuse, Environmental, Marine

113. Methandrostenolone abuse associated with cholestatic liver injury and acute kidney injury treated with plasma exchange

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Background: Anabolic steroids have been associated with cholestatic liver injury in a number of cases; acute kidney injury (AKI) due to anabolic steroid use is much less common. The cause of AKI in these cases is unknown. Severe cholestasis resulting in hyperbilirubinemia, jaundice and associated pruritus can occur and has few effective treatments. In the literature, plasma exchange has been used in few cases for pruritic jaundice; only one case report documents its use in jaundice caused by anabolic steroids. The purpose of the abstract is to report a case of cholestatic hyperbilirubinemia and AKI caused by anabolic steroids along with successful treatment of pruritus with plasma exchange.
Case report: A 39 year-old man presented to the hospital for persistent jaundice. One month prior to presentation he ingested a 5-day course of methandrostenolone; he developed pruritic jaundice several days later. A liver biopsy revealed cholestatic injury. He continued to have worsening pruritus, jaundice and fatigue, and was admitted with a bilirubin of 47 mg/dL (ref 0.3–1.2 mg/dL) and AKI with a creatinine of 2.6 mg/dL (ref 0.6–1.1 mg/dL). Over the next 12 days, his creatinine continued to worsen to a peak of 4.6 mg/dL and bilirubin remained above 42 mg/dL. Despite treatment with hydroxyzine and hydromorphone, pruritus continued and was agonizing for the patient. Plasma exchange was performed for a total of 3 sessions over 5 days, after which pruritus improved markedly. Bilirubin improved only slightly. After plasma exchange was initiated, creatinine began to improve, and had decreased to 2.8 mg/dL 5 days later. The patient was discharged and lost to follow-up.
Case discussion: We report a case of cholestatic liver injury and AKI associated with methandrostenolone abuse. In our case, plasma exchange was used to treat intractable pruritus with success; in addition, kidney function started to improve shortly after this therapy was started. While improvement in AKI may be unrelated to plasma exchange, severe hyperbilirubinemia has been associated with AKI from bilirubin cast nephropathy. Plasma exchange could have theoretically improved kidney function through either systemic removal of bilirubin, or through an immune-mediated mechanism.
Conclusions: We report the second case of plasma exchange used to treat cholestasis from anabolic steroids, and the first use to treat AKI from anabolic steroids. Methandrostenolone abuse can cause severe cholestatic liver injury and, rarely, AKI. Plasma exchange may improve pruritus associated with hyperbilirubinemia in anabolic steroid use, and may be a consideration for severe AKI.
Keywords: Dietary supplement, Hepatotoxicity, Renal toxicity

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114. Retrospective review of Agkistrodon envenomation scenarios for predicting swelling severity

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Background: North American Agkistrodon envenomations (copperheads, cottonmouths) often result in only mild swelling without hematologic or systemic effects, yet most are routinely referred to health care facilities. Treatment for these is observation and local wound care; this could be performed at home. The purpose of this study is to describe scenarios proximate to Agkistrodon envenomations and determine if they relate to the swelling severity for potential development of predictive home management criteria. Additionally, improved poison prevention education efforts could be developed based on envenomation scenarios.
Methods: Retrospective review of one Poison Center's crotalid bite cases from 3/1/13–10/31/13 utilizing case notes, call recordings and available hospital records. Data abstracted included demographics, scenario proximate to bite, characteristics of the snake (species, size), and swelling. Swelling categories of dry bite & mild were combined as minor envenomation; moderate & severe were combined as major envenomation. Cases were excluded if follow up was less than 6 hours after the bite or if it was known to be a rattlesnake. Fisher's exact test was used to compare the bite characteristics with incidence of minor vs. major envenomation with $p < 0.05$ considered significant.
Results: There were 514 included cases; 428 copperheads, 75 unknown crotalids and 11 cottonmouths; no effect of snake type was noted on severity. Six rattlesnake cases were excluded. Swelling was "major" in 46.5% of cases. 60.9% of patients were male; gender had no effect on severity. The common activities reported at the time of the bite were walking (21.5%, p = NS), gardening (18.1%, $p = 0.02$; associated with less swelling) and reaching where one could not see (14.6%, p = NS). The snake had pressure applied to it prior to the bite 16.1% of the time; patients were aware of the snake prior to being bitten 11.1% of the time and the snake was dead at the time of envenomation 0.7% of the time; none of these were correlated with differences in envenomation severity. When more than 2 puncture wounds were reported (5.6% of all cases) it was associated with worse swelling ($p = 0.02$). The snake size was documented 45.3% of the time; when the size was known small snakes were associated with less swelling ($p = 0.005$).
Conclusions: Some scenario aspects of an Agkistrodon bite may be predictive of the degree of envenomation. Some activities such as gardening are different than the reported human encounters with rattlesnakes on the west coast of North America. Prospective validation as well as multiple variable analyses may provide a probabilistic assessment to predict the grade of swelling from an Agkistrodon envenomation.
Keywords: Snake bite, Poison center, Education

115. A change in the recipe – Death camas for prairie turnip

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Background: Commonly known as the "death camas," several species of Zigadenus are toxic plants whose onion-like roots can be mistaken for an edible plant such as wild onion. Toxic Zigadenus spp. contain zygadenine and are similar to the veratradine alkaloids of false hellebore (Veratrum spp.), acting as potent sodium channel activators. All parts of the plant are toxic, however, bulbs are most commonly ingested when foragers misidentify them as edible. Within one hour of ingestion of as little as one half to two bulbs, patients exhibit nausea and vomiting, which can progress to bradycardia, hypotension, and muscle weakness.
Case Report: A father (F) and son (S), ages 60 and 42, were foraging on native grassland in South Dakota and ingested 1–2 bulbs of what they thought was "prairie turnip" (Psoralea esculenta). They presented to an emergency department within 1 hour of ingestion after both becoming short of breath, dizzy, and nauseous with repeated emesis. Initial vital signs (VS) were significant for bradycardia (F-51, S-55), hypotension (F-95/50, S-75/40), tachypnea (F-24, S-20), and both men were diaphoretic. EKG showed sinus bradycardia without interval prolongation. Poison control was contacted and images of the plant were emailed to assist with identification. Using clinical presentation, location, and image review we determined likely exposure to Zigadenus spp.

Atropine (A) was recommended for symptomatic bradycardia and patient S received 1 mg A with improvement in VS – heart rate 120, blood pressure 130/80. He was admitted and required a second dose of A for symptom recrudescence. VS normalized within 24 hours and he was discharged. Patient F improved with fluid resuscitation and antiemetic administration; he refused hospital admission. Images were confirmed as Zigadenus spp. after review by a plant biologist and herbarium director at the University of Minnesota.
Discussion: Veratridine prolongs sodium channel activation by binding to the alpha subunit, initially increasing then decreasing excitability of neurons, resulting in bradycardia and hypotension. The toxin is a gastric irritant, with profound nausea and vomiting often occurring within 1 hour of ingestion. Diaphoresis has been reported previously and, while mechanism is unclear, was noted in our patients. Without direct visualization of the plant, physicians must rely on clinical presentation to diagnose and guide management. This case highlights the importance of obtaining images, in real-time, to facilitate identification.
Conclusion: Toxicologists, especially those covering rural areas, should be aware of the characteristics of poisoning with sodium channel activators and utilize images whenever possible to aid in identification.
Keywords: Plants, Sodium Channel Activator, Poison center

116. Acute human toxicity after the ingestion of the roe of the cabezon, Scorpaenichthys marmoratus

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Background: Cabezon, *Scorpaenichthys marmoratus*, is a member of the *Cottidae* (sculpin) family. The flesh of the cabezon is

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noted to be safe for consumption. However, the roe is known to contain a toxic component. Human effects of ingestion of cabezon roe and its icthyotoxin is not well reported

Case Report: An elderly couple developed gastrointestinal toxicity after ingesting the flesh and roe of a 6 pound greenish colored, scaleless cabezon caught off the coast of Northern California. The fresh fish filets and the roe were poached separately in barely boiling water and both consumed together.

Case 1. The 62 year old female, healthy aside from hypertension, awoke 5.5 hours post ingestion with abdominal cramps, diaphoresis, chills and nausea and proceeded to have voluminous, non-bloody diarrhea for several hours. Aside from tachycardia with a pulse of 100 beats per minute, physical exam was otherwise unremarkable. Basic laboratory evaluation including comprehensive metabolic panel, cell blood count, lipase and lactic acid were normal aside from mild hyperglycemia (116 mg/dL) and white blood cell count of 10.1 K/uL with 92% neutrophils.

Case 2. The 64 year old male, also healthy aside from hypertension, had symptoms ensue at the same time. He had a single episode of emesis followed by immediate and brisk abdominal bloating and profuse diarrhea for several hours associated with diffuse muscle cramps. The patient states he lost approximately five pounds of body fluids based on daily weights. Vitals signs upon arrival were within normal limits and similar laboratory screening was unremarkable aside from hyperglycemia (108 mg/dL).

There is no standard available to identify or quantify the toxin in serum or body fluids. Both patients were discharged after a brief observation period. Follow up via telephone the next day and one week later revealed both individuals feeling well and asymptomatic.

Discussion: There is scant information reported in the medical literature regarding the toxicity of cabezon roe. This ichthyotoxin is thought to be similar to dinogunellin, found in the poisonous roe of another marine fish, *Stichaeus grigorjewi*. There is a report of a couple who experienced chills and fever, vomiting and diarrhea four hours after ingesting roe from a cabezon in 1923. Illness and death in both mice and guinea pigs fed ground up cabezon roe has been demonstrated. Previous studies have shown lethality in mice when purified poison was injected intraperitoneally.

Conclusions: This case uniquely demonstrates the seldom-reported toxicity of cabezon roe ingestion manifested as time limited gastrointestinal distress in the form of nausea, vomiting and predominantly diarrhea and dehydration.

Keywords: Food poisoning, cabezon, Marine

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117. Hypoglycemia associated with Garcinia Cambogia ingestion

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Introduction: *Garcinia Cambogia* is an herbal supplement used for weight loss. Its primary active ingredient is hydroxycitric acid which is thought to work primarily by competitive inhibition ATP-citrate-lyase, resulting in decreased fatty acid synthesis. Animal models have shown decreased glucose absorption and decrease appetite after administration of hydroxycitric acid. Human toxicity information is limited. We present a case of hypoglycemia temporally associated with *Garcinia Cambogia* ingestion.

Case Report: A 67 year old female presented by ambulance after a syncopal event at home. At the scene, the patient was found to be hypoglycemic with a glucose of 33. She was given oral glucose supplementation at the scene and her glucose improved to 124 mg/dl. The history was significant for the fact that she had started taking *Garcinia Cambogia*, a supplement she purchased from the internet for weight loss, 2 days prior. Other medications included Venlafaxine, Lisinopril-Hydrochlorothiazide, and Alprazolam. Her workup in the emergency department was otherwise unremarkable. She was able to provide a sample of the supplement, and it was sent for gas chromatography and mass spectrometry (GC/MS), as there was concern for contaminates or adulterants in the product. The GC/MS showed no contaminants and confirmed the presence of *Garcinia Cambogia*. She was observed in the hospital for 24 hours and did not have a recurrence of hypoglycemia. She did not restart the supplement after discharge and has had no further episodes of hypoglycemia.

Case Discussion: There are no prior reports of hypoglycemia associated with *Garcinia Cambogia* and it was not seen in clinical trials. However, given the temporal relationship between the start of the supplement and the patient's episode, along with the fact that it did not recur after the supplement was stopped, suggests *Garcinia* played a role. There are no reports of herb-drug interactions with this supplement and any of the patient's medications. Studies on rat livers have shown that the rate of glycogen synthesis decreases with age. When this is combined with decreased glucose absorption and decreased appetite, hypoglycemia could result. In fact, a rat model which combined hydroxycitric acid with 3-mercaptopicolinate, an inhibitor of glycogen production, demonstrated hypoglycemia starting 2–3 days after administration.

Conclusion: We present a case of hypoglycemia associated with *Garcinia Cambogia* ingestion. It reinforces the importance of considering physiology changes associated with aging when new supplements are added. While a definitive causal relationship cannot be made, toxicologist should be aware of this possible adverse effects associated with this supplement.

Keywords: Alternative medicine, Herbals, Hypoglycemic

118. Phenibut: One poison center's experience

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Background: Phenibut (3-phenyl-4 aminobuytric acid) is structurally similar to γ-aminobutyric acid (GABA). It is an analog of baclofen and appears to have similar effects at the GABA-B receptor. Phenibut has been used for decades in Russia as an anxiolytic and sedative. In the US, phenibut is considered a dietary supplement (DS) available in health stores and on-line. Interest in phenibut, gauged by a Google Trends query, has increased dramatically over the past 3 years. We describe our experience with 4 cases of phenibut ingestion reported to our poison center.

Case Series: Case 1: A 33-year old female presented with altered mental status responsive only to painful stimuli after a presumed overdose of unknown quantity of phenibut. She had a history of

opioid abuse. She had sedation and myoclonic jerking. Alertness improved over 7 hours. Case 2: A 59-year old female noted lethargic by her husband for 24 hours experienced two tonic-clonic seizures. Her past history included chronic pain with high dose opioid use and the recent addition of phenibut for anxiety. On hospital presentation she was unresponsive with GCS 11. After 12 hours she aroused with agitation, hypertension and tachycardia that was managed with benzodiazepines. Phenibut was suspected as contributing to the altered mental status on presentation and subsequent withdrawal. Case 3: A 23-year old male with a history of substance abuse presented after being found lethargic. He aroused after 7 hours and reported abusing phenibut as an alternative high to evade urine drug screening. Case 4: A 42-year old female presented after being found with altered mental status, incoherent speech and incontinence. She had a 1-week history of phenibut use as sleep aid. Arousal over several hours was complicated by hallucinations and agitation requiring benzodiazepines. Symptoms all cleared within 24 hours.

Discussion: Phenibut is a readily available DS with anxiolytic and sedative properties. Numerous on-line resources describe its use and claim safety. Structurally and pharmacologically similar to baclofen, CNS depression is likely the most common effect with both therapeutic use and misuse. Seizure or seizure-like activity has been reported with baclofen and may also be an adverse event associated with phenibut overdose. Withdrawal appears to have complicated the medical management in at least one case.

Conclusion: Clinicians should be aware of the increasing use and availability of phenibut and the similarities to baclofen.

Keywords: Drug of abuse, Dietary supplement, Alternative medicine

119. Oxyelite pro associated hepatotoxicity

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Background: OxyElite Pro is a dietary supplement recently recalled due to concerns of liver toxicity. We present a case of OxyElite Pro associated hepatitis with a degree of transaminase elevation not previously described, as well as laboratory analysis of its ingredients.

Case Report: A 33 year old female with a history of alcoholism presented with nausea, vomiting, & right upper quadrant (RUQ) pain. Evaluation of similar symptoms 7 days prior noted AST 25 IU/L, ALT 22 IU/L, total bilirubin of 0.5 mg/dL, & INR 0.9. She was diagnosed with alcoholic gastritis & discharged. She denied overdose. Diphenhydramine, Theraflu®, vitamin b complex, pantoprazole, Zzz-quil®, & a common herbal tea were used appropriately. She denied mushroom or steroid use & admitted to alcohol consumption *after* symptoms worsened. She was taking OxyElite Pro for 2–3 years, but none in the past week. Exam noted only RUQ pain. Labs showed AST 18140 IU/L, ALT 8880 IU/L, total bilirubin 1.8 mg/dL, & INR of 2.1. Acetaminophen was not detected & a ten compound urine drug screen of abuse was negative. Abdomen/RUQ ultra sound was normal. Studies for viral & autoimmune hepatitis, hemochromatosis, & Wilson's disease were negative. She received N-acetyl cysteine, phosphorous, thiamine, folate, & multivitamin. Hepatitis & liver function normalized & she was discharged 5 days later.

Ultra performance liquid chromatography time of flight mass spectrometry (UPLC-TOF MS) based drug screening for 61 compounds was positive for oxazepam. Neither DMAA nor aegeline were detected, supporting history of last use. Analysis of OxyElite Pro capsule content by UPLC-TOF MS showed a relatively strong peak at mass/charge (m/z) 298.1439, consistent with aegeline (theoretical M + H+: 298.1443). Confirmation & quantification with analytical standard is pending.

Discussion: OxyElite Pro contained dimethylamylamine (DMAA), a stimulant. After reformulation with aegeline, hepatocellular necrosis & cholestasis have occurred. Prior study suggests illness within 60 days of use with mean ALT, AST, & total bilirubin values of 1793 IU/L, 1128 IU/L, & 12.6 mg/dL respectively. Our patient's transaminase levels were inconsistent with prior alcohol hepatitis & had recently normalized. Combined with the time course and bottle lot number, OxyElite Pro associated hepatotoxicity is suggested.

Conclusions: Hepatotoxicity was likely associated with use of the supplement, OxyElite Pro. This degree of transaminitis is the highest reported, yet bilirubin was within range. Heavy use or alcohol synergism may account for the degree of toxicity. Since OxyElite Pro now contains aegeline, this may be implicated in hepatic injury. Laboratory study suggests high aegeline amounts with further analysis pending.

Keywords: OxyElite Pro, Hepatotoxicity, Dietary Supplement

120. Essential oil exposures reported to a poison system

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Background: Essential oils are concentrated volatile oils derived from aromatic plants. There are over 50 essential oils found in perfumes, soaps, food, and they are also used medicinally in alternative medicine and aromatherapy. These products are readily available and commonly used by the public. While most are irritants, some are associated with severe toxicity. Prevalence of exposure to these agents and level of severity are not well delineated. The purpose of the study is to describe the prevalence of exposure to some of the more common essential oils and the clinical effects of the exposures.

Methods: Some of the more common essential oils including allspice oil, cinnamon oil, lavender oil, and others were examined. Essential oils associated with severe toxicity such as tea tree oil, eucalyptus oil, and pennyroyal oil were excluded. We included human exposures ≤18 years old reported to a statewide poison center system between 2004–2013, excluding exposures reporting multiple substances. Epi Info software was used to assess reported substances, patient age, and clinical effects.

Results: During 2004–2013, there were a total of 1,248 exposures to essential oils. 9% (117) of these exposures were to cinnamon oil. The most common adverse events reported were erythema (46%, 54), dermal irritation (38%, 44), and oral irritation (21%, 25). 18%

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(234) of all essential oil exposures were to allspice oil. These exposures most frequently reported oral irritation (12%, 29), cough (7%, 17), and vomiting (6%, 13). The 52 (4%) exposures to lavender oil reported most commonly vomiting (8%, 4), cough (8%, 4), and oral irritation (6%, 3). There were 843 (68%) exposures reported as simply essential oils without a particular ingredient identified. The most common adverse events associated were oral irritation (9%, 73), vomiting (6%, 50), and cough (5%, 45).
Conclusion: Exposures to essential oils are uncommon. These exposures result in relatively benign adverse events. The adverse events associated with the more common essential oils are similar.
Keywords: Alternative medicine, Herbals, Pediatric

121. Wound Botulism: A retrospective review of cases reported to a regional poison control center

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Objectives: Due to recent cases of possible wound botulism being reported to our regional poison center from within our primary service region we set out to identify and evaluate reported and confirmed cases of wound botulism from intravenous drug abusers using heroin to describe the most common signs and symptoms reported, treatment modalities provided including if the patients received the botulism antitoxin, length of stay, and whether the cases were confirmed or not.
Methods: We conducted a search of a statewide poison control center network database for all Botulism cases from within our primary service region from 2006 to 2014. We retrospectively performed case reviews and evaluated reported backgrounds, signs and symptoms, treatment and outcomes.
Results: Fourteen cases were identified and reported to the regional poison center for suspected wound botulism and all fourteen subsequently received the botulism antitoxin. Only four patients (28%) were subsequently confirmed by a health department. Reported signs and symptoms included muscle weakness, muscle paralysis, respiratory difficulty, dysphagia, visual disturbances and a history of heroin use and skin popping. The length of stay in a healthcare facility ranged from four days to over six weeks.
Conclusion: Although fourteen patients presented with signs and symptoms consistent for wound botulism according to their medical history, social history and medical evaluation, the actual number of confirmed cases of wound botulism were significantly fewer than those initially reported to the regional poison control center.
Keywords: Botulinum, Heroin, Drug of abuse

122. Toxicity from thuja occidentalis ingestion

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Background: Tag Away® is an unregulated homeopathic product marketed for symptomatic relief from cutaneous acrochorda, commonly known as skin tags. The product lists its active ingredient as *Thuja occidentalis* oil (*TO*). This oil comes from a tree commonly known as arbor vitae or white cedar, and is thought to function as an immune modulator. Exposures to *TO* are incompletely characterized in the medical literature, and cases of significant toxicity have not been previously reported. We report a case of a toddler who exhibited significant central nervous system (CNS) toxicity after ingesting this product.
Case Report: A healthy 2-year-old boy (12.5 kg) inadvertently ingested up to 15 ml of Tag Away® liquid (The Pure Source, USA). Within a few minutes he appeared to have speech difficulty, soon followed by a generalized convulsion and vomiting. In the ED, he was intubated and transferred to a pediatric tertiary care center where initially he showed no response to painful stimuli. Physical exam and laboratory workup were otherwise unremarkable. Chest x-ray showed bilateral perihilar interstitial opacities. Soon after arrival the child spontaneously opened his eyes and began moving all extremities. He was extubated and discharged after 24 hours without identifiable residua.
Case Discussion: The frequency of exposures to this and similar products is presently unknown. A "verbatim" search of the regional poison center database identified 6 previous exposures to Tag Away® from 2010 through 2013 but none resulted in significant clinical effects. Risk of toxicity could not be reliably ascertained through NPDS, as there are not specific product or generic codes for this product. An NPDS query of exposures to T. occidentalis from year 2000 through 2013 revealed 119 unintentional exposures in children under age 5. No deaths were reported and 20% had minor effects. Seizure(s) or respiratory compromise were not noted. Unfortunately, due to variation in coding practices, it is unclear how many of those exposures involved Tag Away® vs. other products containing *TO*.
Conclusions: This is the first report of significant CNS toxicity resulting immediately after ingestion of Tag Away®. The toxicity of this and other products containing *T. occidentalis* requires further examination. NPDS coding should be enhanced to better capture and characterize the nature of exposure to such products.
Keywords: Thuja, Homeopathic, Pediatric

123. Subcutaneous injection of cinnamon leading to local painful and petechial rash

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Background: Illicit substances including heroin are often bulked with "inert" products that imitate the physical characteristics of the drug. In the case of "China White" heroin or cocaine, those bulking agents include talc and corn starch, but brown heroin and black tar heroin have been bulked with dirt as well as powders with black dye or coloring. We report a case of bulking of brown heroin with cinnamon and a painful subcutaneous petechial rash from intravenous or subcutaneous injection.
Case report: A 38 yo woman with a history of long standing heroin dependence reported to the emergency department with complaint of pain in her wrist and forearm. The patient reports using heroin for several years and notes that her current dose is 500mg of heroin twice daily. She reports that the night before her presentation, she obtained "heroin" from a friend (her usual source), noted that it was "thick and goopy" when she cooked it, and injected the substance intravenously into a small vein on the palmar aspect

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of the distal forearm. She noted blood flash and says she felt that she had injected intravenously, but did not obtain euphoria. She noted immediate pain proximal to the site of injection. Over several hours, a 10cm × 5cm petechial rash developed in an oval shape proximal to the injection site. She noted severe pain over this area which increased over the 12 hour period. She had no fever, chills, lightheadedness or other systemic complaints. She reported mild heroin withdrawal symptoms. T37.5C, P101bpm, R19/min, Sat 100%RA, BP 142/86. 10cmx5cm well-circumscribed, slightly edematous, petechial rash on palmar aspect of L distal forearm (image shown on poster). Multiple nodules and ulcers c/w minor injection-related scarring/previous infections and black "tattooing" from black tar heroin. She was treated with warm compresses and pain medication. When she developed the pain without euphoria, she inspected the baggy and noted the smell of cinnamon. When confronted, her friend/dealer admitted to bulking the brown powder heroin with cinnamon.

Case Discussion: We report a case of bulking heroin with cinnamon and the short term effect of subcutaneous or intravenous injection of cinnamon in a heroin dependent patient leading to a painful, edematous, petechial rash.

Conclusions: Medical toxicologists should be aware that a painful petechial rash at the site of illicit drug injection may be due to bulking agents, including cinnamon.

Keywords: Heroin, Cinnamon, Substance abuse

124. Prevalence and characteristics of thrombocytopenia 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 thrombocytopenia. There is limited medical literature concerning its prevalence and associated characteristics. We sought to identify prevalence and characteristic of thrombocytopenia 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, INR and administration of platelets or other blood products. For this study, thrombocytopenia was defined as a platelet count of less than 100,000 platelets/dL.

Results: Two thousand five hundred and seventy rattlesnake bites were reported during the study period. Of those, 159 (6%) cases met inclusion criteria. Of those cases, 116(73%) had thrombocytopenia reported at some point in the patient's clinical course. Thrombocytopenia was present on the initial lab evaluation in 79 (68%) of those cases. The average age was 39.5 years (range 2–83) and 101 (87%) were male. A majority were bitten on the hand or upper extremity (60%, n = 70). Eighty-three (72% n = 83) received only Crotalidae polyvalent immune fab (ovine) antivenom with five patient also receiving Crotalidae polyvalent (equine) antivenom with data not reported for six. An average of 20 vials of antivenom (range 0–62) was given. Nineteen (16%) cases had hypofibrinogenemia (fibrinogen level of less than 100mg/dl) reported during their clinical course. 23 (20%) had an INR of greater than 1.5 reported during their care. Eleven (9%) received platelet transfusion. One (0.8%) received cryoprecipitate.

Conclusion: Thrombocytopenia after North America rattlesnake envenomations was infrequently reported in this retrospective study. When present it was associated with male sex and antivenom use but not with hypofibrinogenemia or coagulopathy.

Keywords: Envenomation, Snake bite, Poison center

125. Stress induced cardiomyopathy after ingestion of garcinia cambogia

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Background: Catecholamine induced cardiomyopathy is characterized by transient systolic dysfunction due to catecholamine-mediated myocardial stunning. Garcinia cambogia, also known as Malabar tamarind, is a fruit native to Indonesia that contains hydroxycitric acid (HCA). Its extract is currently being marketed in the US as a weight-loss supplement.

Case: A 51-year-old female with no past medical history who presented to the Emergency Department with shortness of breath and new onset of palpitations and hypertension one week after starting Garcinia cambogia for weight loss. She had previously been healthy and denied any history of chest pain, shortness of breath, or irregular heart beat. She denied use of any prescription or over the counter medications or other dietary supplements, and denied use of any illicit drugs. On presentation, the patient's BP was 188/108 mmHg which increased to a maximal BP of 240/89 mmHg. The initial HR was 96 bpm. Her exam was unremarkable. No edema or murmurs were noted. The chest x-ray was free of cardiomegaly or pulmonary edema. EKG showed a narrow complex sinus tachycardia with frequent PVCs and QT prolongation (QTc 565msec) without ischemic changes. The patient was given 2.5 mg of IV phentolamine and 10 mg of IV labetalol along with 2g magnesium sulfate. She had significant improvement in her symptoms, but a repeat EKG revealed a new t-wave inversions throughout her precordial leads. Troponin was 0.01 ng/ml x2, and BNP was 1160 pg/ml (0–125 pg/ml). An echocardiogram revealed moderate global hypokinesis of the left ventricle with an EF of 35–40%. Upon discharge, she was asymptomatic, with plans for close cardiology follow-up and a repeat echocardiogram.

Discussion: This patient's lack of past medical history as well as her previously active lifestyle (daily exercise without symptoms) prior to her starting Garcinia cambogia is strongly suggestive of

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a drug-induced cardiomyopathy. While we cannot definitively exclude other agents, she specifically denied this on repeated questioning. Previous reports of Garcinia cambogia toxicity include serotonin syndrome, but to our knowledge this is the first description of it causing a catecholamine induced cardiomyopathy. Typically with stress cardiomyopathy, patients recover normal LV function within one to four weeks.
Conclusion: Garcinia cambogia use may lead to catecholamine induced cardiomyopathy.
Keywords: Garcinia cambogia, Dietary supplement, Adverse drug event

126. Death and Taxus: A case of hypotension, bradycardia, and dysrhythmias from yew berry ingestion

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Background: There is a general belief that what is natural is not only effective, but also safe. While most plants chosen to be used for medicinal purposes are generally safe, there are plants that are sufficiently poisonous with even small exposures. We report a case of hypotension, bradycardia, and dysrhythmia following the medicinal use of the yew berry.
Case: A 50-year-old man ingested two handfuls of small, red berries he picked from a shrub in front of his apartment building, with the belief that they would have medicinal value. Two hours later, he developed abdominal cramping and vomits multiple times, followed shortly thereafter by diaphoresis, lethargy, and ataxia. His concerned family brings him to the ED, where his vitals on presentation were: blood pressure (BP), 78/43 mm Hg; heart rate (HR), 50 beats/min. With the exception of bradycardia, his cardiac, pulmonary, and abdominal examinations were normal. His skin was diaphoretic. He had no focal motor or sensory deficits. Initial laboratory values were: hemoglobin, 12.6 g/dL; potassium, 4.6 mEq/L; bicarbonate, 20 mEq/L; BUN, 17 mg/dL; creatinine, 2.2 mg/dL. His troponin I was slightly elevated at 0.06 ng/mL. His electrocardiogram initially showed polymorphic ventricular tachycardia, followed by sinus rhythm with a Brugada pattern.

The emergency physician was able to identify the berries as *Taxus baccata*, or more commonly, yew berries. The patient stated that he chewed both the red fleshy aril and the hard central seed.

Over the next 24-hours, the patient's BP and HR improved with intravenous fluid boluses alone. His dysrhythmia resolved with his hemodynamic improvement. The patient was admitted to the hospital for further testing, and found to have a normal echocardiography, electrophysiology studies, and cardiac catheterization. He was discharged from the hospital three days later without report of sequelae.
Discussion: Taxine, derived from the yew (*Taxus*), is sodium (Na) channel effector that *closes* the Na and calcium (Ca) channels. The decreased flow of Na and Ca leads to a failure of cardiac impulse initiation and propagation, resulting in bradycardia and hypotension. The aril is the only part of the tree that is *not* toxic. Within hours of ingestion, toxicity progresses from nausea, abdominal pain, paresthesias, and ataxia, to bradycardia, cardiac conduction delays, wide-complex ventricular dysrhythmias and mental status changes.
Conclusion: In this case, a previously healthy patient with no cardiac abnormalities develops hypotension, bradycardia, and dysrhythmias shortly after ingesting a small amount of yew berries, showing that a lack of awareness of a plant's potential dangers can be consequential.
Keywords: Taxus baccata, Plants, Cardiac toxicity

127. Herbal remedy or herbal problem?

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Background: Ayahuasca is a beverage form of a plant psychotropic that is used for religious purposes. It consists of the plant *Banisteriopsis caapi* which is endogenous to the Amazon Basin area. The ayahuasca beverage is prepared by soaking the bark and stems of the *B.caapi* plant, then boiling them with multiple other plants. The mixture is then decanted to make the tea. Plants from the Rubunaceous genus *Psychotria*, specifically *Psychotria viridis* are commonly used along with the *B. caapi* in the mixture. The *P. viridis* plant contains alkaloids which are necessary for the psychotropic effect.
Case report: A 23 year old Hispanic female was brought to the Emergency Department (ED) by her family for shaking that began 3 hours after she was given an herbal remedy by her naturopath for a febrile illness. The patient presented to the ED in status epilepticus and was givenbenzodiazepines that terminated the seizure. Her initial vitals were: T: 97.6°F; BP: 115/51 mmHg; HR: 121/min; RR: 24/min; O_2 sat: 100% 2L NC. Her physical exam was significant for depressed mental status, pupils 6 mm and minimally reactive, clonus and hyperreflexia. Initial labs were significant for a leukocytosis, a bicarbonate of 9 mEQ/L and an anion gap of 22. Due to the patient's clinical findings a diagnosis of serotonin toxicity was made. The patient was subsequently treated with intravenous fluids and benzodiazepines until her symptoms resolved about 36 hours later. The naturopath stated that she had given the patient 2 ounces of ayahuasca.
Case Discussion: The pharmacological activity of ayahuasca depends on the synergistic effects of the *B. caapi* and *P. viridis* plants. The bark of B. caapi contains B-carboline alkaloids, potent monoamine oxidase inhibitors and the leaves of P. viridis contain N,N-dimethyltryptamine (DMT). Normally DMT is not orally active when ingested by itself, but can become orally active in the presence of a peripheral MAO inhibitor such as the B-carbolines. DMT is a potent, short acting hallucinogen. It is derived from tryptophan and has structural similarity to serotonin which leads to its clinical effects. Our patient showed many signs of serotonin toxicity including hyperreflexia, clonus, altered mental status and seizures.
Conclusion: Ayahuasca is a unique herbal preparation because it contains DMT, a Schedule I drug. The Drug Enforcement Agency (DEA) argues that any plant or mixture is illegal if it contains DMT. The DEA has lost many recent court battles against the Uniao De Vegetal and Santo Daime churches to restrict importation of ayahuasca into the United States, which is how ayahuasca is available in this country. It is important to be aware of this herbal preparation as it is accessible and may have serious adverse effects.
Keywords: Ayahuasca, Serotonin syndrome, Herbals

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128. Atrial fibrillation in the setting of an acute single ingestion of ibuprofen

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Background: The risk of coronary heart disease associated with non-steroidal anti-inflammatory medications (NSAIDs) has been well studied, however the association of NSAIDs and dysrhythmias is not as well known. A recent study that looked at the incidence of atrial fibrillation in users versus non-users of ibuprofen found that, compared to non-users, recent users were more likely to have incident atrial fibrillation. This study looked at the incidence of atrial fibrillation with therapeutic levels of ibuprofen. Here we report a case of atrial fibrillation in the setting of ibuprofen toxicity.
Case report: 17-year-old boy with no significant past medical history presented to the emergency department six hours after intentionally ingesting four "handfuls" of 200 mg ibuprofen. Upon arrival the patient was asymptomatic and a review of systems was remarkable only for depression. Vitals signs were: HR 100 BP 120/70 RR 16 Temp 98. His physical examination was notable for an irregular heart rate. An electrocardiogram performed showed atrial fibrillation with a ventricular rate of 103 bpm. The patient's laboratory values were within normal limits except for a lactate of 2.5 mmol/L. The patient denied another coingestants and his screening urine toxicology was negative. He was admitted for observation in a monitored bed and spontaneous converted to normal sinus rhythm on hospital day #2. He did not receive any AV node antagonist drugs or any antidysrhythmics. He was discharged on hospital day #3 with no signs of renal injury or metabolic acidosis. His ibuprofen serum concentration was 430 mcg/ml (therapeutic is between 20–40 mcg/ml).
Case Discussion: Usually the concern with a massive ibuprofen overdose is for a metabolic acidosis and acute kidney injury. Our patient had normal renal function and was not acidotic despite having an ibuprofen level ten times the upper therapeutic limit. Our patient did however, have atrial fibrillation, a complication that is not well documented or prevalent in the literature with ibuprofen toxicity. Theories are currently being developed as to why the therapeutic use of NSAIDs may be associated with atrial fibrillation. Most theories are related to the adverse renal effects associated with NSAID use such as fluid retention, electrolyte disturbances, and blood pressure destabilization. However these theories have not been studied.
Conclusion: Aside from the usual sequelae of ibuprofen toxicity, atrial fibrillation may also be associated. It is unknown exactly why this occurs, and more research in this area must be performed to determine the risk of association and cause of this phenomena.
Keywords: NSAID, Arrhythmia, Overdose

129. Pediatric exposures to culinary spices reported to a poison control system, 2004–2013

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Background: Culinary spices can have adverse effects when ingested inappropriately. In 2012, more that 36 million internet viewers saw videos on YouTube of adolescents taking the Cinnamon Challenge, swallowing a dry teaspoon of the spice that coats oral passages and produces coughing, gagging and inhalation of the spice,. Breathing difficulty and aspiration can result and some poison control centers have reported multiple calls for this exposure. Other exposures to culinary spices, including some fatalities, have also been reported in the literature.
Objective: Assess the frequency of culinary spice exposures and outcomes among the pediatric population.
Methods: We assessed the exposures to culinary spices among patients aged 19 years or younger during the decade 2004–2013 reported to a poison center system, excluding exposures reporting multiple substances. We used Epi Info 7 software (CDC) to assess reported substances, demographics of pediatric exposures, reasons for exposure and medical outcomes.
Results: During the decade, the poison system received 1,337 calls, a mean of 133.3 annually (range 81–151). Most reported exposures were among children aged 5 years or younger (871, 65.1%) and most commonly involved Capsicum peppers (875, 65.5%), followed by cinnamon (68, 5.1%). Callers also reported exposures to 39 other spices. Ingestions (634, 47.4%) were the most frequent exposure route followed by ocular (261, 19.5%) and dermal (166, 12.4%). Most exposures were unintentional (1211, 90.1%), required no follow-up (613, 45.9%) produced minimal toxicity and were managed onsite (1217, 91.0%). Referral to health care was needed for a minority of exposures (91, 6.8%). Most cinnamon exposures were ingestions (48, 70.6%) and more than a third of cinnamon exposures (24, 35.2%) were in 2012, the year when the internet views peaked. During that year, adolescents aged 13–19 years were more likely to be reported as being exposed to cinnamon than all other age groups ($p < 0.001$). Cinnamon exposures declined in 2013.
Conclusions: Exposures to culinary spices, especially capsicum peppers, are common among children, especially those aged 5 years and under, but few exposures required medical attention. Cinnamon exposures followed a national trend, then declined. Parents and caregivers need to be take precautions to safely store culinary spices out of reach.
Keywords: Culinary spice, Pepper, Cinnamon

130. Pediatric exposure to veterinary medications and products, 2000–2009

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Background: More than half of U.S. households include companion animals, and many of these animals receive some kind of medication. Some of these are indicated for animals only, some are produced in multiple formularies with indications for both human and animal use. In addition, human medications are frequently used off-label. Assessments of human exposure to veterinary medicines are uncommon. Separate agencies regulate human and veterinary medications and the interface has not been well studied.

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Methods: We used data collected by the 57 centers of the American Association of Poison Control Centers to assess exposures of children (aged 0–19 years) to veterinary drugs and pet products.
Results: During the decade 2000–2909, callers to US PCCs reported 9,725 pediatric exposures to veterinary medications and products. Most calls concerned children younger than 5 years (8240, 84.7%), concerned males (5108, 52.5%), and were made from the caller's residence (9200, 94.5%). The majority of calls concerned medications/products intended for pet use (8000, 82.3%), and were most frequently used to control parasites and ectoparasites (3872, 39.8%). Only a minority of exposures (798, 8.2%) were classified having major (including death), moderate or minor effects. Veterinary anesthetics were identified as the exposure agent in 43.5% of the exposures classified as major (including one death) or moderate.
Conclusion: Most calls about pediatric exposures concerned young children exposed to veterinary medications/products intended for pet use and did not have serious effects. However veterinary anesthetics were identified in all but one exposure considered to be life-threatening or causing death. The reasons that children might be exposed to veterinary anesthetics need additional exploration, and more surveillance for pediatric exposure to veterinary drugs is warranted.
Keywords: Veterinary medications, Pediatric, Epidemiology

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131. OTC weight loss supplement suspected in 5 day hospitalization

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Background: Weight loss products continue to flood the market as Americans struggle to maintain an ideal body weight. In 2010, sibutramine the active ingredient in Meridia$_R$ was voluntarily withdrawn from the market when clinical studies demonstrated cardiovascular accidents, heart attacks, and hepatotoxicity. In 2012, the weight loss supplement, Botanical Slimming Soft Gels(BSSG) was found to contain the undeclared ingredient sibutramine. BSSG continues to be sold and calls to the Poison Center (PC) regarding it get reported. The case study examines a one year old patient(pt) who ingested BSSG and presented to the Emergency Department(ED).
Case Study: A one year old arrived to the ED at 1442hrs, 4 hrs post ingestion, with a history of ingesting BSSG; the case was immediatly reported to the PC. Symptoms of hyperactivity and vomiting were reported and vital signs(VS) BP 98/64, heart rate(HR) 148, respiratory rate(RR) 24, Sat 98% room air(RA), T 96.9, the PC recommended observation and treat symptomatically. The pt was discharged home after a 4hr observation. Day 2, the pt was examined in a private clinic for symptoms that persisted during the evening, the symptoms reported were: "fussy", not sleeping, vomiting, not urinating, thrashing about, lip smacking, spasmodic facial and eye movements, jaw clenching. The pt was diagnosed with dystonia and bronchiolitis and received diphenhydramine and a bronchodilator; at 1114hrs the pt was admitted to a pediatric unit, VS: HR 172, RR 44, the pt received diphenhydramine and lorazepam and 4hr later the pt was upgraded to a PICU bed for dystonia. Day 3, IV fluids and a benzodiazepine administered, but no marked improvement; VS: HR 148, RR 29. Lab results: CPK 1358, urine drug screen negative. Day 4 showed improvement but dystonia continued and lorazepam and cyproheptadine were administered, and a better nights sleep was reported; VS: HR 152, RR 47. Day 5, sleep improvement continued but the pt was irritable when awake or held by anyone except his mother; VS: HR 153, BP 96/75, RR 46, Sat 98%. Day 6 the pt was reported to be asymptomatic and was discharged home; VS: HR 110, RR 21, Sat 99%, BP 106/55.
Discussion: BSSG is marketed as a weight loss supplement and the FDA identified it to contain sibutramine. Amidst all the public warnings issued by the FDA, BSSG and other similar products continue be a popular supplement used for weight management.
Conclusion: We present a case of a BSSG exposure of a symptomatic one year old admitted to a hospital for 5 days requiring intensive care. The pt experienced cardiovascular and central nervous system symptoms that responded favorably to the treatment allowing hospital discharge.
Keywords: Adverse drug event, Dietary supplement, Poison center

132. Severe airway obstruction after Dieffenbachia ingestion

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Introduction: *Dieffenbachia spp*: Araceae family, is an ornamental plant and all parts of the vegetable contain insoluble calcium oxalate sharp needle-shaped crystals (raphides); accidental ingestion can cause severe irritation of mucous membranes and swelling of the tongue, lips and palate. This report describes a case of severe *Dieffenbachia spp* poisoning after accidental ingestion because the patient had taken *Dieffenbachia spp* for *Apium graveolens* better known as celery.
Case report: On February 2014 a male, 76 years old and 90 kg weight, was admitted to Emergency Department with severe symptoms: vesicles and lesions on the lips, tongue, oesophagus and glottis; difficulty in breathing and swallowing; oral-pharyngeal pain, swelling and oedema. The patient, immediately transferred to the Otolaryngology Surgery, was tracheostomied and was given adrenaline at intervals of 30 minutes. The man, about an hour before, had eaten some stems of the vegetable that his wife had pruned and that he had taken for *Apium graveolens* celery. Irritation is caused by mechanical action of the raphides, however the agent which provokes the swelling and the respiratory distress may be an unidentified proteolytic enzyme with irritant action and deemed the cause of local swelling. The treatment was successful and the man was discharged from hospital after a week. An explanation of the strong local irritation can be connected to the combination of two factors: the mechanical effect of the puncture by raphides (small needles) and the chemical effect due to the presence of toxic protease that are located on the surface and in the grooves of the crystals themselves.
The Milan Poison Control Center Epidemiology on Dieffenbachia poisoning: The Milan Poison Control Center, from 2010 to

2014 treated 57 patients exposed to *Dieffenbachia spp*; almost all patients has eaten accidentally the vegetable (N = 56, 98%), only a young woman (2%) has ingested it voluntarily for self-injury. More than 78% (N = 45) of patients involved in poisoning were children and the most calls came from private citizens all over Italy (N = 32, 56%).

Conclusion: It would be desirable that everyone pay a greater attention to the fact that even natural plant cold be dangerous as they can hide important pitfalls and it is absolutely not true that everything that is natural is good and safe.

Keywords: Plants, Poison center, Dieffenbachia spp

133. Adult exposures to E-cigarettes

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Background: Exposures to electronic nicotine delivery systems (E-cigs) reported to the National Poison Data System have been steadily increasing since 2010. E-cigs present a significant poisoning risk given the high order of toxicity of liquid nicotine. Legislation has been proposed at state and federal levels to restrict access to E-cig products by children. However, adult exposures account for a significant portion of calls to poison centers regarding E-cigs. E-cigs are not currently regulated by the FDA (unlike nicotine replacement products such as patches and gum).

Methods: A 39 month review of a Regional Poison Center data from 1/1/2011–3/31/2014 was undertaken. Numbers of calls regarding traditional cigarettes and E-cigs for all age groups were compared. Cases regarding adult patients (≥ 18 years) with an exposure to an E-cig device or E-cig liquid nicotine were reviewed for exposure scenario, symptoms, and disposition.

Results: There were a total of 277 cases regarding traditional cigarettes/butts for the study period; 32 (12%) involved adults. There were 67 total E-cig cases for the study period; 28 (42%) involved adults. Of the 28 adult E-cig cases, 1 patient reported symptoms that were determined to be unrelated. 21 out of the remaining 27 patients reported symptoms related to the exposure (78%). 11 patients were in/en route or referred to a HCF (41%). 12/27 cases were caused by a product malfunction (44%): 10 cases involved ingestion of a portion of the liquid nicotine cartridge when the liquid leaked out of the E-cig during regular use; 2 cases involved filter malfunction--1 patient ingested the contents of an entire cartridge and 1 patient aspirated liquid nicotine. 9/12 patients exposed because of product malfunction experienced nicotine-related symptoms (75%). There were 7 patients who called after experiencing symptoms after regular inhalational use, 2 ocular cases, 2 dermal cases, 2 patients who used E-cigs in addition to wearing a nicotine patch, 1 patient who aspirated liquid nicotine after inserting the cartridge backwards and 1 ingestion self-harm case.

Conclusion: Adult exposures to E-cigs account for a significantly higher percent of total E-cigarette exposures than adult exposures to traditional cigarettes. 78% of adults reported symptoms and 41% of exposures required evaluation in a HCF. Nearly half of all adult exposures to E-cigs were caused by device malfunction.

Keywords: Nicotine, Adult exposure, Substance abuse

134. Kids and vapor: A 4-year analysis of pediatric exposures to electronic cigarettes

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Background: The use of electronic cigarettes (EC) as a smoking substitute or method of smoking cessation has increased since US marketing in in 2010. EC devices contain variable amounts of nicotine or may be considered "nicotine-free". US poison center surveillance data demonstrates a rising call volume for exposures. EC devices or "refills" are not standardized or regulated by FDA. Product labels are not required to reveal nicotine amounts or concentrations. Nicotine fluid concentrations vary as do containers in size and use of child resistant closures. Current products also come in an array of flavors and/or scents such as bubble gum and pineapple, further increasing appeal to the pediatric population. One cigarette may contain as much nicotine in 1 mL of nicotine fluid. Our multi-state regional poison center (RPC) retrospectively analyzed data regarding EC pediatric exposures over a 4-year period.

Methods: Retrospective review of RPC data obtained from American Association of Poison Control Centers' National Poison Data System (NPDS) from January 1, 2010 to March 31, 2014 for unintentional exposures to electronic cigarettes in children < = 5 using AAPCC Generic Codes 0200620 and 0200622.

Results: From 2010–2014, there were 155 total exposure calls involving ECs. 92 of these exposures involved children < = 5. See Table 1 for pediatric exposure count by year.

Age distribution was as follows: children under 2 years: 43%, 2 year olds: 38%, 3–5 year olds: 16% child's age unknown: 2%. 92% of exposures occurred in the child's own residence, 52% were seen or referred to a health care facility, and none were admitted. Route was ingestion in 88% of cases. Other routes included ocular and inhalation (both 5%). 52% of exposures had no effect. There was 1 case in which the parent reported child "stopped breathing and turned blue" and coded as a Major Effect, but child was reported to by asymptomatic 10 minutes after the initial symptoms. There were no reports of death. When reported, nicotine amounts per product label ranged from "nicotine-free" up to 32 mg/mL.

Conclusion: Although the overall rate of RPC exposures remains low, the number of exposures increased significantly from 2012 to 2013 and the trend continues through 1st quarter 2014. Children are sensitive to the effects of nicotine and while our study did not reveal severe toxicity, large amounts of nicotine, such as found in a 32 mg/mL EC refill, could cause life-threatening sequelae. EC use continues to be popular. Standardized concentrations, clear labels, non-refillable cartridges all in child-resistant devices and packaging should be considered by regulatory agencies.

Table 1. Case distribution by year.

2010	1
2011	7
2012	13
2013	53
2014	18

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Keywords: Pediatric, Nicotine, Electronic cigarette
Disclosure: Do you have relevant financial or other relationship(s) with the commerical supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

135. Benzodiazepine abuse reported to poison centers

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Background: Prescription drug abuse has become a problem in US, and of these, benzodiazepines are among the most commonly reported. Currently, there is little information on the scope of benzodiazepine abuse reported to the poison centers around the country.
Methods: All benzodiazepine exposures coded as "intentional abuse" reported to a statewide poison center system during 2000–2013 were identified. These cases were examined for patient demographics and exposure circumstances. Those with multi-agent exposures were excluded from analysis of management and clinical outcome.
Results: Of the 8,683 total cases, the most commonly reported benzodiazepines were alprazolam (63%), clonazepam (13%), diazepam (7%), lorazepam (6%), and flunitrazepam (3%). The annual number of cases increased 146% from 350 in 2000 to 861 in 2007 then decreased 45% to 473 in 2013. 56% of patients were 20 years or older and 59% were male. 97% involved ingestion, 9% inhalation, and 2% injection. Most exposures occurred in patient's own residence (72%); however, 7% were in schools and 7% in public areas. Single agent exposures accounted for 3,728 (43%) of the cases. Of these cases, 60% were already at or en route to a healthcare facility, 18% were referred to a healthcare facility, and 19% were managed on site. The medical outcome was no effect (20%), minor effect (33%), moderate effect (13%), major effect (1%), not followed-nontoxic (1%), not followed-minimal effects (15%), unable to follow-potentially toxic (17%), and unrelated effect (1%). The most common symptoms included drowsiness (52%), slurred speech (13%), ataxia (7%) and confusion (4%). Also, 5% were reported to have tachycardia, and 4% were agitated. Most commonly used treatments were activated charcoal (17%), IV fluids (16%), cathartic (11%), and naloxone (2%).
Conclusions: In this poison center system, the most common intentionally abused benzodiazepine was alprazolam. The number of cases peaked in 2007 but since then has been declining. Most of the patients were adult and male, and majority of exposures occurred by ingestion. Of the single agent exposures, the majority were managed at healthcare facilities and most did not have serious outcomes.
Keywords: Abuse, Benzodiazepine, Poison center

136. Comparison of vaccine exposures reported to two programs

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Background: Although vaccines are produced with high levels of safety, adverse events or health problems may occur in a small portion of the individuals exposed to them. The Vaccine Adverse Event Reporting System (VAERS) is a passive US surveillance program that collects information on suspected adverse events that occur after the use of vaccines licensed in the US. US poison centers (PCs) also receive calls about potentially adverse exposures to vaccines. This study compares vaccine exposures reported to the 2 programs.
Methods: Exposures to vaccines during 2000–2013 were obtained from a statewide PC system. Exposures involving substances in addition to the vaccine and those not followed to a final medical outcome were included. Data on vaccine exposures reported during 2000–2013 also were downloaded from the VAERS website (https://vaers.hhs.gov/data/index). Cases were all of the exposures reported from the same state as the PC. The distribution of cases by selected factors was determined and comparisons were made between the two groups.
Results: There were 16,275 VAERS and 871 PC cases. The most frequently reported vaccines in the VAERS database were influenza (26%), diphtheria-pertussis-tetanus combination (24%), pneumococcal (20%), varicella (17%), and measles-mumps-rubella combination (15%). The most frequently reported vaccines in the PC database were influenza (26%), pneumococcal (9%), diphtheria-pertussis-tetanus combination (9%), hepatitis B (8%), and tetanus (8%). Both programs demonstrated a seasonal pattern with the highest proportion of cases reported in October (13% for VAERS, 17% for PC). The distribution by patient age for VAERS and PC cases, respectively, were 0–5 years (34% vs 32%), 6–12 years (10% vs 9%), 13–19 years (10% vs 7%), 20 + years (41% vs 49%), and unknown (5% vs 3%). 59% of VAERS and 53% of PC patients were female. The most frequently reported symptoms in the VAERS cases were injection site erythema (17%), pyrexia (17%), injection site swelling (11%), erythema (10%), injection site pain (10%), pain (9%), and rash (9%). The most frequently reported symptoms in the PC cases were dermal edema (10%), dermal irritation/pain (9%), dermal erythema/flushed (9%), puncture wound/bite/sting (8%), fever/hyperthermia (6%), and rash (5%).
Conclusions: A much smaller number of vaccine exposures were reported to the PC system than to VAERS. The pattern of most commonly reported types of vaccine differed between the two systems. In spite of this, the pattern of cases in the VAERS and PC was similar with respect to seasonality, patient age and gender, and most frequently reported symptoms. This suggests that PCs might serve as an additional source of information on vaccine adverse events.
Keywords: Poison center, Vaccine, Vaccine Adverse Event Reporting System

137. Comparison of lurasidone and ziprasidone ingestions reported to poison centers

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Background: Lurasidone is an atypical antipsychotic approved for the treatment of schizophrenia in 2010. Its efficacy and tolerability is considered similar to ziprasidone. This investigation compared potentially adverse lurasidone and ziprasidone ingestions from a single data source.

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Methods: Cases were lurasidone and ziprasidone ingestions reported to a statewide poison center system during 2011–2013. Exposures involving coingestants and those not followed to a final outcome were included. The distribution of cases for each medication was determined for selected characteristics. Comparisons were made by calculating the rate ratio (RR) and 95% confidence interval (CI). For management and outcome factors, analysis was limited to those cases not involving coingestants.
Result: There were a total of 140 lurasidone and 675 ziprasidone ingestions. Patients 20 years or older accounted for 70.7% of lurasidone and 61.8% of ziprasidone cases (RR 1.14, 95% CI 1.01–1.29); 65.7% of lurasidone and 66.2% of ziprasidone patients were female (RR 0.99, 95% CI 0.87–1.13). Suspected attempted suicide accounted for 54.3% of the lurasidone and 53.2% of the ziprasidone ingestions (RR 1.02, 95% CI 0.86–1.21); adverse reactions accounted for 8.6% of lurasidone and 3.6% of ziprasidone ingestions (RR 2.41, 95% CI 1.24–4.70). 55 (39.3%) of the lurasidone and 291 (43.1%) of the ziprasidone cases did not involve coingestants. Of cases without coingestants, 56.4% of lurasidone and 56.7% of ziprasidone patients were already at/en route to a healthcare facility when the poison center was contacted (RR 0.99, 95% CI 0.77–1.28) and 10.9% of lurasidone and 15.5% of ziprasidone patients were referred to a healthcare facility by the poison center (RR 0.71, 95% CI 0.32–1.57). Serious outcomes were reported in 30.9% of lurasidone and 32.3% of ziprasidone cases (RR 0.96, 95% CI 0.62–1.47). The most common adverse clinical effects of lurasidone and ziprasidone ingestions were, respectively, 14.5% and 34.0% drowsiness/lethargy (RR 0.43, 95% CI 0.22–0.83), 5.5% and 12.0% tachycardia (RR 0.45, 95% CI 0.14–1.42), 12.7% and 7.2% agitated/irritable (RR 1.76, 95% CI 0.79–3.95), and 7.3% and 6.9% hypertension (RR 1.06, 95% CI 0.38–2.98).
Conclusions: Lurasidone and ziprasidone ingestions reported to Texas poison centers were generally similar. However, lurasidone ingestions were significantly more likely to involve adults and involve adverse reactions and less likely to result in drowsiness/lethargy.
Keywords: Antipsychotic, Lurasidone, Ziprasidone

138. Tarantula exposures reported to poison centers

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Background: Tarantulas are often large and hairy spiders of the Theraphosidae family. Although tarantulas are venomous, and their bites may cause pain, their bites are not known to be fatal. New World tarantulas have urticating hairs on their abdomen that may cause discomfort if they get into the skin. Tarantulas are found in the southern and western regions of the US. This study describes tarantula exposures reported to poison centers.
Methods: Cases were all spider exposures reported to a statewide poison center system during 2000–2013 where the spider was described as a tarantula and the exposure route was a bite/sting. Exposures not followed to a final outcome were included. The distribution by demographic and clinical factors was determined.
Results: There were 255 tarantula exposures, of which 4 specifically mentioned exposure to the spider's hairs. 29 of the tarantulas were specifically mentioned to be pets. 49% of the exposures occurred during May-July. The distribution by patient age was 10% 5 years or less, 15% 6–12 years, 13% 13–19 years, 61% 20 years or more, and 1% unknown; 70% of the patients were male. Of the 111 cases where the affected body part was mentioned, 31% involved the finger, 19% hand, 17% foot, and 10% leg. 88% of the exposures occurred at the patient's own residence, 4% other residence, 3% workplace, 2% school, 2% public area, and 2% other/unknown site. The management site was 88% on site, 10% already at/en route to a healthcare facility, 1% referred to a healthcare facility, and 1% other/unknown location. The medical outcome was 4% no effect, 22% minor effect, 5% moderate effect, 1% not followed-nontoxic, 65% not followed-minimal effect, 2% unable to follow-potentially toxic, and 0% unrelated effect. The most commonly reported clinical effects were puncture/wound (57%), dermal pain (53%), erythema (14%), and dermal edema (11%). The most frequently reported treatments were dilution/irrigation/wash (82%), antihistamines (23%), and antibiotics (17%).
Conclusion: The majority of patients reporting tarantula exposures were adults and male. Most of the exposures affected the finger or hand. Tarantula bites and stings reported to poison centers are generally not likely to result in serious outcomes and usually can be successfully managed outside of a healthcare facility. Limitations of this study are that the type of spider was not independently verified and some of the "bites" may not have involved actual bites but simply involved persons seeing or coming into contact with the spider.
Keywords: Spider bite, Poison center, Tarantula bite

139. Home management of unintentional pediatric aripiprazole and quetiapine exposures

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Background: Aripiprazole (ARP) and quetiapine (QTP) are atypical neuroleptics initially approved for psychotic disorders. Because they are increasingly prescribed for other psychiatric conditions, unintentional pediatric exposures have become relatively common.
Methods: This was a retrospective review of unintentional pediatric exposure cases at a single poison center (PC) that met criteria for the PC's ARP or QTP home management guidelines including: (1) Age between 1.5 and 6 years and weight $\geq$ 25 lbs, (2) Known exposure amount (ARP: $\leq$ 15 mg; QTP: $\leq$ 100 mg) without coingestants, (3) No more than minimal signs/symptoms. Follow-up calls were made at 2 and 8 hours (QTP) or 4 and 24 hours (ARP) with parents instructed to call the PC if symptoms occurred. Children were referred to a health care facility (HCF) if signs/symptoms progressed. Most calls originated from home, but calls from HCFs were included if patients met home management criteria. Cases were reviewed for clinical features, medical outcome, and the need for HCF referral.
Results: Aripiprazole: There were 15 home observation cases (7 F, 8 M, age range 1.5 to 6 years) over a 2 year period (2012–13). Exposure amounts were 2–15 mg. Follow-up calls at 4 and 24 hours were completed in 15 and 12/15 cases, respectively. No effect was documented in 5/15 (33.3%). Other documented effects included drowsiness, vomiting, irritability, and diarrhea. All were minor, with range of duration from 2 to 24 hours. No child needed HCF referral. There were 5 HCF cases (2 M, 3 F, age range 21 months to 3 years) that met home observation criteria and would have been managed at home if the PC had been contacted prior to HCF arrival. All 5 had mild symptoms including drowsiness, single vomiting episode,

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slurred speech, ataxia, and tachycardia. Three were admitted (2 for ≤24 hours). One had hyponatremia (127 mEq/L) that was likely unrelated to ARP, and was discharged within 36 hours. Quetiapine: There were 7 home observation cases (1 M, 6 F, age range 1.5 to 5 years) over the same period. Exposure amounts were 12.5–100 mg. Follow-up calls at 2 and 8 hours were completed in 7 and 6/7 cases, respectively. No effect was documented in 5/7 cases (71.4%). One child had burning of the tongue that resolved with fluids (minor effect with duration <2 hours) and one had mild drowsiness. No child needed HCF referral. There were 3 HCF cases (3 F, age range 20 months-2 years) that met home observation criteria. All 3 had no effect documented and were discharged within 8 hours.

Conclusion: Home management of children with unintentional aripiprazole (≤15 mg) or quetiapine (≤100 mg) exposures may be facilitated by guidelines utilizing scheduled followup calls tailored to drug kinetics.

Keywords: Pediatric, Aripiprazole, Quetiapine

140. Toxicity of and trends in use of tiagabine: 2000 to 2013

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Background: Tiagabine is a novel antiepileptic that acts by increasing synaptic and extra-cellular GABA concentrations. Information concerning overdose of tiagabine is limited and suggests the effects in supra-therapeutic doses and overdoses follow the GABA neurological mechanism, with seizures, lethargy, confusion and coma. However atypical presentations have been reported with profuse vomiting, hyper-salivation, bradycardia and hypertension. Following introduction the development of additional off-label uses suggested that wider tiagabine use would increase. However, in 2005 and 2008 warnings from the FDA were issued on the risk of seizures in non-epileptics and increased suicidal ideation, respectively. The impact of these two warnings was likely a reduction of tiagabine prescribing by providers.

Method: retrospective review of all single substance tiagabine exposures to NPDS 2000–2012

Results: There were 2147 patients with a single-substance-only ingestion of tiagabine, with a mean of 165/year but this was disproportionally distributed with a steep rise leading up to 2004 (max 559/year) and then a steep decline after 2005. The number of cases reported to NPDS mirrored sales reported of tiagabine with both single-substance and poly-substance cases involving tiagabine. The patients were predominantly adults (72%), with 239 young children <6 years of age (11%). Clinical effects were predominantly neurological, with the most commonly reported effects of drowsiness (27%), agitation (19%), confusion (12%), seizures (11%) and tachycardia (10%). A minority of cases presented with the "atypical" findings of vomiting (3%), hypertension (4%), muscle rigidity (1%), and bradycardia (1%). There were 758 patients (35%) with a major or moderate medical outcome, with no deaths. Two thirds of the patients were a suicide attempt (40%), adverse drug reaction (9%) or a therapeutic error (18%). A disproportionate share of the major outcomes was in the suicide attempt group (73%) with their intentionally large ingestions. The majority of patients (n = 1612, 75%) were treated in a healthcare facility. The duration of clinical effects was short and similar to previous reports: 6% with duration <2 hours, 32% with duration 2 to <8 hours, 42% with duration 8 to <24 hours, 13% with duration >24 hours and 7% not recorded.

Conclusions: The high HCF usage is likely due to high rate of symptomatic patients (59%) and the large proportion of suicide attempt cases; both figures are high for PC cases. The pattern of cases seen in NPDS mirrored pharmaceutical sales: NPDS may serve as a sentinel for changes in dosing/prescribing patterns. The steep decline in tiagabine use appeared temporally related to the 2005 FDA warning.

Keywords: National Poison Data System, Seizure, Public health

141. Munchausen syndrome by proxy due to tetrahydrozoline poisoning

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Background: Tetrahydrozoline (THZ) is an imidazoline compound commonly found in over-the-counter (OTC) eye drops and nasal sprays. THZ is widely available, colorless, tasteless, and potent in producing sedation after ingestion. These properties of THZ have resulted in its abuse for malicious intent. We present a case of Munchausen syndrome by proxy believed to result from repeated intentional administrations of THZ.

Case Report: A previously healthy 3-year-old boy presented to the hospital due to lethargy. His family reported that his only possible drug exposure was 3 oral doses of homeopathic *Gelsemium* administered by his grandmother 5 days prior to admission for fever after which lethargy developed. Initial vital signs included HR 46 bpm, BP 92/41 mmHg, RR 26 bpm and a temp. 37°C. His physical examination was remarkable for decreased level of consciousness but he was arousable to painful stimulus. A complete blood count, metabolic panel, CSF studies, electroencephalogram, echocardiogram, magnetic resonance imaging of the brain and a urine immunoassay for drugs of abuse were obtained - all of which were unremarkable. The child improved and was discharged 3 days later. The primary care team ascribed the patient's symptoms to the ingested *Gelsemium* preparation. Twelve days after discharge, the boy returned with lethargy, bradycardia and pinpoint pupils. Further questioning revealed that the child's grandparent was concerned that his mother could be altering the child's drink. An interview of the patient's relatives revealed the availability of liquid nicotine, Visine and Afrin at the house but no illicit substances. Comprehensive LC/MS/MS of the patient's serum, performed at a reference laboratory, demonstrated a THZ concentration of 20 ng/ml and no other xenobiotics.

Case Discussion: Malicious poisoning with THZ has been implicated in cases of drug-facilitated sexual assault. Based on the pattern of symptoms and signs, the child's apparent clinical deterioration when alone with his mom, the concern expressed by his grandparent, and confirmation of THZ in the blood, it was determined that this boy's illness represents a case of medical child abuse using Visine eye drops.

Conclusions: We report a case of intentional THZ poisoning secondary to Munchausen syndrome by proxy. The illness was initially erroneously ascribed to an herbal supplement by the primary care team, and highlights the potential pitfall of making toxicological association without careful laboratory investigation and confirmation. THZ is undetectable on most routine hospital toxicology "screens", but should be considered in the appropriate clinical context.

Keywords: Pediatric, Tetrahydrozoline, Munchausen by Proxy

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142. Initial ethylene glycol levels as a predictor of intensive care unit admission or hemodialysis

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Background: Ethylene glycol ingestion is an important cause of injury and death in the United States and internationally. We undertook a retrospective chart review of ethylene glycol ingestions to determine predictors of the need for hemodialysis (HD) or intensive care unit (ICU) utilization.
Methods: We performed a retrospective chart review at an urban tertiary care hospital for patients treated for ethylene glycol ingestion between January 1, 2009 and July 1, 2012. Inclusion criteria included an admission diagnosis of ethylene glycol poisoning. There were no exclusion criteria. A total of 22 cases were identified. The suspected time of ingestion, anion gap (AG), serum pH, osmolal gap (OG), serum ethylene glycol concentrations (EG), ICU utilization, HD, and patient outcome were recorded. Regression analysis was performed to determine whether AG, serum pH, OG, or EG predicted ICU utilization or HD.
Results: Of the 22 cases identified, 17 were men and five were women. Age ranged from 16 to 77 years old with an average age of 44 years. Serum ethylene glycol concentration ranged from below limits of detection to 379 mg/dL. Serum pH on arrival ranged from 6.7 to 7.5. Initial OG ranged from 6 to162 and initial AG ranged from 7 to 40. Mean EG for cases admitted to the ICU was 195 mg/dL, whereas mean EG for non-ICU patients was 72 mg/dL. Logistic regression demonstrated a significant association between EG and ICU admission (exponentiated $B = 1.01$, $p < 0.05$). AG and presenting serum pH were not predictive of the need for ICU admission. Logistic regression demonstrated a significant association between HD and both AG and pH (exponentiated $B = 1.28$, $p < 0.05$ and exponentiated $B = 0.004$, $p < 0.05$ respectively). EG was not predictive of the need for HD.
Conclusions: In our retrospective study, EG was predictive of the need for ICU admission while anion gap and serum pH did not demonstrate a statistically significant association. The lack of significance with regards to pH predicting ICU admission may be due to limited power secondary to the small sample size. A larger prospective study is needed to further investigate these associations.
Keywords: Ethylene glycol, Intoxication, Alcohol

143. Poison control center surveillance of unintentional laundry detergent exposures

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Background: Laundry detergent capsule (LDC) exposures have been an emerging public health event and appear to have a different exposure profile than traditional automatic laundry detergents. Each LDC contains 15–32 mL of concentrated surfactants in easy dissolvable polymer membranes. Membrane dissolution can be triggered a variety of water sources including washers, saliva or moist hands. We compared LDC exposures to non-LDC such as powders and liquids. Manufacturers have initially modified packaging based on PC surveillance data.
Methods: We analyzed our laundry detergent exposures from 2009–2013 data by age, gender, call site, detergent type (LDC, powder, liquid, tabs, unknown), route, circumstances of exposure, management site, clinical effects and Poisoning Severity Score1. The two exposure groups (LDC vs non-LDC) were compared using the Pearson X2 or Fisher's exact test.
Results: During the study period 2009–2013, a total of 3,254 LDC and non-LDC enquiries were received. Of these, 46% (1,492) were LDCs, 33% (1.062) liquid detergents, 10% (323) powders, 2% (67) tabs, and 10% (310) unknown formulation. The route of exposure was primarily ingestion for both groups (LDC: 92%, Non-LDC: 91%). LDC exposures 76% (1,138) had a higher number of clinical effects (oral irritation, vomiting, coughing, ocular hyperemia, and skin irritation) than Non-LDC exposures 25% (447) ($p < 0.001$). No deaths were reported.
Conclusions: LCD exposures required hospital evaluation more often than Non-LCD exposures due to more severe clinical effects. It is still too early to assess the results achieved by the modification of the packaging made on the recommendation of the CCP and the Ministry of Health, but this is an example of how data collected from the PCC can be used for surveillance and prevention of public health.
Keywords: Laundry detergents, Monodoses, Poison center

Reference

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144. Prolonged laboratory interference after intravenous lipid emulsion therapy

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Background: Although rarely reported, pancreatitis and laboratory interference may occur after administration of intravenous lipid emulsion (ILE) therapy. We report a case of significant laboratory interference after treatment with ILE.
Case report: A 43 year-old, 63 kg female was found alone in a hotel room with agonal respirations, approximately 12 hours after checking in. Multiple pill bottles were found nearby; 12 grams of propranolol, 1.5 grams of tramadol, 200 milligrams of zolpidem, and 15 milligrams of alprazolam were unaccounted for. The patient was taken to a local hospital where she was noted to have a blood pressure of 64/47 mmHg and a heart rate of 81/min. She was intubated and treated with intravenous normal saline, insulin/glucose, and norepinephrine (NE) infusions. She was admitted to the intensive care unit (ICU) where two 150 ml/kg bolus doses and one maintenance dose (0.25 ml/kg/min) of 20% ILE were administered 8 hours after admission. Beginning approximately 2 hours after ILE administration, laboratory assays were unable to be performed due to the presence of lipemia in the collected samples. The patient developed worsening hypotension; echocar-

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diography showed an ejection fraction of 10–17%. A vasopressin (VP) infusion was ordered, and the patient was transferred to a tertiary care center where she remained hypotensive despite NE, VP, dobutamine, and epinephrine infusions. Upon admission to the ICU, the patient received one additional 150 ml/kg bolus of 20% ILE without hemodynamic improvement. Laboratory assays were again attempted but were unable to be adequately performed due to discoloration of the patient's blood; despite ultracentrifugation, the plasma appeared opaque and pinkish-white. Percutaneous femoral extracorporeal membrane oxygenation (ECMO) was initiated, but oxygenation was not able to be monitored due to laboratory interference noted with the arterial blood gas analyzer. The patient's hemodynamic condition did not improve with ECMO; she became increasingly difficult to ventilate, experienced an asystolic cardiac arrest, and was pronounced dead 31 hours after initial admission.

Case discussion: In one previous report, centrifugation was effective in removing more than 90% of glycerol-banked triglycerides, thus minimizing lipid interference with laboratory assays. We noted persistent laboratory interference for more than 20 hours after ILE administration, despite ultracentrifugation of specimens.

Conclusion: ILE administration may cause significant and prolonged interference with laboratory assays. Clinicians should be aware of the potential for this interference, which may affect the monitoring of critically ill patients.

Keywords: Antidote, Beta blocker, Laboratory

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145. Effects of amiodarone ingestion as reported to seven regional poison centers

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Background: Amiodarone HCl, FDA approved in 1986 for the treatment of arrhythmias, is utilized intravenously in the treatment of ventricular tachycardia and fibrillation as well as atrial fibrillation. The medication is also prescribed for oral use in the treatment of cardiac dysrhythmias. Limited data exists describing the frequency and nature of toxicity associated with amiodarone exposure. We examined all reported ingestions of amiodarone as recorded by 7 regional poison centers between January 1st, 2000 and December 31st 2013 to determine if significant toxicity occurs after oral exposure.

Methods: All cases of reported amiodarone exposure were obtained from the participating centers for the dates provided. Cases were reviewed manually, including case narratives, to determine exposure characteristics and verify coding accuracy. Inclusion criteria applied: (1) isolated ingestion of amiodarone (2) known clinical outcome. Exclusion criteria: (1) multi-drug ingestion, (2) unknown outcome, (3) outcome judged to be unrelated to the exposure and (4) confirmed non-exposure. Cases were examined for clinical effects as well as time of onset of effects. Subgroup analysis of pediatric exploratory exposures and intentional overdoses were performed.

Results: A total of 373 cases were reviewed; 132 were excluded. Of the 219 cases that met inclusion criteria, 170 (77.6%) developed no clinical effects. Mild effects were noted in 29 (13.2%). Sixteen (7.3%) moderate outcomes were recorded, 4 major outcomes (1.8%), and 0 deaths. Amid cases with reported symptoms the most common effects were dizziness/vertigo (10), nausea (8) and bradycardia (7). The majority of cases with moderate/major outcomes developed symptoms >5 days after treatment initiation, though 3(15%) developed symptoms <24 hours. Amongst pediatric exploratory ingestions (<5 years), 93.9% (92/98) of cases had no clinical effects, 4 (4.1%) developed minor effects, and 2 (2%) experienced a moderate outcome. The maximum reported dose in the moderate pediatric outcomes was 12.8 mg/kg. Only 3 (1.38%) suspected suicide cases were reported with a maximum reported dose of 1800 mg, none of which developed clinical effects judged to be major.

Conclusion: Of 219 exposures to amiodarone 199 (90.9%) had either no or minor clinical effects. Significant (moderate and major) outcomes were noted in 20 (9.1%) of cases. The most frequently noted clinical effects in moderate and major outcomes were cardiac in nature. Only 2% of pediatric exploratory exposures resulted in significant clinical effects. Though most clinical effects occurred >5 days after exposure 3 cases, including 2 pediatric exposures, developed effects in less than 24 hours.

Keywords: Amiodarone, Cardiac toxicity, Pediatric

146. Retrospective review of oxcarbazepine toxicity

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Oxcarbazepine (OXC) is a 10-keto analogue of carbamazepine approved by the FDA in 2000 as monotherapy or adjunctive therapy in patients with partial and secondary generalized seizures. Off-label uses may include treatment of bipolar disorder, diabetic neuropathy, neuralgia and neuropathies. There is limited data available regarding oxcarbazepine in single substance overdose. We sought to evaluate all individuals with ingestions of oxcarbazepine reported to US poison centers to evaluate adverse effects from supratherapeutic doses and/or overdose.

Method: Retrospective analysis of data reported to NPDS from single substance oxcarbazepine ingestions between January 2000 and December 2012.

Results: there were 18,867 cases with a mean of 1,451 exposures/year. The patients were predominantly adults with 5464 exposures in children <6 years (29%). The most commonly reported clinical effects were drowsiness (n = 4703, 25%), vomiting (n = 1559, 8%), tachycardia (n = 590, 3%), agitation (n = 342, 1.8%) hypotension (n = 178, 0.9%), electrolyte disturbance (n = 153, 0.8%), coma (n = 156, 0.8%) and seizures (n = 121, 0.6%). There were 176 patients with a major effect (0.9% of all cases), of which 31 involved children <6 yrs (0.57% of children), and 1728 (9%) patients with moderate effects of which 300 involved children <6 yrs (5.5% of children). Five deaths were reported in adults. Intentional exposure (e.g. suicide) was the reason for exposure in 68% of patients with major effects and in all fatalities. In all OXC cases, the most common reason for exposure was Therapeutic Error (n = 7679, 41%), Suicide (n = 5142, 27%) and Unintentional General (n = 4029, 21%). 53% of adults and 38% of children <6yrs were managed in a healthcare facility (HCF). HCF utilization levels remained consistent over the 13 year period.

Discussion: This is the first large case series of OXC exposures comprising data from 13 years. Severe outcomes appear to be infrequent (< 1%). Unlike other anticonvulsants (e.g. carbamazepine or tiagabine) OXC does not appear to be proconvulsant in overdose. HCF utilization appeared to remain consistently high despite predominantly benign outcomes. This is especially true in young children where < 6% had a moderate or major outcome but nearly 40% were seen in a HCF.
Conclusion: Serious outcomes for OXC overdoses are unlikely in the pediatric patient. With only mild symptoms likely, observation at home may be appropriate for the majority of cases. In the adult population there appears to be few neurologic and cardiovascular complications even in the intentional exposure.
Keywords: Oxcarbazepine, Overdose, Poison center

147. Laundry pack exposures in children 0–5 years evaluated at a single pediatric institution

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Background: Concentrated laundry packs were introduced to the United States (US) market in early 2012. Case reports and poison center series have highlighted increased safety concerns with these products especially when compared to traditional laundry detergents. The purpose of this study was to examine the clinical experience with laundry pack exposures at a single institution.
Methods: A retrospective chart review was performed for exposures to laundry packs seen at a single tertiary care children's hospital, its associated urgent cares, and outpatient clinics. Cases were identified by searching the regional poison center database for exposures to laundry products from 3/12 to 10/13. Children < 5 years were eligible. Emergency department (ED), electronic medical records were reviewed for all identified cases. Data collected included demographics, vital signs, treatments, laboratory and radiology data, disposition, and length of stay in the ED.
Results: 40 cases were included. 32 were ingestions; 8 were ocular exposures. 9 children were admitted, 2 of which were admitted to a critical care unit (CCU). 1 child was reported to be unresponsive and was intubated at another institution before transfer to ours. The 2nd was admitted to the CCU after being admitted for endoscopy and bronchoscopy. 7 other children were discharged after 1 night admissions; none received any treatments after initial ED treatment. Of these, 4 children were admitted for concerns over the possibility of central nervous system (CNS) depression but none showed any progression. 2 children were admitted specifically for endoscopy or bronchoscopy. 1 child was admitted for symptoms of upper airway obstruction. 29 children with ingestions were discharged directly from the ED. No children had progression of CNS symptoms. Children discharged from the ED were observed an average of 189 minutes with 48% observed greater than 3 hours. 3 children had endoscopy. No high grade injuries were observed. All 8 ocular exposures had corneal injuries. All were seen by ophthalmology and had resolution within 6 days.
Conclusion: Cases of laundry pack exposures seen at our institution were generally similar to cases described by US poison centers. In children that were able to be discharged from the ED, symptoms had generally resolved by the time they were seen in the ED. Although our study sample is small, this suggests that prolonged observation is not necessary if the child does not have CNS depression upon presentation. No child developed high grade caustic injuries and the decision for endoscopy should be made on a case by case basis. Eye exposures should be evaluated in the ED for corneal injury if the child is symptomatic after simple flushing.
Keywords: Pediatric, Laundry Detergent, Ingestion
Disclosure: Do you or any member of your immediate family have a relevant financial interest or other relationship with the manufacturer(s) of any of the products or providers(s) of any of the services you intend to discuss?

	Commercial Interest	What Was Received	For What Role?		
Proctor & Gamble	Honorarium	Honorarium	Proctor & Gamble	Study Funding	Study Funding

148. Poisonings among California inmates 2011–2013

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Background: Prisoners and persons in police custody have a high prevalence of substance misuse and abuse. We sought to further characterize the nature of drug exposures among this population using the California Poison Control System case database.
Methods: Keyword searches identified cases between 2011–2013, defined as "inmate" if the patient was at least 20 years old, had ingested only a single substance, and was taken to a health care facility from jail, prison or police custody. Comparisons were made with calls concerning non-inmates during the same period, using similar limitations. A variety of demographic and clinical information was abstracted. Odds ratios with 95% confidence intervals were calculated using statistical software.
Results: 704 inmate cases were compared to 106,260 non-inmate cases. Inmates were more likely to be younger (mean age 34 vs. 42, $p < 0.000$), male (Odds Ratio 6.2, 95% Confidence Interval 5.1–7.6), and to have engaged in drug misuse (OR 3.3, 2.8–4.0) or abuse (OR 2.3, 1.9–2.9). Most of the drug misuse cases involved ingestion of drug packets to avoid detection by police. Most inmate drug exposures took place during incarceration, but 17% occurred prior to arrest. Inmates most commonly ingested stimulants (including methamphetamine and cocaine), heroin and other opioids, acetaminophen, antidepressants, antipsychotics, and anticonvulsants. Cleaning products accounted for 10% of the exposures, compared to 5% in the non-inmate population (OR 2.1, 1.7–2.7). Inmates were more likely to require endotracheal intubation (OR 4.1, 2.9–5.7), and, perhaps reflecting the large number of suspected "body stuffers" (112) and "body packers" (14) in this population, they were more likely to have received activated charcoal (OR 9.9, 8.2–11.9) and whole bowel irrigation (OR 44.5, 33.8–58.5). Inmates were also more likely to have an outcome of major clinical outcome or death (7% vs. 4%; OR 1.5, 1.1–2.0). Four inmates died, all male methamphetamine users. Subgroup analyses showed inmate methamphetamine users were much more likely to experience agitation (OR 10.4, 6.3–17.3), require ICU admission (OR 5.4, 3.3–8.8), intubation (OR 8.1, 4.8–16.8) and have a major outcome (OR 6.3, 3.4–11.8).

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Discussion: Though our inclusion criteria limited the cases to single ingestions in adults requiring hospital evaluation, these data provide a profile of the types of exposures among inmates. Amphetamines, cocaine, heroin, anticonvulsants, acetaminophen and cleaning substances were more likely to be involved compared with the non-inmate population. The potential for high morbidity among body stuffers reinforces the imperative that all such persons receive medical evaluation prior to incarceration.
Keywords: Prisoners, Amphetamine, Body stuffer

149. Trends in prescription opioid abuse and misuse among older adults

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Background/Objective: The increasing prevalence of chronic pain associated with an aging population suggests that older adults may be a high risk group for prescription opioid abuse/misuse. We aimed to describe recent trends in abuse or misuse of prescription opioids among older adults as reported to poison centers in the U.S.
Methods: We analyzed poison center call counts for prescription opioids (oxycodone, fentanyl, hydrocodone, morphine, oxymorphone, methadone, buprenorphine, hydromorphone, tramadol, and tapentadol) that were reported to participating poison centers of the Researched Abuse, Diversion and Addiction Related Surveillance (RADARS®) System. Calls were identified as intentional abuse or intentional misuse (including suspected suicide) exposures among adults aged 20 years or older between 1Q2006 and 4Q2013. Cases were categorized into two age groups: 20–59 years and 60 + years. Population rates of exposure were calculated using quarterly counts of abuse or misuse exposures reported to the RADARS System and using age-specific population data for the coverage area from the US Census 2010. Linear regression models, with and without the addition of a quadratic term, were used to identify linear and non-linear trends over the time period.
Results: We identified 150,403 calls reporting intentional abuse or misuse of a prescription opioid among adults during the 8-year time period. Of the total calls, 8% were from the 60 + age group at an average rate = 23.8 per 100,000 population over the time period and 92% of the total calls were from the 20–59 year age group at an average rate of 98.5 calls per 100,000 population over the time period. Population rates of abuse or misuse were lower among the 60 + year age group than the 20–59 year age group at each quarter. Among the older age group there was a significant linear upward trend in intentional exposures across the entire time period ($p < 0.0001$). In contrast, rates for adults aged 20–59 showed a significant ($p < 0.0001$) non-linear trend of increasing rates from 1Q2006 through 3Q2012 and then decreasing rates from 4Q2012 through 4Q2013.
Conclusions: Although population rates of intentional exposures to prescription opioids were lower for older adults than younger adults during the time period, recent rates for older adults continued to trend upward while recent rates for younger adults trended downward. These results suggest a potential for a moderate increase in the prevalence of prescription opioid abuse and misuse as the population ages and portends the possible acceleration of rates among older adults.
Keywords: Opioid, Aging, Exposures

Disclosure: Do you have relevant financial or other relationship(s) with the commerical supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

150. First report of drug concentrations of the synthetic cannabinoid 5F-PB-22 found on post-mortem testing

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Background: The number of new synthetic cannabinoids (SynCann's) continues to proliferate and there is no information on the pharmacokinetics/toxicokinetics of these chemicals. We report three cases in which the SynCann 5F-PB-22 was detected on autopsy. In all three cases, comprehensive post-mortem drug testing did not reveal any other drugs or medications of significance.
Case Reports: Case (1) A 17 year old decedent was at a friend's house drinking ethanol and using other drugs, including synthetic cannabinoids. The decedent collapsed, and resuscitation was initiated and continued until the decedent was pronounced dead in the emergency department (ED). The postmortem exam was notable for borderline cardiomegaly with mild four chamber enlargement and biventricular hypertrophy and a liver with moderate to severe congestion and minimal steatosis. Post mortem toxicology was notable for ethanol of 33 mg/dL and 5F-PB-22 of 1.1 ng/mL. The cause of death was listed as "5F-PB-22 (synthetic cannabinoid) intoxication."
Case (2) An 18 year old was found dead early Monday morning. The decedent had been to several parties in the two nights prior to death and reported feeling lightheaded on the evening prior to death. The autopsy was unremarkable. Post mortem 5F-PB-22 concentration was 1.5 ng/mL. The cause of death was listed as "suspected acute drug intoxication using the synthetic cannabinoid 5F-PB-22."
Case (3) A 27 year old presented to an ED with a several day history of worsening anorexia, fever, vomiting and diffuse abdominal pain. ED labs: lactic acid > 15 mEq/L, ALT/AST > 10,000 U/L, INR 6.5, APAP 6.8 mcg/mL and creatinine 2.2 mg/dL. The patient's only drug/medication use were acetaminophen, 2 tablets, b.i.d., for 2–3 days prior to admission and smoking marijuana. The patient was treated with n-acetylcysteine. The patient rapidly deteriorated and died the next day. Autopsy was significant for 80–90% acute hepatocellular necrosis, acute tubular necrosis, and ARDS. Antemortem blood: Carboxy-THC 246 ng/mL and 5F-PB-22 1.3 ng/mL. The cause of death was listed as "fulminant liver failure in the setting of THC (marijuana) and 5F-PB-22 (synthetic cannabinoid) exposure."
Discussion: There are no serum concentrations reported in the literature for either 5F-PB-22 or its non-fluorinated parent, PB-22. The significance of these three concentrations and how they correlate to morbidity and mortality needs to be investigated. Until such a correlation is made, it is not possible to assign direct causality to 5F-PB-22 as the cause of these deaths.
Conclusion: We report a series of deaths in which 5F-PB-22 was quantitated at autopsy.
Keywords: Cannabinoid, synthetic, Postmortem, 5F-PB-22

151. Disulfiram inhibition of cyanide formation after acetonitrile poisoning

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Background: Cyanide poisoning may be caused by acetonitrile, a common industrial organic solvent and laboratory agent. Acetonitrile initially is slowly metabolized by cytochrome P450 2E1 (CYP2E1) to cyanohydrin, which is broken down by catalase to form cyanide and formaldehyde. Disulfiram has been proposed as an inhibitor of CYP2E1-mediated toxification of volatile solvents and may therefore be a useful antidote in acetonitrile poisoning. We describe its use in a patient who had cyanide poisoning caused by acetonitrile ingestion.
Case report: A 30-year-old man presented with a cholinergic toxic syndrome due to aldicarb ingestion and developed severe metabolic acidosis that was caused by coingestion of acetonitrile. After 3 treatments with hydroxocobalamin and sodium thiosulfate, he had transient improvement but recurrent lactic acidosis. Treatment with disulfiram was associated with resolution of metabolic acidosis and slowing of the decrease in acetonitrile plasma concentration. He recovered from acetonitrile toxicity completely. The time course of acetonitrile, thiocyanate, and cyanide concentrations suggested that disulfiram inhibited cyanide formation. In this context we further evaluated the effect of disulfiram on acetonitrile metabolism in human liver microsomes in vitro. On 3 different days, experiments were performed with 18 samples (9 samples with and 9 samples without disulfiram). The mean cyanide concentration was significantly lower after incubation with acetonitrile and disulfiram (mean ± SD; 4 ± 3 μM) than acetonitrile alone (10 ± 3 μM; 1-sided *t* test, $P \leq .001$); disulfiram caused a mean 60% reduction in cyanide level.
Case discussion and conclusion: The present case demonstrates the importance of considering the mechanism of toxicity during treatment of suspected poisoning. In clinical toxicology, well-designed clinical studies usually are unavailable and case reports frequently are the only source of clinical information. In vitro studies may provide additional insight into the treatment of uncommon intoxications. The present clinical and in vitro observations suggest that disulfiram may be a useful antidote in delayed cyanide poisoning after acetonitrile intoxication, possibly by inhibiting CYP2E1-mediated metabolism of acetonitrile.
Keywords: Acetonitrile, Disulfiram, Hydroxocobalamin

152. Anaphylaxis following fomepizole for ethylene glycol poisoning

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Background: Fomepizole is a competitive inhibitor of alcohol dehydrogenase that prevents the formation of toxic metabolites from ethylene glycol (EG) and methanol. Data regarding adverse effects are limited. We report a case of anaphylaxis following fomepizole for EG poisoning.
Case: A 16-year-old boy with asthma and urticarial allergy to penicillin was transferred to our latex free facility 20 hours after an intentional ingestion of 75 mL of 98% EG. He complained of isolated nausea and denied concomitant ingestion. Exam was notable for heart rate 106, blood pressure 147/88, respiratory rate 22, temperature 36.5 Celsius and oxygen saturation (SpO2) of 100%. He was encephalopathic and alert. Cardiac, lung and skin exams were normal. Laboratory data were remarkable for potassium 6.1 mEq/L, creatinine 2.47 mg/dL, CO2 10mEq/L and pH 7.2. Ondansetron, calcium gluconate, regular insulin and dextrose were administered for nausea and hyperkalemia. Fomepizole 15mg/kg IV over 30 minutes (min) was started. 19 min after fomepizole initiation the patient complained of abrupt dyspnea. He displayed marked tachypnea, hypoxia (SpO2 88%), and had severe bilateral wheezing with diffuse flushed skin. Epinephrine IM was administered immediately. Moments later he suffered respiratory arrest requiring emergent intubation. He required escalating epinephrine boluses followed by epinephrine infusion, neuromuscular paralysis, continuous nebulized albuterol, diphenhydramine and methylprednisolone to achieve adequate ventilation and oxygenation. Post intubation SpO2 was 55% and gradually normalized over 22 min. A chest xray was negative. Emergent hemodialysis was performed. Initial EG concentration was 17mg/dL. Epinephrine infusion was weaned over 24 hours and he was extubated on hospital day (HD) 2. He required 6 days of intermittent dialysis and was discharged neurologically intact with a creatinine of 2.10 mg/dL on HD 16.
Discussion: The reported adverse effects of fomepizole typically outweigh the consequences of ongoing glycolic and formic acid production. This case meets NIAD/FAAN criteria for anaphylaxis and is the first description of a potential life-threat associated with fomepizole. Ondansetron is an unlikely culprit as the patient received this medication multiple times without complication during his hospitalization. We suspect fomepizole induced the event given the timing, non-allergic profile of concomitant medications, and the absence of alternative explanation.
Conclusion: Clinicians should be familiar with the potential for anaphylaxis following fomepizole and integrate this into decision-making regarding its use.
Keywords: Anaphylaxis, Antidote, Adverse drug event

153. Availability of antidotes in New Zealand hospital pharmacies

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Objectives: Antidotes, while critical for the successful management of certain poisoning cases, are recognised in the published international literature as generally under stocked by hospitals. However, a survey recently published in New Zealand concluded that hospital pharmacies stocked "adequate quantities of most antidotes"; but, the stock level considered "adequate" was not stated.[1] This study explores this conclusion by comparing New

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Table 1. Percent of hospitals holding adequate antidote stocks to manage a single patient.

	Meets stock level recommendation for:		
Antidote	8 Hours (%)	24 Hours (%)	No Answer (%)
Acetylcysteine	100	100	0.0
Atropine Sulfate	83.3	50.0	0.0
Calcium Chloride	87.5	87.5	8.3
Calcium Gluconate	70.8	70.8	8.3
Ca Disodium EDTA	12.5	4.2	33.3
Cyanide Antidotes	75.0	70.8	8.3
Deferoxamine	29.2	0.0	0.0
DigFAB	0.0	0.0	45.8
Dimercaprol	62.5	12.5	12.5
Ethanol	41.7	12.5	16.7
Fomepizole	0.0	0.0	0.0
Flumazenil	75.0	54.2	4.17
Glucagon	8.3	0.0	0.00
Methylene Blue	58.3	58.3	16.7
Naloxone	70.8	12.5	0.00
Octreotide	100.0	100.0	0.00
Physostigmine	0.0	0.0	0.00
Pralidoxime	25.0	4.2	4.2

Zealand hospital pharmacy stock levels of antidotes to a published guideline.[2]

Methods: An online survey form listing a range of antidotes and requesting current stock holding was developed then tested in three hospitals of varying size. Following modification and validation, the pharmacies of 24 hospitals throughout the country with emergency care facilities were contacted and invited to participate in the survey. Access to the online form was provided during the period February 28th to April 7th 2014 and results compared with the guideline. Ethical approval was obtained from the Ngai Tahu Research Consultation Committee and the University of Otago Human Ethics Committee.

Results: All hospitals contacted agreed to participate, with a resulting 100% response rate. However, not all questions were fully answered in all forms. Wide variation of stock levels were reported, with only two antidotes being held in sufficient quantities by all hospitals to manage a single patient for 8 and 24 hours (see Table 1).

Conclusion: The quantity of antidote stocked in New Zealand hospitals is generally below that recommended. Consideration should be given to how best to rationalise and improve the availability of these critical drugs at a national level.

Keywords: Antidote, Overdose, Public health

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154. Clinical outcomes after utilization of multi-dose activated charcoal in phenytoin toxicity

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Background/Purpose: Phenytoin remains a widely used anticonvulsant. As such, it is frequently involved in exposures reported to poison information centers nationwide. Management of toxicity is largely supportive; however, it has been well established that administration of multi-dose activated charcoal (MDAC) decreases serum phenytoin concentrations more rapidly. Nevertheless, there is a lack of evidence to substantiate that MDAC-related increases in phenytoin clearance results in faster resolution of clinical manifestations or reduction in hospital length of stay when compared to no therapy. This study aimed to evaluate the clinical benefits of MDAC administration in patients exhibiting phenytoin toxicity, targeting resolution of altered mental status (AMS).

Methods: A retrospective review of poison center cases between Jan. 1, 2004 and Dec. 31, 2013 was performed. Hospitalized patients with total serum phenytoin concentrations >20 mcg/mL and signs of AMS (coma, confusion, drowsiness/lethargy, slurred speech) were included. Cases involving co-ingestants known to cause AMS were excluded, as were any cases where etiology of AMS was unclear due to baseline neurologic deficits. Patients were grouped by use of MDAC (at least 2 consecutive doses) or no MDAC. If MDAC was foregone due to chronic therapy with other anti-epileptics or maintenance medications, cases were not included in the final analysis. Patients who received other modalities of gastrointestinal decontamination (single dose activated charcoal, orogastric lavage, whole-bowel irrigation) were included only if such modalities were initiated within a maximum of 2 hours after reported ingestion. Clinical data included acuity, formulation, serum concentrations, clinical effects, and treatments provided. The primary endpoint was time to resolution of AMS.

Results: 196 cases were included for analysis, with 53 cases receiving MDAC. The groups were similar in age, gender, acuity of exposure, and formulation involved in exposure. Median initial phenytoin concentrations were found to be higher in the MDAC group (45 mcg/dL vs. 39.4 mcg/dL, $p = 0.0096$). Additionally, median amounts of phenytoin ingested or administered, if known, were found to be greater in the MDAC group (3000 mg vs. 800 mg, $p = 0.0141$). Accounting for these differences statistically, the use of MDAC was not found to improve time to resolution of AMS when compared to the no MDAC group. In fact, the use of MDAC was associated with a longer duration of AMS (33.42 hours vs. 23.63 hours, $p = 0.0207$).

Conclusion: This investigation of patients exhibiting phenytoin toxicity did not demonstrate clinical benefit on time to resolution of AMS when utilizing MDAC.

Keywords: Activated charcoal, Enhanced elimination, phenytoin

155. Physostigmine: A safe and effective antidote for treatment of coma and delirium in cyclobenzaprine overdose

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Background: Cyclobenzaprine is a centrally-acting muscle relaxant structurally similar to tricyclic antidepressants (TCAs). Compared to TCAs, it has substantially lower risk of seizures and conduction blocks in overdose while also causing considerable sedation and anticholinergic toxicity. Only two previous reports of

physostigmine use for treatment of cyclobenzaprine overdose are reported in the literature.
Methods: Retrospective review of patients seen by a toxicology service at a large academic medical center from 1/2011–4/2014. Cases of intentional cyclobenzaprine ingestion treated with physostigmine were reviewed. Data includes demographics, exposure, medical history, urine screening, presenting symptoms, and details of physostigmine administration (dosing and response, adverse effects, intubation, and disposition).
Results: There were 40 cases involving cyclobenzaprine as the primary agent in overdose with 15 (38%) receiving physostigmine. Physostigmine was administered per institutional protocol developed by toxicology (1–2 mg/10mL saline over 10 minutes). Patients with cyclobenzaprine exposure not receiving physostigmine were intubated prior to toxicology consultation in 1 case (4%) and had mild symptoms not requiring intervention in 24 cases (96%). Physostigmine was used as a single administration in 10 cases (67%) with 5 patients requiring repeat dosing (33%). No patients had any contraindication to physostigmine administration. Physostigmine reversed CNS depression in 15 cases (100%) and reversed agitation/delirium in 8 (100%). Of the 9 patients who were profoundly obtunded, physostigmine use prevented intubation in 7 cases (78%); both cases of intubation occurred after the admitting team chose not to repeat physostigmine administration despite prior success. No complications were observed as a result of physostigmine administration. Of the 9 patients at risk of intubation, 5 were admitted to the general medicine floor, with the rest requiring ICU admission. All other patients given physostigmine were admitted to the floor.
Conclusions: Physostigmine administration prevented intubation and attenuated severe agitation and delirium that likely would have required a higher level of care in many patients receiving it. While antidotal effect persisted longer than anticipated in most patients, others required redosing due to recurrent symptoms. No significant adverse effects were observed. When used judiciously in cyclobenzaprine overdose, physostigmine appears safe and effective.
Keywords: Cyclobenzaprine, Physostigmine, Intubation

156. Hemodynamic changes after methylene blue administration in poison-induced shock

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Background: Methylene blue (MB) is an emerging therapy for poison-induced shock that is yet controversial. Literature includes a small number of case reports and animal studies. Very little evidence exists where invasive hemodynamics are captured on poisoned humans. We present a case where MB was administered to a patient poisoned with cardio active medications followed by objective improvements in hemodynamics measured via a pulmonary artery catheter (PAC).
Case Report: A 54-year-old man with a history of hypertension presented after an overdose of atenolol, amlodipine, and valsartan in addition to carbon monoxide exposure. Presenting vital signs were within normal limits and initial labs were significant for creatinine 2mg/dl and carboxyhemoglobin 15%. He received 2L normal saline, 3 g calcium gluconate, 5 mg glucagon and was admitted to intensive care. He was started on dopamine (DA) for hypotension and required increasing amounts to maintain a mean arterial blood pressure $>$ 55 mmHg. Subsequently, he was started on high dose insulin titrated to 10 u/kg/hr, phenylephrine 3 mcg/kg/min, and epinephrine 0.1 mcg/kg/min. DA was discontinued. Oliguric renal failure, lactic acidosis, and pulmonary edema developed on hospital day (HD) 2, necessitating mechanical ventilation, initiation of continuous veno-venous hemodialysis and addition of norepinephrine and vasopressin. A bolus of 20% intravenous fat emulsion (1.5ml/kg) was given, however no change in blood pressure or heart rate was noted. MB was administered (2mg/kg IV over 30 minutes) due to findings from echocardiogram and PAC data consistent with vasodilatory shock– ejection fraction 60–65%, pulmonary capillary wedge pressure 24 mmHg, and systemic vascular resistance (SVR) 240 dyn•s/cm^5. Within 1 hour following MB load, SVR improved to 1204 dyn•s/cm^5 and vasopressor requirements decreased. MB infusion continued (0.75 mg/kg/hr) for 12 hours. The patient continued to improve and was discharged on HD #4 without significant sequelae.
Case Discussion: MB for poison-induced vasodilatory shock is a novel adjunct and the mechanism of effect is supported in sepsis literature. Objective improvements in hemodynamics based on pulmonary artery catheter data have not been well-documented in previous cases. This patient appeared to benefit from methylene blue demonstrated by a dramatic increase in SVR shortly after administration. Further studies are indicated to understand the risks and benefits of this treatment.
Conclusion: MB may improve hemodynamics in vasodilatory poison-induced shock and should be considered in critically ill patients poisoned with vasodilatory medications refractory to standard therapies.
Keywords: Methylene blue, Cardiac toxicity, Antidote

157. The differential use of physostigmine by toxicologists in anticholinergic toxicity based on causative agent

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Background: The anticholinergic toxidrome is well described and relatively common, seen over 800 times by toxicologists reporting to the ToxIC registry over a 27 month period. Physostigmine is generally regarded as the antidote to anticholinergic toxicity, yet previous studies suggest physostigmine is underutilized. Case reports have described adverse events related to physostigmine in TCA overdose, therefore, we would expect a differential use of physostigmine in TCAs versus other agents.
Methods: We retrospectively analyzed data in the ToxIC registry, a repository of data reported by bedside Medical Toxicologists in 44 institutions nationwide. We searched for patients diagnosed with an anticholinergic toxidrome, determining what agent(s) were likely causative based on "primary agent #1" as recorded by the Toxicologist. We then calculated the rate of physostigmine use in the following agents: antihistamines, antipsychotics, cyclic antidepressants, botanicals, SSRI/SNRI, anti epileptics, benztropine, cyclobenzaprine, mixed, others and left blank. Results: 815 patients were seen by Toxicologists for anticholinergic toxidromes from

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January 2012 through March 2014, of which 173 (21%) received physostigmine. The rate of physostigmine use for those in which antihistamines were the primary agent was 78 of 350 (22%), 20 of 114 for antipsychotics (18%), 4 of 57 (7%) for TCAs, 23 of 44 (52%) for cyclobenzaprine, 8 of 21 (38%) for benztropine, 2 of 26 (8%) SSRI/SNRIs, 1 of 13 (8%) anti epileptics, and 6 of 17 (35%) for botanical exposures. Among 173 patients with the causative agent left blank, with mixed agents, or with agents with no identified anticholinergic effects, 31 (18%) received physostigmine.

Discussion: These data suggest there is a differential use of physostigmine based on likely causative agent. Anticholinergic toxidromes caused by cyclobenzaprine overdoses were nine times more likely to receive physostigmine than those caused by a TCA. It is interesting to note the relatively low rate of physostigmine use in antihistamine overdose (22%) given its frequency. This may represent a selection bias in patients with mild toxidromes.

Conclusion: Overall, the rate of physostigmine use in anticholinergic toxidromes was lower than we expected. When stratified by causative agent, it appears physostigmine was used more readily for agents that exert a pure anticholinergic effect such as cyclobenzaprine, benztropine, and botanicals; whereas agents with multiple actions (antipsychotics), mixed ingestions, or tricyclic antidepressants were less likely to receive physostigmine.

Keywords: Physostigmine, Anticholinergic, Cyclic Antidepressants

158. Hemodialysis complications after intravenous fat emulsion administration

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Background: Published literature includes few case reports describing complications during hemodialysis (HD) after use of intravenous fat emulsion (IFE) in poison-induced shock. IFE has been reported as a potential cause of filter dysfunction in continuous veno-venous hemodialysis (CVVHD), presumably due to lipemia. We present a case where use of IFE was temporally related to complications in CVVHD and hemodynamic measurements.

Case Report: A 46-year-old woman with a history of hypertension presented to the emergency department after an overdose of atenolol, amlodipine, and zolpidem. Presenting vital signs and labs were significant for blood pressure 98/46 mmHg, heart rate 66 bpm, creatinine 1.8mg/dL and lactate 4.1. She was intubated for airway protection, given normal saline and 2g/hr calcium gluconate infusion and admitted to the intensive care unit. Over the following 12 hours she required multiple vasopressors to maintain a mean arterial blood pressure (MAP) $>$50mmHg (norepinephrine 0.4mcg/kg/min, dopamine 50mcg/kg/min, vasopressin 0.04U/min, phenylephrine 2mcg/kg/min). High dose insulin therapy was initiated and titrated to 10u/kg/hr. Oliguric renal failure and severe lactic acidosis developed followed by initiation of CVVHD. After a bradycardic arrest, a transvenous pacer was placed but did not achieve consistent electric capture. Cardiac index, via pulmonary artery catheter readings, was calculated to be 1.7l/min/$m^{2,}$ and systemic vascular resistance 650 dyn•s/cm^5. A 1.5 ml/kg bolus of 20% IFE was given without change in blood pressure or heart rate. After administration of IFE adequate flow on CVVHD was difficult to achieve due to episodes of filter clotting. Additionally, hemodynamics using thermodilution and Fick techniques were unable to be measured after IFE. Methylene blue 1.5mg/kg IV was administered with minimal effect on vasopressor requirements. On hospital day 2 extracorporeal membrane oxygenation was initiated. Unfortunately, due to persistent MAP $<$ 50mmHg for a prolonged period, multiple organ failure and ischemic bowel developed. The patient transitioned to comfort care and died on hospital day 2.

Discussion: Complications of HD due to administration of IFE in toxin induced cardiogenic shock is poorly described in the literature. This case describes potential effect of IFE on the HD circuit. Further studies are indicated to understand the risks and benefits of use of IFE in conjunction with HD.

Conclusion: Complications of HD may occur after IFE administration including filter dysfunction and diminished flow which may have a detrimental effect on resuscitation. Healthcare providers need to be aware of potential complications of IFE administration.

Keywords: Lipid therapy, Cardiac toxicity, Antidote

159. Valacyclovir toxicity presenting with neurologic symptoms and treated with hemodialysis

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Background: Valacyclovir use may lead to neurologic symptoms, usually mild, in 0.1–1% of patients.

Case: A 37 year-old female with AIDS and end-stage renal disease (ESRD) on peritoneal dialysis (PD), presented with generalized weakness, paresthesias and visual hallucinations. She had been seen 2 days prior for herpes zoster and prescribed valacyclovir 1000 mg every 8 hours.

Initial physical exam demonstrated normal vitals, a herpetiform rash in the C8–T2 dermatomes and normal neurologic exam. Thyroid tests, CBC and BMP were consistent with ESRD and otherwise unremarkable. Head CT was normal. A lumbar puncture showed clear fluid, 42 RBCs/microliter, 10 WBCs/microliter with 87% lymphocytic predominance, glucose of 48 mg/dL & protein of 54 mg/dL. Empiric antibiotics and renally-dosed IV acyclovir were started with concern for disseminated herpes zoster.

Within 12 hours, she became lethargic and confused with visual hallucinations despite successful PD, benign lab tests, negative blood and CSF cultures and a negative MRI. Further review revealed that the outpatient valacyclovir dose was not renally dosed and acyclovir neurotoxicity was suspected. The patient then underwent a hemodialysis (HD) treatment with brisk improvement thereafter, becoming more alert with resolution of hallucinations. Serum acyclovir levels sent to Quest Diagnostics were 10 mcg/mL pre-HD and 0.7 mcg/mL post-HD.

Discussion: Valacyclovir is a L-valyl ester converted to acyclovir by first pass metabolism in the liver, and is a favored treatment for shingles due to less post-herpetic neuralgia and higher bioavailability than acyclovir. While considered safe, side effects occur more in elderly and renally compromised, as 46% is excreted in the urine. Current guidelines for ESRD recommend a dose of 500 mg daily.

Neurologic sequelae in valacyclovir toxicity include irritability, insomnia, tremors, ataxia, depression, delirium and visual or auditory hallucinations, with onset in 1–2 days of use. The mechanism

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for this is unknown, but the metabolite 9-carboxymethoxymethylguanine has been found in CSF and correlates with toxicity.

The treatment of choice remains HD – diffusion into the peritoneal space is poor. Estimates suggest removal of 1/3 of acyclovir in a 4-hour treatment. In this patient, HD was effective in removing 93% of measured acyclovir.

Conclusion: Given symptoms and onset, this patient's presentation was consistent with acute valacyclovir toxicity. Hemodialysis is the treatment of choice; improvement will likely be noted with a single treatment, with ranges of removal from 33% to over 90%, as demonstrated by this case. Newer HD technology may offer better filtration than previously available.

Keywords: Neurotoxicity, Hemodialysis, Valacyclovir

160. "Freedom" by intentional ingestion of batteries: A case report

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Background: Intentional foreign body (FB) ingestions are frequently reported to poison centers. Often, patients have repeated ingestions and underlying psychiatric illness. Inmates are especially known to ingest FBs to manipulate the system. We describe one of the largest ingestions of batteries by a prisoner reported to date.

Case Report: A 27-year-old incarcerated male with a history of cutting, poly-substance abuse, bipolar disease and previous ingestion of one AA battery presented to the emergency department (ED) with abdominal pain. He had been seen 7 days earlier, after swallowing 30 intact AA batteries (with labels removed). He admits ingesting them to avoid spending New Year's in prison. The first visit revealed a gastric mass on x-ray suggestive of 20–30 batteries without evidence of perforation or esophageal obstruction. He was discharged on polyethylene glycol and reportedly passed 3 batteries. Due to abdominal pain, vomiting, malaise, hematemesis and melena, he returned to the ED. The patient was well appearing, mildly hypovolemic with epigastric tenderness. He had mild leukocytosis and a normal chem-7 panel. A CT scan of his abdomen and pelvis revealed a battery mass in the distal stomach without signs of perforation or obstruction. Surgical, GI and toxicology consults were obtained and he was scheduled for an endoscopy. Twenty-five foul-smelling alkaline non-vented AA batteries with varying degrees of corrosion were removed via a snare device after the mass was manually separated. Several had damage to the outer shell. The gastric mucosa was blackish-silver in appearance with gastric ulcerations noted. The type of battery ingested contained potassium hydroxide, zinc, manganese and iron. His 24-hour urine mercury and arsenic levels and blood lead level were all within normal limits. The patient had an unremarkable recovery and was discharged on day 3.

Case Discussion: Management of FB ingestion varies, depending on object type, anatomical location and time elapsed from ingestion. Literature suggests removal of gastric FBs if their size is $>$6–8 cm. Household cylindrical batteries usually pose a low threat. This patient had moderate morbidity after ingesting batteries retained in the stomach for one week. Prompt intervention may have prevented some of his clinical effects, hypothesized due to the sheer mass and physical pressure of the battery bezoar.

Conclusion: This report of a massive battery ingestion suggests that a more aggressive collaborative approach is needed for large quantity FB ingestions. Prison staff as well as ED personnel should be educated on the importance of timely diagnosis and treatment. Preventing access to FB by at-risk patients is by far the best strategy.

Keywords: Foreign body, Ingestion, Battery

161. Utility of ultrathin transnasal esophagogastroduodenoscopy for poisoned patients

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Background: The presence of residual toxic stomach contents after an acute oral overdose is often unclear in the clinical setting. The efficacy of gastric lavage in such situations has been investigated, but many of the details regarding the presence of residual stomach contents on admission remain unclear. Ultrathin transnasal esophagogastroduodenoscopy (EGD) with a 4.9-mm diameter endoscope has been used increasingly in recent years for screening. EGD can be used without sedation and poses no risk to the airways. The present study investigated the utility of EGD for poisoned patients.

Methods: Informed consent was obtained after participants received details regarding the study objective. The patients received routine emergency treatment. After respiratory and circulatory stabilization, EGD was performed by emergency physicians. Nasal anesthesia was achieved by inserting a catheter coated with 2% lidocaine and 1:5,000 epinephrine gel into the nose for 5 min. The patient was placed on the left side, and the endoscope (lubricated with 2% lidocaine gel) was slowly advanced transnasally. Endoscopy results on admission were recorded for each patient.

Results: All patients were evaluated on admission. Twenty patients were enrolled in the study. The status of residual toxic substances in the stomach was evaluated in drug overdose situations ($n = 18$) and liquid poisoning by insecticide ($n = 1$). Evaluation of the esophageal and stomach mucosae by alkali agents was performed in 1 case. Of the 20 patients, two underwent successful gastric lavage under direct observation. No patients exhibited contraindications for endoscopy, such as aspiration, hypoxia, or oropharyngeal or gastric trauma.

Conclusions: Transnasal esophagogastroduodenoscopy was useful for poisoned patients.

Keywords: Overdose, Decontamination, Medical toxicology

162. A retrospective review of the prehospital use of activated charcoal

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Background: Activated charcoal (AC) is the preferred method of decontamination when indicated for a variety of intoxicants. Its efficacy is often limited by the timing of administration, with

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declining efficacy the more time has elapsed since the overdose. For this reason, some regions will attempt to administer prehospital AC to more rapidly begin the decontamination process. A concern with this therapy is the occurrence of side effects such as vomiting during transport, but incorrect patient selection is also possible.
Methods: We reviewed our city's use of prehospital AC to assess its safety and to determine its pattern of use by medics. Our city's protocol for the administration of AC includes ingestion of a substance potentially bound by AC with a cooperative patient whose gag reflex is intact. County prehospital protocol allows administration of 50 grams of AC by standing order or in consultation with our poison control center or a base hospital. We retrospectively reviewed our city's prehospital records between May 1, 2010 and December 31, 2012. Records were identified of overdose cases where prehospital AC was administered. Each case was assessed for amount and type of intoxicant ingested, clinical findings on arrival of medics, time of administration of AC, timing of transport and arrival into the emergency department (ED), and complications during transport. "Complications" were defined as decline in blood pressure (<90 systolic), decline in oxygen saturation ($<90\%$) or declining mental status (unarousable or GCS <11) after patients received AC, or presence of emesis after administration of AC.
Results: A total of 441 cases were identified where AC was given and incidence of complications was able to be assessed. 281 cases had complete information regarding timing of ingestion, AC administration and transport. The 3 most common intoxicants to receive AC were benzodiazepines (127), antidepressants (97), and NSAIDs (95). Many of these were combination ingestions. Only one case involved the pure ingestion of an intoxicant that would have fallen out of the city's standing protocol (lithium). Complications included: emesis in 29 cases (7%), declining mental status in 20 cases (4%), 2 patients who developed declining blood pressure (0.4%) and 2 patients whose oxygen saturation declined after AC (0.4%). There was one case where medic documentation of suctioning AC suggested aspiration. For cases where timing of AC could be evaluated, an average of 29 minutes (range 10–53 minutes) was documented from paramedic arrival on scene to arrival in the ED.
Conclusions: The prehospital use of AC by our paramedics is generally safe and does not appear to markedly delay transport or arrival of overdose patients into the ED.
Keywords: Decontamination, Intoxication, Overdose

163. Recommendations from North American poison control centers on strategies for reversal of life-threatening bleeding secondary to target specific oral anticoagulants

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Background: The management of life-threatening bleeding secondary to target specific oral anticoagulants (TSOACs) is complex due to the lack of antidotes and insufficient data supporting the efficacy and safety of hemostatic agents such as prothrombin complex concentrates and fresh frozen plasma. In addition, there are no guidelines that provide recommendations for a standardized approach for managing TSOAC-related hemorrhage. The objective of this cross-sectional study was to assess the how poison control centers (PCCs) across North America are incorporating treatment strategies into their recommendations for the reversal of life-threatening bleeding secondary to TSOACs.
Methods: An electronic survey was distributed to directors of PCCs across the United States and Canada. The survey tool was aimed to assess practice patterns and recommendations from PCCs regarding hemostatic agents and other adjunct therapies for the reversal of life-threatening bleeding secondary to TSOACs. The survey instrument included four clinical scenarios of life-threatening bleeding (dabigatran-associated bleeding in the settings of both normal renal function and acute kidney injury, and rivaroxaban- and apixaban-associated bleeding) to assess PCC recommendations. Responses were analyzed using descriptive statistics.
Results: Of the 14 responses (response rate = 22.2%), 4 PCCs (29%) indicated that a protocol existed for the reversal of life-threatening bleeding secondary to TSOACs; specific algorithms were in place for dabigatran (3, 75%), rivaroxaban (4, 100%), and apixaban (2, 50%). The majority of respondents recommended four-factor prothrombin complex concentrate as a potential agent for reversal of life-threatening bleeding secondary to rivaroxaban (10, 71%), apixaban (9, 64%), dabigatran with concomitant acute kidney injury (6, 43%), and dabigatran in the setting of normal renal function (5, 36%); a dose of 50 units/kg was generally recommended. Although fresh frozen plasma was recommended by one-half of all respondents for rivaroxaban-associated life-threatening bleeding, only 36% recommended it for the remaining three clinical scenarios. In the scenario related to dabigatran-induced life-threatening bleeding in the setting of acute kidney injury, 7 (50%) of all respondents recommended hemodialysis as a mode of therapy.
Conclusions: Recommendations from PCCs regarding the management of patients with life-threatening bleeding secondary to TSOACs are widely variable. Standardized protocols should be developed to guide clinicians in managing patients in the emergent setting.
Keywords: Anticoagulant, Life-threatening hemorrhage, Poison center

164. Hypoxia and dyspnea immediately following unintentional rapid infusion of IFE

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Background: Intravenous fat emulsion (IFE) has been successfully used in resuscitation of poisoned patients. Based on encouraging animal data and human case reports, use of IFE for poisoned patients in extremis has increased. Subsequent reports of complications associated with IFE toxicity have followed. Exact mechanisms of potential toxicity from IFE have not been elucidated, though sudden loss of oxygen carrying capacity with a rapid IFE infusion is plausible. We present a case where IFE was rapidly given due to a medical error followed by hypoxia and tachycardia.
Case Report: A 51-year-old female with a PMH of hypertension, alcoholism, depression, and obstructive sleep apnea was hospitalized for diverticulitis complicated by abscess, colo-vesical fistula, and urinary tract infection. She received 250ml of 20% IFE (50g) over about 2 hours (2.6 mL/kg) instead of the intended 24 hours

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to accompany a total parenteral nutrition regimen. Approximately 3 hours following the IFE infusion, the patient became dyspneic. Her pulse oximetry readings decreased from 98% to 86%, heart rate increased from 80 to 154 bpm, and blood pressure decreased from 104/56 mmHg to 94/56 mmHg. Respiratory rate remained unchanged at 18 breaths per minute. After consultation with Medical Toxicology, the care team chose to provide oxygen via nasal cannula and monitor volume status carefully. The patient's dyspnea and vital signs normalized within 1 hour after onset. Oxygen saturation improved to 94% with 2 L of oxygen over 30 minutes. Baseline chest film the day prior indicated minimal blunting of right lung base and repeat chest film obtained 1.5 hours after onset of hypoxia was negative for pulmonary infiltrates suggesting no concern for pulmonary edema. All labs were unremarkable including serial troponins, hemoglobin, electrolytes, lipase (12.9 IU/L), and EKG.

Case Discussion: Rapid infusions of IFE have the potential to induce fat overload syndrome, characterized by sudden elevations in serum triglycerides, dyspnea, fever, respiratory distress, hepatic function and coagulation disturbances, seizures, and coma. Our patient experienced hypoxia and tachycardia in strong temporal association with rapid administration of IFE, consistent with fat overload syndrome. As poisoned patients receiving IFE are typically already in extremis, providers who choose this therapy should be prepared for sudden hypoxia and associated complications that may result including impaired perfusion, dysrhythmias, and cardiac arrest.

Conclusions: We report a case of transient hypoxia associated with rapid IFE administration due to medical error. Clinicians using bolus doses of IFE should be prepared for hypoxia and related complications.

Keywords: Medication Error, Medical toxicology, Intravenous Fat Emulsion

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165. Safe and effective use of low dose flumazenil

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Objective: Flumazenil is a competitive benzodiazepine (BZD) antagonist indicated for reversal of BZD activity or overdose. Due to safety concerns of reversal, use in poisoned patients is limited. Objective was to evaluate flumazenil use in a cohort of patients treated by a toxicology service.

Methods: Retrospective review of patients treated with flumazenil by toxicology service at a large academic medical center between 1/2011–4/2014. Flumazenil was administered in consultation with a single medical toxicologist. Data includes demographics, exposure and medical history, urine drug screen, symptoms, and details of flumazenil administration (response, adverse effects, intubation, and disposition).

Results: A total of 33 unique patients received flumazenil. BZD ingested included 10 clonazepam (30%), 5 zolpidem (15%), 4 alprazolam (12%), 2 diazepam (6%), 1 chlordiazepoxide (3%), 1 midazolam (3%), and 4 unknown (12%). Two cases involved multiple BZD. Co-ingestions included 21 cases of other sedatives (64%), 6 cases of eleptogenic drugs (18%), and 10 cases without co-ingestions (30%). Chronic BZD use was documented by medication reconciliation in 19 patients (58%). There were no patients with seizure disorder. Most common initial flumazenil doses were 0.1 mg in 17 patients (52%) and 0.05 mg in 11 patients (33%); mean initial dose was 0.1 mg (median 0.1 mg). Average total initial incremental dose was 0.2 mg (median 0.15 mg). Reversal was apparent in 23 patients (70%) with 3 (9%) partial responses. Five patients (15%) required repeat doses and 2 (6%) received continuous infusion. Initial symptoms included coma in 30 patients (91%), respiratory depression in 14 (42%), and respiratory failure in 10 (30%). Intubation was performed in 4 patients not responding to flumazenil; all of them had co-ingested other sedatives. Serious adverse effects were not reported. Urine drug screens obtained in 22 patients had 10 (45%) positive for BZD. Disposition included 19 patients to hospital floor (58%), 11 to ICU (33%), 2 patients to psychiatry (6%), and 1 patient discharged home (3%).

Conclusion: Although flumazenil is frequently avoided due to concern for adverse effects, we report use in a cohort of 33 patients without any serious adverse effects. Recommended doses for benzodiazepine overdose include starting at 0.2 mg with titration to 0.5 mg doses that can be repeated not to exceed 3 mg total. Doses used in this cohort frequently started at 0.05–0.1 mg; the total initial dose did not exceed 0.5 mg for any patient. Urine drug testing for the presence of benzodiazepines was unreliable. Potential benefits for flumazenil may include confirming diagnosis, avoiding intubation, avoiding brain imaging, and utilization of lower level of care.

Keywords: Benzodiazepine, Flumazenil, Overdose

166. Massive lacosamide overdose treated with continuous renal replacement therapy

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Background: Lacosamide is a sodium channel blocking agent which has been used as an adjunctive medication for refractory seizures since its FDA approval in 2008. Very little information about overdose exists. Death has been reported within 14 hours of a 7 gram lacosamide ingestion. Here we describe a 10 gram lacosamide overdose resulting in QRS widening, hemodynamic instability, and coma successfully treated with sodium bicarbonate and continuous renal replacement therapy (CRRT).

Case Report: A 17 year-old woman with a severe seizure disorder managed with lacosamide, valproate, and lamotrigine developed seizures 45 minutes after ingesting 10 grams of her own lacosamide. On presentation to the ED, the seizure had resolved, but she was noted to be hypoxic, hypotensive (60/30), with a severe metabolic acidosis (pH 6.7) and wide QRS (140ms.)

Case Discussion: On arrival to the ED, the patient was intubated and started on pressors. The poison center was contacted for further recommendations. Sodium bicarbonate infusion was started, resulting in a narrowing of her QRS interval to 98 msec. Her blood pressure improved, but she continued to require pressors, and remained in a coma with a GCS of 3. Given the severity of the overdose, the low volume of distribution, and low protein binding of lacosamide, CRRT was then recommended. Hemodialysis has previously been used successfully in lacosamide overdose during clinical trials, on a patient with end stage renal disease already undergoing chronic dialysis.

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She showed significant hemodynamic and neurologic improvement after 12 hours of CRRT, and returned to baseline the following day. Upon further questioning, she admitted to taking the lacosamide but denied any other ingestion. Her initial serum valproate level was low (32mcg/mL) and lamotrigine was therapeutic (5.6mcg/mL.) A lacosamide level was not obtained.
Conclusion: Lacosamide is a novel antiepileptic with sodium-channel blocking properties. Acute toxicity can manifest with neurologic as well as hemodynamic effects, including widening of the QRS interval, which appears to respond to sodium bicarbonate therapy. In view of this drug's low volume of distribution and low protein binding, CRRT appears to be effective in enhancing the elimination of lacosamide in the case of severe intoxication.
Keywords: Anticonvulsant, Hemodialysis, Cardiac toxicity

167. Analysis of gastric lavage reported to a statewide poison control system

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Background: Gastric lavage (GL) has become less commonly advocated at the same time that poisoning trends have evolved. We sought to evaluate the clinical indications, outcomes, and complications associated with this procedure as reported to a statewide poison control system.
Methods: A retrospective review of a statewide poison control system's electronic database was performed on exposures reported from January 1, 2009- December 31, 2012. Anonymized data collected were: demographic and clinical details, specific substances ingested, results and complications of GL, therapies used, and zip code of the treating institution.
Results: A total of 923 cases from 281 zip codes were identified after 20 cases were excluded due to miscoding or unclear documentation. Ages ranged from 9 months to 88 years, with 26 patients aged less than 8 years. There were 381 (41%) single substance ingestions and 540 (59%) multiple substance ingestions. GL procedures were performed without PCC recommendation in 536 cases (58%), while 387 procedures (42%) were PCC-recommended. Pill fragments were reportedly returned in 248 (27%) cases. There were 20 complications including aspiration, vomiting, esophageal bleeding, and seizures or mental status deterioration during the procedure. There were 5 deaths, all following multiple ingestions. Among survivors, 36.7% were treated and released from the emergency department, 13.3% were admitted to a non-critical care unit, and 47.6% were admitted to intensive care units. The most commonly ingested substances included non-TCA psychotropic agents (313 cases), benzodiazepines (233 cases), acetaminophen (191 cases), NSAIDS (107 cases), diphenhydramine (70 cases), tricyclic antidepressants (45 cases), aspirin (45 cases), lithium (36 cases), and antifreeze (10 cases). One hundred ninety five (21%) cases were reported from only 16 zip codes (6%), which were broadly distributed in location and population density.
Discussion: In this series, gastric lavage was done without PCC recommendations in a majority (58%) of cases. The procedure resulted in retrieval of pill fragments in few (27%) cases, and procedural complications were reported with 2% of cases. Substances ingested reflect a broad spectrum of potential hazards, some of which have alternative effective treatments (e.g. acetaminophen). A large number of cases originated from a small number of zip codes, reflecting that hospital-specific overuse of this modality may be occurring in select areas.
Conclusions: Gastric lavage continues to be done with and without poison center recommendations. Toxicologists and emergency clinicians need to stress appropriate selection of patients when recommending or teaching this procedure.
Keywords: Decontamination, gastric lavage, Epidemiology

168. Repeated massive ingestion of verapamil with early endoscopic removal

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Background: Massive calcium channel blocker (CCB) overdoses can be life-threatening; delayed absorption can result in significant duration of toxicity. We present a case series of the same individual who ingested lethal doses of verapamil twice and was treated with late and early endoscopic intervention.
Case Report: A 40 year old male came to the emergency room (ER) 40 minutes after ingesting 12g of sustained-release (SR) verapamil. Vital signs showed: BP 87/53, HR 88, RR 28, T 36.4°C, O_2 saturation 94% on room air, blood glucose 297. He was alert, oriented, and complained of abdominal pain. Activated charcoal, IV fluids, and calcium gluconate were given. 1 hour after presentation his BP and HR fell to 47/26 and 44; atropine, calcium chloride, 100mcg phenylephrine, 20% lipid emulsion (1.5mg/kg), and a norepinephrine infusion were administered. He was admitted to the intensive care unit (ICU), and intubated for gastric decontamination; this was aborted due to ileus and hypotension despite infusion of 4 vasopressors. Hyperinsulinemia-euglycemia (HIE) was started (70U/hour); 30 hours post-presentation, his serum verapamil level was 2,390 ng/mL (therapeutic: 20–300 ng/mL). He underwent endoscopy; charcoal and 6 undigested pills were removed from the stomach. HIE was weaned over 48 hours; pressors were required for 4 days. His course was complicated by pulmonary embolus and ileus; he was discharged 8 days after presentation. Verapamil levels peaked at 3,150 ng/mL 46 hours after arrival.

3 months later, he returned to the ER after ingesting ~14.5g of SR verapamil. He was hypotensive and bradycardic despite IV fluids, calcium gluconate, epinephrine and norepinephrine infusions, and HIE. He was intubated, admitted to the ICU and started on a lipid infusion. Within 6 hours of presentation 30 partially-digested pills were removed endoscopically. Vasopressors were weaned over 48 hours. His course was complicated by an arterial thrombus with ischemia of the right hand and renal failure requiring renal replacement therapy. He was discharged from the hospital on day

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14; verapamil levels were 700ng/mL on presentation; peak was 1,100 (7 hours after arrival).

Serum verapamil levels were measured using liquid-chromatography quadrupole time of flight mass spectrometry (AB Sciex TripleTOF® 5600).

Case Discussion: CCB overdoses can be life-threatening, and require immediate intervention. In this case series, peak verapamil levels, time to peak, and duration of pressor requirement were lower with earlier endoscopy.

Conclusions: We report the first documented case of serum level reduction and decreased duration of clinical symptoms associated with early endoscopic removal of verapamil in a massive overdose.

Keywords: Calcium channel blocker, Enhanced elimination, Intoxication

169. Cardiac arrest secondary to flecainide toxicity successfully treated with intravenous lipid emulsion

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Background: Flecainide is a class IC anti-arrhythmic agent indicated in patients with structural heart disease for the prevention of atrial and ventricular dysrhythmias. The primary mechanism is blockade at the cardiac Nav1.5 sodium channels and prolongation of phase 0 of the myocardial action potential. After overdose, this can result in a significant widening of the ECG QRS interval. Flecainide has a large volume of distribution (Vd) of 5.5–10L/kg. Intralipid emulsion (ILE) has been used successfully to treat toxicity from a multitude of pharmaceuticals with large volumes of distribution.

Case Report: A 49 year old man with history of alcohol abuse, hypertension, and atrial fibrillation presented to the emergency department (ED) unresponsive and bradycardic with a heart rate of 31 bpm. Initially, EMS reported a potential metoprolol ingestion based on inconclusive history at the scene. In the ED, he received atropine 0.5 mg IV and Glucagon 1mg IV but deteriorated to asystole. After CPR, intubation and epinephrine 1 mg IV he had a return of spontaneous circulation with a HR 45 bpm. Severe hypotension persisted (systolic BP as low as 50 mmHg) and dopamine was started at 10mcg/kg/min (increased to 25 mcg/kg/min) and magnesium 2 grams IV was administered. ECG demonstrated a HR 64, QRS 178 ms and QTc 367 ms. His wife arrived at the ED with an empty bottle of flecainide and denied the use of metropolol. A bolus of NaHCO3 3 amps (150 mEq) was given and NaHCO3 infusion was started (37.5 mEq/hr). Despite these treatments, the patient remained hypotensive with a wide QRS interval. At this point, ILE therapy was initiated; a 20% ILE 1.5mL/kg bolus was given followed by an infusion at 0.25ml/kg/hr. After treatment was started, SBP stabilized at ~ 85–100 mmHg and repeat ECG demonstrated a narrowing of the QRS to 147 ms. After a two hour infusion of ILE was complete, the SBP increased to 124–144mmHg and HR to 105–120 bpm. Dopamine was weaned and NaHCO3 was discontinued after ~ 12 hrs and QRS interval remained $<$ 100 ms.

Case Discussion: Flecainide is a potent anti-arrhythmic agent with high mortality in overdose. Although there is no specific antidote, NaHCO3 has traditionally been the treatment of choice for sodium channel blocker toxicity with widened QRS. A few case reports describe successful treatment of Flecainide with ILE but none had cardiac arrest. The mechanism of ILE is not completely understood, but its binding properties allow lipophilic substances to be drawn in forming a 'lipid sink'.

Conclusion: ILE improved severe flecainide toxicity with cardiac arrest that was unresponsive to conventional therapy and should be considered as a first-line treatment along with NaHCO3, magnesium, and vasopressors.

Keywords: Lipid therapy, Cardiac toxicity, Cardiac Arrest

170. Thrombophlebitis associated with concentrated fomepizole administration

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Background: Fomepizole (4MP) has become the antidote of choice in the treatment of methanol and ethylene glycol ingestions. Adverse drug events due to 4MP are infrequently reported. We present a case of significant superficial thrombophlebitis related to misadministration of 4MP.

Case Report: A 14 year old male presented 3 hours after ingesting approximately 12 oz of ethylene glycol (EG) antifreeze. He had a PMH of depression and asthma. His medications were aripiprazole and albuterol. He had no history of previous drug reactions or sensitivities. His vital signs and physical exam were normal. Initial pertinent labs were: venous pH 7.36, Na 145, K 3.7, Cl 104, CO2 23, BUN 11, Cr 0.8, glucose 102, ETOH $<$ 5 mg/dL, methanol $<$ 5 mg/dL, and EG 196 mg/dL. 1000mg (15mg/kg) of 4MP was diluted in 100mL of normal saline and administered IV over 30 min through a left AC fossa. The IV flushed well prior to administration and he tolerated the initial dose without incident. He was admitted for laboratory monitoring and 4MP treatment. The patient received his second and third doses of 4MP (10mg/kg) approximately 12 and 24 hours, respectively, after the initial dose. Both of these doses were administered undiluted over 30 minutes. Following both doses, he complained of pain in his arm. Within 24 hours of receiving the second dose, erythema developed that was localized to the AC fossa. The medication administration error was identified following the third dose. His laboratory studies remained normal without acidosis and his EG level was 17 mg/dL after the fourth (correctly diluted) 4MP dose (approx 48 hours post-ingestion). An ultrasound demonstrated a clot in a superficial branch of the brachial vein. He was treated symptomatically and transferred to a psychiatric facility. He was readmitted approximately 36 hours after his second 4MP dose with progressive erythema, swelling, and pain to the L arm (Figure). WBC and CRP were normal. A repeat arm US was unchanged. He was started on clindamycin for possible cellulitis although it was thought to be chemically-induced phlebitis from 4MP. Supportive care included warm compresses and pain medications. Symptoms improved over 48 hours

Case Discussion: Reported adverse effects of 4MP include: headache, nausea, dizziness, and elevated liver enzymes. There are no reports of concentrated 4MP-induced thrombophlebitis in the medical literature. According to the package insert phlebitis developed in 2 of 6 volunteers that received concentrated 4MP over 5 min. Our patient received concentrated 4MP over 30 min. Treatment is supportive.

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Conclusion: Health care providers should be aware that concentrated 4MP administration can cause thrombophlebitis.
Keywords: Fomepizole, Thrombophlebitis, Adverse drug event

171. Crofab® use during 2nd trimester of pregnancy

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Background: Rattlesnake envenomation in pregnancy is rare and associated with great maternal and fetal risk, with the highest risk being in the early stages of pregnancy. This case report is the second of its kind to describe the use of crotalidae polyvalent immune fab (ovine) (Crofab®) following a rattlesnake bite in a pregnant patient and the first described use during the second trimester of pregnancy.
Case Report: A 25 year old, 22 week pregnant female presented to a Southern California Coastal emergency department an hour after being bit on the right foot by a rattlesnake. She presented with swelling of the foot and to 6 cm above the ankle. She complained of pain, perioral numbness and a metallic taste. She was given 6 vials of CroFab®. Her initial laboratory values were: hematocrit = 41.2, platelets = 190K, INR = 0.94, fibrinogen = 344. Fetal monitoring showed no distress. She had regression of swelling. Her pain was controlled with hydromorphone then hydrocodone and acetaminophen. The patient and fetus did well over the next two days and were discharged on hospital day 3. She was discharged in stable condition with normal laboratory values. She was scheduled to have repeat CBC, fibrinogen and INR as an outpatient and follow-up by her obstetrician.
Case Discussion: Snakebites in pregnancy are associated with high fetal demise (43%) and a high maternal mortality rate (10%), however the standard of snakebite treatment in North America is not without risks to the mother and fetus. Crofab® which has become the standard treatment since its availability in 2001 has been associated with hypersensitivity reactions and in rare cases anaphylaxis. This antivenin also contains 30ug of mercury per vial in the form of ethyl mercury, which has been shown in large exposures to cause neurodevelopmental disorders in the fetus. Even with these risks, Crofab® has been used during pregnancy. In a study characterizing venomous snake exposures reported to poison control centers from 2001–2005, of the 25% of rattlesnake exposures, 0.1% of these cases were pregnant and 100% of them received treatment with Crofab®. However, the stage of pregnancy and fetal outcomes were not documented. Positive fetal outcomes after Crofab® use were documented in two cases reports, one of a rattlesnake and one of a copperhead envenomation, both of which occurred in the third trimester. To date rattlesnake envenomation in the first two trimesters of pregnancy and the use of Crofab® have not been described in the current literature.
Conclusion: In this case Crofab® was an effective treatment in preserving the health and wellness of both mother and child during the second trimester of pregnancy
Keywords: Rattlesnake, Pregnancy, crotalidae polyvalent immune fab

172. No adverse drug events from flumazenil: an emergency department observational study

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Background: Flumazenil is an effective benzodiazepine (BZD) antagonist. Empiric use of flumazenil in the emergency department (ED) is not widely recommended due to concerns of seizures, which are commonly associated with co-ingestants. A 7 year retrospective review of flumazenil use in the ED at a single tertiary academic medical center was performed to assess adverse events and clinical outcomes.
Methods: Cases of flumazenil use in the ED from 2007–2013 were retrospectively identified from ED electronic medical records. Patients were included if they were 18–90 years old, had a history of BZD ingestion or received BZD in the ED, and flumazenil was administered. Data were collected by two independent reviewers, reconciled, and included type of BZD overdose (acute, acute on chronic, unknown), co-ingestants, mental status, vital signs (heart rate [HR], blood pressure [BP], respiratory rate [RR] and oxygen requirements both pre and post flumazenil, flumazenil dose), intubation status and presence of seizure activity. Of 49 patients identified, 26 were excluded due to incarceration and incomplete records. Complete data was available for 23 patients, all of whom were included in the analysis.
Results: Of the 23 patients, 11 (48%) were male with a mean age of 43 years (range 19 to 86, SD 18.5). The ingestion of BZD was acute in 15 (65%), acute-on-chronic in 4 (17%) and unknown in 4 (17%) cases. In 12 of the 15 (80%) acute cases, BZDs were administered in the ED to treat agitation. Twenty of 23 (87%) patients ingested multiple substances. Eight of 20 (40%) patients ingested substances that could induce seizures. The initial dose of flumazenil was 0.2 mg in 21 (91%) patients and 0.1 mg and 0.4 mg in 2 other patients. Eleven of the 23 (48%) patients received a second dose of flumazenil. Flumazenil was only administered intravenously, with an average total dose of 0.35 mg (range 0.1 to 1, SD 0.2). There were no significant differences in HR, BP, or RR in patients when comparing pre and post flumazenil vital signs. There were no cases of seizure; one patient was intubated and subsequently extubated in the ED.
Conclusion: Flumazenil is occasionally administered by ED physicians in both acute and acute- on-chronic BZD overdoses. The majority of patients in this study received greater than 0.2 mg flumazenil, which is the maximum dose often recommended in the literature. Overall, flumazenil had minimal effect on HR, BP, and RR and was not associated with seizures in any patient. Further elucidation of ED flumazenil use and adverse drug events in suspected BZD overdoses are warranted.
Keywords: Flumazenil, Benzodiazepine, Seizure

173. Endoscopic removal of K-DUR (sustained release potassium chloride) tablets after overdose

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Background: Multiple previous reports of overdose from sustained-release potassium chloride exist. Despite aggressive treatment with gastric lavage and whole bowel irrigation, significant toxicity, including fatalities, have been reported, with peak serum potassium up to 9.7 mmol/L**.** Here we present a case of esophagogastroduodenoscopy (EGD) for removal of K-DUR tablets using basket extraction.
Case Report: A 50-year-old female presented to the Emergency Department after reportedly ingesting 80 pills of 600 mg K-DUR tablets. Labs were significant for serum potassium of 7.2 mmol/L, which was treated with insulin, dextrose, nebulized albuterol, calcium gluconate, and sodium polystyrene sulfonate. An abdominal x-ray visualized multiple pills measuring 11 mm in diameter in the stomach fundus. There was concern that gastric lavage would have been inefficient in removal of the tablets due to their size. The Gastroenterology service was consulted and performed an EGD during which 25–30 pills were removed nearly 7 hours post-ingestion. The patient had been intubated prior to EGD, and whole bowel irrigation was commenced afterwards. Her serum potassium never increased beyond its initial value and normalized over the next 24 hours.
Case Discussion: We present a case of a potentially fatal K-DUR ingestion treated with EGD. A previous report exists for the use of EGD for removal of K-DUR slurry from the stomach using dry suction after intentional overdose, but this is the first report of endoscopic removal of intact pills. Multiple previous reports exist for the use of EGD in the overdose setting but guidelines do not exist for its recommended use. EGD should be considered in overdose cases that may lead to critical illness. Further research in the potential use of EGD in the overdose setting warranted.
Conclusion: In this case of massive ingestion of K-DUR tablets, EGD proved efficacious in removing large amounts of drug and likely ameliorated toxicity.
Keywords: Decontamination, Overdose, Ingestion

174. Inappropriate fomepizole administration results in unnecessary cost, easily avoidable

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Intro: Toxicologists are frequently consulted on patients with potential toxic alcohol ingestions. Fomepizole (4-MP) is often administered empirically in the setting of clinical or laboratory suspicion of toxic alcohol ingestion until such ingestion can be excluded. Our institution utilizes an offsite laboratory for toxic alcohol analysis which often results in time delays. While results are pending, the patient receives scheduled 4-MP doses until the toxic alcohol level is shown to be $<$ 20 mg/dL. This review sought to quantify lab turnaround time and assess its impact on 4-MP administration at our institution.
Methods: This was a retrospective, observational evaluation at a large urban hospital. Patients were identified by an electronic medical record search for all 4-MP orders between 3/1/2011 and 4/30/2013. Data regarding toxic alcohol values, 4-MP orders, and 4-MP administration were collected.
Results: 36 patients had one or more order for 4-MP. Of these, the median time to lab result was 11 hours, 46 minutes. A total of 75 4-MP doses were administered. 23 of 36 patients (64%) received one dose, 11 (31%) received two or more doses, and 2 (5%) had an order for 4-MP placed, but never received a dose. Of 11 patients who received two or more doses, six had no detectable toxic alcohol on their first sample, and two of these received an additional dose due to lab delay $>$ 12 hours. Eight doses were administered to patients after a subtoxic result was reported.
Discussion: A typical 4-MP regimen includes a loading dose followed by a standing maintenance dose every 12 hours. In two cases, a subtoxic alcohol level was not reported for $>$ 12 hours and resulted in the patients receiving an additional dose. In eight patients, a subtoxic level was reported within 12 hours, but 4-MP was not discontinued in a timely manner resulting in the administration of unnecessary doses. We have identified strategies that may reduce the administration of unnecessary 4-MP doses. One strategy is to require the laboratory to report all toxic alcohol levels to the toxicology team, allowing for timely intervention. Another option is to require the hospital pharmacist to review toxic alcohol values before dispensing each 4-MP dose. Another strategy would be to flag all toxic alcohol levels in the electronic medical record as "critical levels", requiring immediate attention from a covering physician.
Conclusions: EG analysis at our institution was prolonged, averaging $>$ 11 hours. 10.6% of all 4-MP doses were administered to patients whose level had already been reported to be subtoxic. At over $1000 per vial, inappropriate 4-MP use contributes cost burden at no benefit to the patient. Strategies to control the use of 4-MP need to be implemented.
Keywords: Fomepizole, Alcohol, Quality Improvement

175. Characterizing flumazenil use through utilization of a toxicology registry

J Laes

Background: Use of flumazenil as an antidote for benzodiazepine poisoning is infrequent, possibly as a result of literature advising caution in several clinical scenarios: presence of hypoxia, airway compromise, severe hypotension, significant arrhythmias, seizure disorder, cardiac signs of tricyclic poisoning, co-ingestion of seizurogenic xenobiotics or when ingested poisons are unknown. Few studies describe the current practice of flumazenil use in medical toxicology and none identify whether recommended precautions in the literature guide management. Using the Toxicology Investigators Consortium (ToxIC) Case Registry, we aimed to describe characteristics of poisoned patients who received flumazenil in the setting of medical toxicology consultation.
Methods: A retrospective search of the Toxicology Investigators Consortium (ToxIC) Registry was performed to characterize all patients consulted by a medical toxicologist who received flumazenil as an antidote during the period of January 1, 2010 to April 9, 2014. Demographic and clinical parameters were collected and analyzed.
Results: Of the 28,702 patients registered to the ToxIC database, we identified 610 cases in which flumazenil was administered. The majority of cases (91.6%) occurred in adults $>$ 18 years and approximately half were men. The reason of exposure was typically "intentional" or related to "drug abuse" (77.5%). The most

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common drug classes identified as agents of exposure were benzodiazepines (71%), followed by opioids (25%), ethanol (17%), and antidepressants (13% non-cyclic, 4% tricyclic). Exposure to multiple agents was documented in 67% of cases. The most frequent vital sign abnormalities were hypotension (23%; 15% of those received vasopressors) and tachycardia (18%). Prolonged QTc > 500ms was documented in 7% of cases while ventricular dysrhythmia and prolonged QRS > 120ms were infrequent (< 1%). Coma was the most frequent nervous system abnormality reported (60%). Seizure was documented in 5% (unknown relation to flumazenil administration). Intubation occurred in 7%. Of other antidotes, naloxone was administered in 35% and physostigmine in 22% of cases. Benzodiazepines were administered as pharmacological support in 15%.

Discussion: Administration of flumazenil occurs infrequently in medical toxicology consultations. Severe hypotension, exposure to tricyclics, and interestingly benzodiazepines as pharmacologic support were present in a proportion of the cases. This study demonstrates the ability to use a nationwide toxicology registry to identify poisoned patients who have received flumazenil and can be used as a tool to conduct further studies on the characteristics of these patients.

Keywords: Flumazenil, Epidemiology, Antidote

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176. Decontamination strategies for poisonings in Nyakibale Hospital Emergency Care Center, Uganda

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Background: Gastric lavage (GL) is a contentious issue in the management of poisoned patients in the Global South. The Global Emergency Care Collaborative and Nyakibale Hospital in Rukungiri opened the first functional emergency care center (EC) in rural Uganda. Emergency care practitioners usually perform GL with patient consent. During the procedure, patients are held upright, and contents are aspirated. Lavage is optional. We investigated decontamination (DC) strategies and outcomes.

Methods: An electronic database started recording charts from 3/24/2012. A search for diagnoses containing "poison", "tox", "overdose", "medication", "exposure" and "suicide" was performed from 3/24/2012–12/30/2013 and 192 charts were found and de-identified. 3 trained reviewers collected data directly from hand-written charts. Excluded charts had diagnoses related to alcohol or non-malicious food poisoning (41% and 4.7%, respectively). Confirmed diagnoses of malaria (1%) or meningitis (0.5%) were also excluded. Data collection included: age, sex, poison and duration, intent, vital signs, physical examination, DC, and follow-up (FU) status.

Results: From 3/24/2012–12/31/2013 a total of 8,755 patients were seen at the EC. Poisoning accounted for 96 patient encounters (PE) (1%). Males accounted for 73 PE, and 38 were ≤ 18 years old. 56 were intentional. 19 were accidental. 24 were lost to FU. Of the 96 PE, 60 were associated with pesticides. Other exposures included: rat poison (9), hydrocarbons (7), medications (4), and smoke inhalation (1). 60 had improved on FU. There were 7 deaths; all but 2 were due to pesticides. There were 9 cases of home DC: milk (4), cow dung (2), water (2) and pineapple juice (1). 35 patients were approached for DC. 20 had GL, 5 had charcoal tablets, 8 had both and 2 refused GL. There were 7 patients who were unable to provide consent but still underwent GL (GCS 3–6). Of these, 2 expired. One presented 6 hours post-ingestion with GCS 3. The other had an unknown ingestion time with GCS 4. The post-GL fatality rate was 7.1%. 60.7% of the GL group was treated with atropine (mean = 5.29 mg, range 0–21 mg). Those who did not undergo DC had a fatality rate of 8.3%; 56.7% of this group received atropine (mean = 7.18 mg, range 0–39 mg).

Conclusions: Pesticides were the main agent used in intentional and accidental poisoning. Our total case fatality rate of 9.7% is similar to other global rates (10–30%). The fatality rate of the DC group was only slightly lower. In resource-limited settings where pesticides are easily accessible, and antidotes and resuscitative capabilities are scarce, GL needs to be further studied.

Keywords: Organophosphate, Decontamination, Epidemiology

177. Management and outcomes of poisoning in Nyakibale Hospital Emergency Care Center, Uganda

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Background: Self-poisoning results in nearly one-third of all suicides worldwide. In Uganda, poisoning has been studied in the capital city, Kampala, however this data is not representative of the rest of the country. The Global Emergency Care Collaborative and Nyakibale Hospital in Rukungiri opened the first functional emergency care center (EC) in rural Uganda. Cow tick poisons (CT), such as Amitraz, are alpha-2 agonists and may not require atropine but are difficult to differentiate from organophosphate exposures. We investigated management and outcomes of poisoned patients presenting to the EC.

Methods: An electronic database started recording charts from 3/24/2012. A search for diagnoses containing "poison", "tox", "overdose", "medication", "exposure" and "suicide" was performed from 3/24/2012–12/30/2013 and 192 charts were found and de-identified. Three trained reviewers collected data directly from hand-written charts. Excluded charts had diagnoses related to alcohol or non-malicious food poisoning (41% and 4.7%, respectively). Confirmed diagnoses of malaria (1%) or meningitis (0.5%) were also excluded. Data collection included: age, sex, poison and duration, intent, vital signs, physical examination, DC, antidote use and follow-up (FU) status.

Results: From 3/24/2012–12/31/2013 a total of 8,755 patients were seen at the EC. Poisoning accounted for 96 patient encounters (PE) (1%). Males accounted for 73 PE, and 38 were ≤ 18 years old. 56 were intentional and 19 were accidental. 24 were lost to FU. Of the 96 PE, 60 were associated with pesticides. Over half were CT and 24 were organophosphate or carbamate exposures

(OCP). Other exposures included: rat poison (9), hydrocarbons (7), medications (4), and smoke inhalation (1). 60 improved on FU. 33 patients underwent DC, 2 expired. 19 had no bradycardia or secretions but were given atropine (2–21mg); 3 of them died. After atropine (5–10mg), 4 had heart rates that increased > 20 beats/minute; 1 continued to receive multiple doses. Two patients had bradycardia and secretions but never received atropine. None of these 6 patients died. Of the 96 PE, there were 7 deaths; 5 were due to pesticides and the rest were due to unknown poisons.

Conclusions: Pesticides were the predominant agent used in intentional and accidental poisoning. Our case fatality rate of 9.7% is similar to other global rates (10–30%). Repeat atropine was used for unknown reasons; this may lead to depletion of an essential antidote in a resource-limited setting. Future directions include a public health program to help limit childhood exposures and an algorithm to aid practitioners in differentiating CT from OCP-poisoned patients.

Keywords: Organophosphate, Antidote, Epidemiology

178. Ten-fold cisplatin dosing error resulting in severe and prolonged multisystem toxicity

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Background: Cisplatin is a commonly used antineoplastic drug with a wide adverse effect profile; however, due to close monitoring, overdose is rarely reported. We present herein a case of repeated dosing errors 10-fold above the therapeutic range and its clinical consequences.

Case Report: This is a review of a poison center chart of a single patient. A 42 year-old man was admitted to the ICU after a cisplatin dosing error was discovered during treatment for testicular cancer. Over the previous three days, the patient had received two doses of cisplatin 400 mg/m2 instead of 40 mg/m2. The patient presented with acute hearing loss, acute kidney injury and acute liver injury. Neuropathy or bone marrow depression was not present. He was treated initially with amifostine, aggressive isotonic fluid hydration, and N-acetylcysteine. Subsequently, he received daily plasmapheresis and hemodialysis. The patient suffered near complete hearing loss. By hospital day (HD) 3, the patient developed severe immunosuppression as evidenced by declining white blood cell (WBC) counts, oropharyngeal candidiasis, and an upper lobe pneumonia. Treatment with daily plasmapheresis and hemodialysis continued, and antibiotics and antifungals were initiated. Epoetin alfa was initiated on HD 4, but substituted with filgrastim due to concerns for worsened outcomes in cancer patients. He was intubated for respiratory failure on HD 5 and remained intubated for nine days. He required multiple platelet and packed red blood cell transfusions for severe thrombocytopenia and anemia. The patient gradually improved but continued to require intermittent hemodialysis. Plasmapheresis continued daily until HD 31. His hearing had not returned at the time of hospital discharge on HD 36.

Discussion: In this patient with repeated10-fold dosing errors, the onset of cisplatin toxicity was both rapid and progress. The duration of effect was prolonged. Cisplatin toxicity may result in significant multisystem toxicity and death, and requires aggressive supportive care. This case represents successful use of plasmapheresis as the primary treatment. Multiple theoretical and experimental therapies are available. With strong evidence lacking their routine use, judicious decision-making based on the administered dose, patient's clinical status, and laboratory aberrations is warranted.

Conclusion: Plasmapheresis has been previously shown to be effective in reducing serum cisplatin levels. Our case report represents 10-fold dosing errors of cisplatin with plasmapheresis being the primary treatment.

Keywords: Cisplatin, Plasmapheresis, Medication error

179. High-flux hemodialysis enhances phenytoin elimination and improves neurological function after oral overdose: A case report

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Background: Phenytoin (PHT) is a commonly prescribed antiepileptic medication. Oral overdose has not demonstrated the well-described cardiotoxic adverse event profile seen with intravenous PHT; although neurotoxic events due to oral overdose are common. Due to high protein binding, clearance of phenytoin and neurotoxicity are generally not thought to improve with hemodialysis. We present a case of oral PHT overdose, leading to altered mental status progressing to coma, in which hemodialysis was utilized as a treatment modality.

Case report: A 51 year-old woman with a history of seizures and anticoagulation with warfarin was found unresponsive in a field for an unknown period of time. She was intubated at the scene by EMS. She was bradycardic and hypotensive, requiring transcutaneous pacing. Upon arrival to the ED, she suffered a cardiac arrest. Spontaneous circulation returned five minutes after initiation of CPR. Vasopressor support was initiated with norepinephrine; the patient was cooled to 36° C. A phenytoin level was 68.33 µg/mL (adjusted). The level rose to 72.97 µg/mL (adjusted) three hours later, which was concerning for acute, rather than chronic toxicity. Serum chemistries revealed a metabolic acidosis and acute kidney injury, with a creatinine of 2.7 mg/dl. Medical toxicology was consulted and recommended hemodialysis for enhanced clearance. On hospital day (HD) two, the patient began continuous hemodialysis until the serum phenytoin level was sub-therapeutic. She was extubated on HD three and transferred out of the ICU on HD eight.

Discussion: Neurotoxicity following oral ingestion of PHT has been well described previously. Toxicity includes coma, seizures, and ataxia. At elevated serum levels, PHT excretion follows zero order kinetics which leads to a prolonged toxic effect. In patients with severe neurotoxicity requiring intubation, hemodialysis may enhance phenytoin elimination and restore normal neurologic function.

Conclusion: Due to alteration in phenytoin elimination at serum concentrations > 10 µg/mL, high-flux hemodialysis may be effective in enhancing phenytoin elimination. Thus, the hospital course and time spent intubated may be abbreviated by restoring normal neurologic function.

Keywords: Phenytoin, Hemodialysis, Anticonvulsant

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180. Outcomes in suspected "missed" acetaminophen overdose

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Background: Acetaminophen (APAP) has a short half-life and may not be detected in some patients with ongoing APAP-induced liver injury demonstrated by rising aminotransferases (ATs). In such "missed APAP overdoses", liver injury may continue to worsen despite undetectable APAP. This study was undertaken to determine the proportion of patients with suspected missed APAP overdose who develop ATs ≥ 1,000 U/L.
Methods: This was a prospective study of suspected overdose patients (age ≥ 12 years) at a single poison center (PC) over a 14 month period to determine how many developed hepatotoxicity (HT), defined as ATs ≥ 1,000. Inclusion criteria were (1) undetectable APAP, (2) aspartate aminotransferase (AST) and/or alanine aminotransferase (ALT) > 100 U/L or above normal range for the health care facility (HCF). During follow up calls, repeat AT values were obtained. HCFs were queried about N-acetylcysteine (NAC) treatment, other causes of abnormal ATs (ethanol abuse, rhabdomyolysis, hypotension), as well as medical outcome. The PC recommended NAC treatment and international normalized ratio (INR) determination for patients with ATs ≥ 100.
Results: Between January 2013 and February 2014, 107 cases met inclusion criteria. ATs ≥ 1000 were reported in 10 (9.3%) cases. AST or ALT reached 1000 in 9 and 8 patients, respectively. Both AST and ALT reached 1000 in 6 patients. Six (5.6%) and 7 (6.5%) presented with AST or ALT ≥ 1000, respectively. Four developed either AST or ALT ≥ 1000 that was not present initially (AST 3, ALT 1). Fifteen had creatine kinase (CK) > 1000 U/L, although most did not have CK levels tested. Among patients with ATs ≥ 1000, only 2 had a peak INR > 1.5 (2.1, 4.1). In one case with ATs ≥ 1000 INR was not obtained, but the patient had a peak CK of 365,229 U/L, suggesting that AT elevation may have been due to rhabdomyolysis. Hypotension and ethanol abuse were non-factors in the cases with ATs ≥ 1000, whereas possible sepsis and recent surgery were suspected in two of the cases with ATs ≥ 1000 at presentation. NAC was given in 36 cases (8/10 with ATs ≥ 1000). There were no fatalities and no patients required liver transplant.
Conclusions: In our population of 107 suspected overdose patients with AT elevation but undetectable APAP, 9.3% had values ≥ 1000 either at presentation or by hospital day 3. Nearly 4% began with mild AT elevation that rose to ≥ 1000. Suspected overdose patients with undetectable APAP and mild AT elevation may benefit from NAC treatment until ATs can be trended, as some will develop significant hepatotoxicity.
Keywords: Acetaminophen (paracetamol), Hepatotoxicity, Overdose

181. Laboratory confirmed massive donepezil ingestion

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Background: As the prevalence of dementia rises, there has been an increase in the use of antidementia agents, such as donepezil. There is a paucity of literature concerning toxicity from donepezil exposures, especially intentional exposures. We describe a case of a massive intentional ingestion of donepezil.
Case Report: A 67 year old male with hypertension and dementia presented to the emergency department one hour after ingesting 290 mg of donepezil in a suicide attempt. No other medications were taken. On presentation, the patient was alert and oriented but diaphoretic and vomiting. No other signs or symptoms of cholinergic excess were noted. His initial heart rate was 82 beats per minute (bpm). He was given 4 mg of intravenous ondansetron and 50 g of activated charcoal. His laboratory workup was normal. Within 90 minutes of his arrival his heart rate had decreased to 59 bpm. His blood pressure was 168/77 mm Hg and his mental status remained unchanged. The lowest heart rate recorded was 50 bpm approximately four hours from presentation. His blood pressure remained elevated throughout. Atropine was considered but never administered. Donepezil levels obtained at presentation and 3.5 hours after presentation were 240 ng/mL and 130 ng/mL, respectively (normal 15–50 ng/mL). The patient was admitted for observation. He had no further episodes of bradycardia. A serum donepezil level 10 days from presentation was 8.9 ng/mL. He was discharged after a 40 day hospital course which was complicated by ileus, delirium and placement issues.
Case Discussion: Alzheimer's disease and other forms of dementia are associated with a decrease in central nervous system synaptic neurons responsible for the release of acetylcholine. Donepezil is a centrally acting, reversible inhibitor of acetylcholinesterase commonly used in the treatment of dementia. There is concern that a donepezil overdose could lead to cholinergic excess and potentially cause bronchorrhea, bradycardia, miosis, diaphoresis, seizures, and neuromuscular weakness. There is little published literature on donepezil overdoses. Most that does exist involve doses of less than 50 mg resulting from therapeutic errors or unintentional ingestions. Our case is remarkable for being the largest known ingestion of donepezil and having a serum level almost 5 times normal. Despite this, he developed only mild bradycardia which responded to supportive care. As with other cases of supratherapeutic donepezil exposures, there was no evidence of concerning signs and symptoms of cholinergic excess.
Conclusion: This case suggests that even after large ingestions with significantly elevated serum levels, donepezil causes only mild symptoms which respond to observation and supportive care.
Keywords: Ingestion, Overdose, Antidementia

182. Magic BBQ? 10 year old with laboratory confirmed psilocin intoxication

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Background: Psilocybin is a potent hallucinogen found in several species of mushrooms. Upon ingestion, it is rapidly metabolized to psilocin. Psilocin binds with high affinity to serotonin receptors

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and produces an altered mental state characterized by hallucinations and synthesias. There is little literature on the effects of psilocybin exposure in young pediatric patients. We report a case of an acutely altered 10 year old boy who was found to have high levels of psilocin in his serum.

Case Report: A 10 year-old boy presented with altered mental status. Per family, he was in his normal state of health prior to going to a barbeque at an apartment complex. Afterwards, he was unable to say his name or walk straight. There was no evidence of trauma. No ingestion was witnessed. His vital signs were within normal limits for his age. His physical exam was significant for mydriasis without nystagmus. He moved all extremities but would not follow commands. No hyperreflexia or clonus was noted. He would not speak but appeared to be hallucinating as he intermittently reached for things in the air and giggled inappropriately. He was given intramuscular ketamine (3mg/kg) to obtain a head CT and labs. They were normal, including a negative urine drug immunoassay screen and serum ethanol level. He was admitted for observation. Within 12 hours he had returned to his baseline mental status and was discharged. His serum from admission was sent for comprehensive screening using liquid chromatography-time-of-flight mass spectrometry (LC-TOF/MS) (Agilent LC 1260- TOF/MS 6230). Psilocin was detected at 45 ng/mL. Metabolites of psilocin, 4-hydroxytryptophol and 4-hydroxyindole-3-acetic acid, and ketamine were also detected. Further investigation could not identify the source of the psilocin. The ketamine result was attributed to his emergency department workup.

Case Discussion: Psilocybin and psilocin were isolated and identified by Albert Hofmann in 1958. Psilocin is the active, primary metabolite of psilocybin. Studies indicate that when taking orally, psilocybin is rapidly and almost completely converted to psilocin. Psilocin has its clinical effects by binding to 5-HT_{2A} and 5-HT_{1A} receptor. Though poorly studied, psilocin levels of 4–6 ng/mL are described to cause psychotic symptoms in adults. There are no other reports of laboratory confirmed psilocin exposures in a patient this young. This patient's level is among the highest reported in the medical literature and makes it likely his symptoms were due to psilocin.

Conclusion: While uncommon, psilocin may cause significant symptoms in apediatric patient. It should be considered in the evaluation of the acutely altered child, especially if hallucinations are present.

Keywords: Hallucinogen, Pediatric, Laboratory

183. Massive diltiazem and metoprolol overdose rescued with extracorporeal life support

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Background: Calcium channel blocker and beta blocker overdoses can often produce overwhelming hemodynamic instability. Often these overdoses respond to traditional supportive care such as vasopressors or alternative antidotes such as high-dose insulin therapy, glucagon, or intravenous fat emulsion(IFE). We present a case of a massive diltiazem and metoprolol ingestion that was successfully rescued using extracorporeal life support (ECLS).

Case Report: A 26 year old female with intermittent atrial tachycardia was brought to the hospital with extreme hypotension and bradycardia . Upon arrival, she became asystolic and was completely dependent on transvenous electrical pacing. Family subsequently arrived stated that she had empty bottles of diltiazem and metoprolol. Despite early aggressive management with calcium, glucagon, 20% fat emulsion, high-dose insulin, and norepinephrine, she remained hypotensive and developed cardiogenic pulmonary edema. She had several ACLS codes with chest compression and lost pacer capture. She was emergently transitioned to veno-arterial ECLS with membrane oxygenation approximately 2 hours and 20 minutes after her arrival. She spent 37 hours on extracorporeal membrane oxygenation regaining intrinsic cardiac function until she was weaned off and decannulated. She was discharged on hospital day 7 without neurologic deficits. Blood levels from a sample obtained about 3 hours and 45 minutes after her estimated time of ingestion returned: diltiazem 3200ng/mL (50–200ng/mL) and metoprolol 3800ng/mL (20–340ng/mL).

Discussion: ECLS can provide a temporary bridge for the hemodynamically unstable overdose patient refractory to less invasive measures. Literature supports the use of hemodialysis and IFE for medications whose properties such as protein binding and volume of distribution make them amenable to these therapies. ECLS may serve as an alternative therapy when these parameters are not met or in patients who are refractory to standard and alternative therapies.

Conclusion: ECLS is a treatment option for hemodynamically unstable overdoses refractory to standard and alternative therapies. Consider ECLS early if pharmacologic properties make alternative treatments like hemodialysis or IFE less likely to be successful.

Keywords: Calcium channel blocker, Beta blocker, Cardiac toxicity

184. Treatment of massive verapamil overdose with peripheral veno-arterial extracorporeal membrane oxygenation

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Introduction: Verapamil overdose can be extremely difficult to manage due to progressive cardiogenic and vasoplegic shock that is often refractory to medical management. Previous case reports describe numerous approaches to treatment, with variable success. We present a case of a massive sustained release verapamil overdose (OD) managed with multiple medical therapies, and ultimately requiring peripheral veno-arterial extracorporeal membrane oxygenation (VA-ECMO).

Case Report: A 51 year old man was brought to the Emergency Department 3 hours post-ingestion of verapamil SR 19.2 g and diphenhydramine 200 mg. The patient had an initial GCS of 15 that rapidly deteriorated to a GCS of 7, with associated hypotension and bradycardia. He was intubated and transferred to the Intensive Care Unit. Initial management included activated charcoal, calcium, atropine, transvenous pacing, high dose insulin (160 units/hr) and glucose, intravenous lipid emulsion (960 ml total), glucagon

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(5 mg), methylene blue (80 mg) and high dose vasopressors including norepinephrine, epinephrine and vasopressin. A trial of whole bowel irrigation failed due to ileus. The patient's condition continued to deteriorate with worsening lactic acidosis and refractory hypotension.

The patient was assessed for peripheral VA-ECMO and deemed to be an appropriate candidate. Upon initiation of VA-ECMO, layering and separation of ILE in the ECMO circuit was noted, necessitating discontinuation of ILE. VA-ECMO support was maintained with approximately 4.5 LPM of flow for 3 days as native biventricular systolic function was minimal and there was persistent loss of pulsatility. Also, the underlying rhythm was asystole and the pacemaker could only capture at a rate of 30 bpm. Cardiac dysfunction was further exacerbated by progressive hyperkalemia from rhabdomyolysis due to possible compartment syndrome of the left leg. Hyperkalemia was responsive to calcium infusion and continuous renal replacement therapy. Recovery of native cardiac function on day 4 allowed for weaning of vasoactive and VA-ECMO support, with successful decannulation from VA-ECMO on day 5. All vasoactive agents were discontinued by day 7. The patient was extubated on day 11 with no cognitive deficits, and later transferred to the medical floor with arrangements for intermittent hemodialysis.

Conclusion: VA-ECMO may be considered in the management of verapamil OD with cardiogenic shock refractory to medical management. VA-ECMO provides a bridge to recovery, allowing time for drug clearance from the body. Close monitoring for recognized but uncommon complications of VA-ECMO, including compartment syndrome, is warranted.

Keywords: Calcium channel blocker, ECMO, Lipid therapy

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185. Pediatric bupropion overdose mimics clinical brain death

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Background: Bupropion overdose can cause seizures, cardiovascular collapse, and death. Exams consistent with brain death have been infrequently reported in adult bupropion poisoning. We report a massive bupropion overdose in a pediatric patient resulting in a clinical exam consistent with brain death followed by complete neurological recovery.

Case Report: A 13 year old female presented to an emergency department in status epilepticus after intentionally overdosing on bupropion. Intubation was performed using succinylcholine and 5 milligrams (mg) of midazolam. She was transferred to a level 1 trauma center and received 5 mg of vecuronium during transport. Vital signs included blood pressure 93/46 mmHg and heart rate 116 bpm. Neurologic examination was significant for coma, flaccid paralysis, and absent brainstem reflexes with fixed and dilated pupils. Midazolam sedation and vecuronium were discontinued, yet repeat exam 7 hours later by the attending neurologist still was consistent with clinical brain death while on a low dose propofol infusion of 25 micrograms per kilogram per minute. An electrocardiogram showed sinus tachycardia with a QTc of 506 milliseconds. Laboratory analysis was remarkable for a HCO3 20mmol/L. The patient was placed on continuous electroencephalogram (EEG) and initially only slowing was seen. Over time, short focal seizures developed lasting less than 30 seconds with mouth chewing and clonic body movements. Phenytoin was initiated. On HD #2 she began to respond to noxious stimuli and regained brainstem reflexes with reactive pupils. Head CT on HD #1 and brain MR on HD #2 were normal. After prolonged intubation due to aspiration pneumonia she was extubated on HD #7. At that time, her EEG was dramatically improved and she had no further seizures. Clinically, she exhibited full neurological recovery. Send-out serum testing drawn on admission revealed bupropion 4321.2 ng/mL (ref 50–100) and hydroxybupropion 1903.8 ng/mL (600–2000).

Discussion: Bupropion overdose is not typically associated with a clinical picture consistent with brain death; however there is one published report of an adult with clinical brain death and burst suppression on EEG after bupropion overdose that also completely recovered. This is the first case reported in a pediatric patient. The mechanism underlying this exam finding is unclear.

Conclusion: By unclear mechanisms, massive bupropion overdose can produce a clinical picture consistent with brain death with complete recovery after clearance of drug.

Keywords: bupropion, brain death, Pediatric

186. Hyponatremia, SIADH, Seizure, and Cerebral Edema in a Fatal Trazodone Overdose

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Background: All of the few reported fatalities associated with isolated trazodone overdoses have been attributed to cardiac dysrhythmia. We present herein the first report of a case fatality due to an isolated massive trazodone overdose complicated by hyponatremia, SIADH, seizure, and cerebral edema.

Case Report: A 37 year-old woman with a history of depression presented to an emergency department three hours after an intentional ingestion of 6.45 grams of trazodone. She was mildly somnolent but conversant and able to provide a complete history. Her neurologic examination was otherwise normal. Upon admission to the intensive care unit, her initial vital signs were: temperature 36.4 C°, blood pressure 151/94, pulse 114, respiratory rate 18, and oxygen saturation of 99% on room air. EKG showed sinus tachycardia at 116, QRS 78 ms, and QTc 364 ms. Over the subsequent 12 hours she developed increasing somnolence and suffered a 30-second generalized seizure; she was intubated for airway protection. There were no documented episodes of hypoxia. At admission, she was noted to have hyponatremia that persisted over 20 hours. Initial sodium was 121 mEq/L, the nadir was 115 mEq/L and it corrected to 137 mEq/L 23 hours after presentation. Previously documented laboratory results revealed normal electrolyte values three months prior to her presentation. Workup including serum and urine osmolality and urine electrolytes was consistent with SIADH. Over 24 hours, she received 5L of normal saline. No hypertonic saline was given. Once stabilized, a CT of the head demonstrated diffuse cerebral edema. She was transferred to a tertiary care facility and her neurologic injury progressed. She was pronounced brain dead

on hospital day four based on radionuclide brain perfusion scan without intracranial blood flow. Urine gas chromatography-mass spectrometry comprehensive drug screen detected only trazodone. Thirty-three hours after presentation her serum trazodone level was 817 ng/mL (reference 800–1000).
Case Discussion: Trazodone has rarely been reported to cause SIADH, hyponatremia, and seizure. The mechanism of SIADH in trazodone overdose is not clear. In our case, the patient developed cerebral edema and brain death in the absence of cardiovascular toxicity which is unique among reported trazodone-related fatalities.
Conclusions: Trazodone has rarely been associated with SIADH, hyponatremia, and seizure. The mechanism of SIADH in trazodone overdose is unknown. This is the first report describing cerebral edema and brain death likely due to a combination of hyponatremia and seizure activity. All other trazodone deaths were the result of cardiovascular toxicity.
Keywords: Antidepressant, Neurotoxicity, Death

187. Lactate and ibuprofen metabolites as cause of metabolic acidosis after massive ibuprofen ingestion

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Background: In massive overdose, ibuprofen is known to cause metabolic acidosis. The metabolic acidosis associated with ibuprofen toxicity has been attributed to lactate and some have theorized propionic acid as a cause as well; however, no organic acid analysis of serum or urine in the setting of ibuprofen overdose has been reported. We report a case of massive ibuprofen ingestion with coma and elevated anion-gap (AG) metabolic acidosis with gas chromatography-mass spectrometry (GCMS) urinary organic acid analysis confirming lactate in conjunction with ibuprofen metabolites as the primary cause of metabolic acidosis.
Case Report: A 37-year-old woman presented several hours after intentional ingestion of ibuprofen, acetaminophen, caffeine, aspirin, and guafenesin. She was obtunded and having multiple bouts of emesis. She was intubated and transferred to a tertiary care facility. Her vitals were T 36.7, BP 146/85, HR 133, RR 14/min. An ABG showed a mixed respiratory and metabolic acidosis with pH 7.04, PaCO2 61 mmHg, and bicarbonate 16 mEq/L. Sodium and chloride levels were 138 and 104 mEq/L, respectively. Anion gap was 18 mEq/L. Serum lactate peaked at 4.8 mmol/L. Ethanol and toxic alcohols were undetectable. Acetaminophen level was 42 mcg/mL and salicylate level peaked 6 hours after presentation at 15.1 mg/dL. Serum ibuprofen level 3 hours after presentation was >360 mg/L (reference 5.0–49.0 mg/L). She was started on bicarbonate and N-acetylcysteine infusions. GCMS urine drug screen detected ibuprofen, caffeine, acetaminophen, and guafenesin. Urine organic acid analysis by GCMS showed severe lactic aciduria and smaller peaks of acidic ibuprofen metabolites (hydroxyibuprofen and carboxyibuprofen). The metabolic acidosis resolved 18 hours after presentation. She was discharged on hospital day 7.
Case Discussion: The patient's clinical presentation was consistent with massive ibuprofen ingestion. The primary cause of her metabolic acidosis was lactate; however, the elevated lactate was not thought to be due to poor perfusion. Salicylate toxicity was unlikely to have significantly contributed to her acidosis as peak serum concentration was in the therapeutic range. Other toxin-associated causes of metabolic acidosis were excluded as well.
Conclusions: This is the first reported confirmation of lactate in combination with acidic ibuprofen metabolites as the primary cause of AG metabolic acidosis in the setting of massive ibuprofen overdose. Previous case reports have suggested lactate as the cause of ibuprofen-associated metabolic acidosis, but this case is the first to confirm lactate in combination with ibuprofen metabolites as the cause of the acidosis.
Keywords: NSAID, Overdose, Acidosis

188. Favorable acute toxicity profile of agomelatine

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Background: Agomelatine, a structural analog of melatonin which acts as a melatonergic agonist and 5-HT_{2C} antagonist, received marketing authorization for major depressive disorder in Europe in 2009. Agomelatine seems to have a favorable side effect profile, but information about toxicity is limited. The aim of this study was to determine the acute toxicity profile of agomelatine in overdose.
Methods: A multicentre retrospective review of all acute agomelatine monointoxications involving adolescents/adults (≥ 14 y) reported by physicians to German, Austrian, and Swiss PCs until December 2013 with a follow-up of at least 4 h 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 according to the Poisoning Severity Score.
Results: 42 patients, 33 (78%) females and 9 (22%) males with a mean age of 34 y (15–67 y), were included. Mean ingested dose was 678 mg (25–2450 mg). No effects were reported in 14 cases, minor in 27, and moderate in 1 case. There were no severe cases and no fatalities. Observed symptoms and signs were drowsiness (9 cases), dizziness (6), somnolence (4), psychomotor slowing (3), nausea (5), abdominal pain (5), vomiting (2), headache (5), tachycardia 100–120 bpm (4), QTc-prolongation <500 ms (3), rhabdomyolysis (1), tremor (1), confusion (1), and dry mouth (1). ECG was documented in 11 cases. Gastrointestinal decontamination was performed in 2 patients, (both induced emesis). Serum agomelatine concentration was measured in one case, and was 16.2 µg/L 72 h after the ingestion of 2450 mg of the substance in an asymptomatic patient.
Conclusions: Agomelatine seems to have a favorable acute toxicity profile and significant overdoses were tolerated with only mild

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to moderate effects, which were predominantly of neurological and gastrointestional nature. Four patients had mild tachycardia and three other patients with normal heart rates showed mild QT prolongation. Although no other reasons for this finding were reported by the treating physicians, the possibility of coingestion of other QT-prolonging drugs or the presence of underlying medical conditions associated with QT interval prolongation cannot be excluded in this retrospective observational case series. Nevertheless, dose-dependent QT prolongation with complete resolution after cessation of treatment has been previously reported in a patient treated with agomelatine. We therefore recommend that further research be performed to investigate the possible role of agomelatine in QT prolongation.

Keywords: Agomelatine, Overdose, QTc-prolongation

Reference

Kozian R et al., QTc-prolongation during treatment with agomelatine, Psychiat Prax. 2010; 3:405–7.

189. Citalopram overdose: a fatal case

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Background: Citalopram is a selective serotonin reuptake inhibitor (SSRI) with cardiac and neurologic toxicities, as well as the potential for Serotonin Syndrome. In most instances, patients recover fully from toxic ingestions of SSRIs. We describe a fatal case of a citalopram overdose.

Case Report: A 35-year old woman presented to the emergency department after having witnessed seizures at home. An empty citalopram prescription bottle was located and intentional overdose was suspected. At the scene, she was found to be in cardiac arrest with pulseless electrical activity and underwent cardiopulmonary resuscitation, including intravenous epinephrine and bicarbonate. In the emergency department, her physical exam was notable for cough and gag reflexes and movement in all extremities with increased muscle tone and tachycardia. Her initial post-resuscitation ECG showed sinus rhythm with QRS 92 msecs and QTc 502 msecs. Her temperature was initially normal but she rapidly became febrile to 41.8 degrees Celsius shortly after admission. She was treated symptomatically and with cyproheptadine for suspected Serotonin Syndrome (SS) but became increasingly hemodynamically unstable over the next six hours and then developed Torsades de Pointes (TdP) progressing to pulseless, wide complex tachycardia. She underwent CPR for approximately 50 minutes but ultimately expired. Post-mortem serum analysis revealed a citalopram concentration of 7,300 ng/mL (therapeutic range: 9–200 ng/mL) and THC but no other non-resuscitation drugs or substances.

Case Discussion: Citalopram overdoses often have only mild to moderate symptoms, particularly with ingestions under 600 mg in adults. However, with higher doses, severe manifestations have been described, including QTc prolongation, TdP and seizures. Serotonin syndrome has also been described in SSRI overdose and our patient exhibited signs consistent with SS, including increased muscle tone and autonomic dysregulation. Our patient's serum concentration suggests a massive overdose, with major clinical effects, possible SS and death.

Conclusions: Citalopram overdose can be fatal with high-dose ingestions and the clinician must be aware of the wide range of manifestations that can occur.

Keywords: Overdose, Selective serotonin reuptake inhibitors, Serotonin syndrome

190. Diethylene Glycol– a DIF-ferent type of acute ingestion?

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Background: Diethelyne Glycol (DEG) is an industrial solvent that is occasionally implicated in accidental epidemic poisonings that are discovered only after clinical sequelae have developed. Here, we present a case of acute intentional DEG poisoning treated immediately post-ingestion.

Case Report: A 43-year-old male with a history of chronic alcohol abuse presented approximately 30 minutes after being caught by his mother in the act of drinking DIF® wallpaper stripper [labeled ingredient: DEG (undisclosed %)]; approximately 3.6 L had been consumed. Upon arrival, he had normal vital signs and was alert but agitated, progressing to obtundation within 20 minutes. Significant initial laboratory values include pH 7.21, pCO2 45 mmHg, anion gap 11, serum ethanol 188 mg/dL, and osm gap 19. Ethylene glycol (EG) and DEG levels were also drawn. Fomepizole (4-MP) was administered while awaiting placement of a dialysis catheter and initiation of hemodialysis (HD). A single 4-hour HD session was performed with pre- and post-HD DEG levels of 89 mg/dL and 37 mg/dL, respectively. The patient was maintained on 4-MP for 24 hours without further HD and serial metabolic panels, osmolalities and EG/DEG levels were trended. When the serum DEG level reached 20mg/dL, 4-MP was discontinued and chemistries were again trended for 24 hours without development of acidosis or end organ toxicity. At no time was EG detected in the patient's serum. He was discharged on day 3 without sequelae.

Discussion: Literature guiding the management of acute DEG exposures is limited and no clear safe level of DEG has been proposed. Toxicity from untreated DEG comes primarily from the development of 2-hydroethoxyacetic acid via metabolism through alcohol dehydrogenase (ADH). DEG may also be metabolized into EG. Hemodialysis can effectively clear DEG, but the threshold for initiation is poorly described. One reported case describes initiation of HD for a DEG level of 17mg/dL after an acute ingestion with complete clearance after 4 hours. Blockade of ADH has also been shown to prevent end-organ toxicity in animal models and human case reports, however a specific treatment goal has not yet been clearly described. In our case, a large DEG burden was incompletely cleared with traditional HD, but further ADH blockade allowed for safe clearance. An untreated DEG level of 20 mg/dL was not associated with the development of acidosis or renal injury.

Conclusion: In cases of acute methanol or ethylene glycol ingestion, it is generally accepted that levels of $\leq$ 20 mg/dL need no acute intervention. While no specific treatment goals for DEG have been well described, the data in this case suggest that it may be safe to extend these treatment parameters to cases of acute DEG ingestion.

Keywords: Diethylene glycol, Fomepizole, Hemodialysis

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191. He put it where? A case of intentional doxepin overdose via the rectal route

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Background: Rectal administrations of xenobiotics with suicidal intent are rarely reported in the scientific literature. Well-described and effective management strategies have been developed for many oral overdoses. In the end, the clinical effects and toxicity of oral medications administered rectally are less well elucidated. Here we present a case of intentional TCA overdose via the rectal route.
Case Report: A 29-year-old man presented approximately 1.5 hours after a suicide attempt involving rectal administration of 5 g of Doxepin, reportedly achieved by emptying the contents of 100 capsules of doxepin 50 mg into an over-the-counter sodium phosphate enema preparation. Upon arrival, the man's vital signs were: HR 140 bpm, BP 111/50 mm Hg, RR 13/min, Temp 36 deg C. He was responsive only to painful stimuli, was endotracheally intubated and sedated for airway protection. The initial EKG showed: QRS 146ms, QTc 496 ms and an R-wave height of 5 mm in aVR. The pre-intubation ABG showed a pH of 7.27 and pCO2 52 mmHg. Serum electrolytes were significant only for a potassium of 2.8mmol/L. He was given multiple 50meq boluses of sodium bicarbonate and placed on a bicarbonate infusion at a rate of 40 meq/hr that, along with ventilator management, achieved alkalemia and resolution of EKG abnormalities. He was maintained on the infusion for 24 hours. The patient recovered well and was transferred to a psychiatric facility 5 days post presentation.
Discussion: This case describes clinically significant TCA toxicity via rectal administration of doxepin. Oral doxepin undergoes significant first-past metabolism and has low bioavailability in non-overdose settings. Published pharmacokinetic data of daily oral doxepin dosing (150 mg) demonstrates steady-state doxepin + *N*-desmethyldoxepin (DOX + DMD) serum levels of 45–65 ng/mL. Unfortunately, the pharmacokinetic profile of rectally administered doxepin is not well described. A Medline search reveals a single publication regarding rectal doxepin use: three patients with chronic cancer pain had rectal administration of unaltered tablets of doxepin 50mg TID with steady-state DOX + DMD serum levels between 204–573 ng/ml (therapeutic range 50–200 ng/ml). This suggests that following rectal administration, doxepin may have increased bioavailability compared to oral administration, likely related to bypassed first-pass metabolism.
Conclusion: Enemas may be abused for rectal administration of drugs in intentional self-poisoning leading to increased bioavailability. Intentional rectal administration of doxepin can result in significant toxicity and warrants the same close monitoring and aggressive therapy afforded to all oral TCA overdoses.
Keywords: Enema, Antidepressant, Overdose

192. Polypharmacobezoar or pylorospasm? APAP and ASA co-ingestion causing Rumack-Matthew nomogram failure

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Background: Acute ingestions of enteric-coated aspirin (ECASA) and acetaminophen (APAP) are common. Large co-ingestions may behave unexpectedly and complicate management.
Case Report: A 17-year-old male presented nearly two hours after an intentional combined ingestion of 200 ECASA and APAP tablets with a "small amount" of 3% hydrogen peroxide (H2O2). His initial vital signs were normal, but had nausea and epigastric tenderness; bicarbonate and 21 n-acetylcysteine infusions were initiated. The initial salicylate level was 20 mg/dL; the 4-hour post-ingestion (PI) acetaminophen level was 48 mcg/mL. Over the course of his hospitalization, the salicylate level continued to rise despite bicarbonate therapy, peaking 22 hours PI (66 mg/dL). The APAP level also continued to rise, crossing the treatment line 8 hours and peaking 17 hours PI (101 mcg/mL). At 20 hours PI, the patient vomited 10 pills of two varieties. Activated charcoal was administered followed by whole bowel irrigation. Pill fragments were later observed in the rectal effluent. Both serum levels decreased after WBI. The patient recovered fully without incident.
Discussion: This is a case of an acute polypharmacy ingestion including APAP with a late line crossing of the Rumack-Matthew nomogram. Most reported cases of late line crossings are associated with acetaminophen combination products containing diphenhydramine or opioids, which may slow gastric motility. With large ECASA ingestions, pylorospasm and bezoar formation have been postulated as causes of delayed/prolonged serum salicylate level elevations. In this case, there were no ingested agents that pharmacologically slow gastric motility. The slow rise of both APAP and ASA serum levels over time with similar velocities suggests delayed release of both, possibly related to pylorospasm from the ECASA or H2O2. While APAP is not known to form bezoars, it may have been incorporated within an ECASA bezoar creating a polypharmacobezoar, the formation and dissolution of which could explain the above kinetics. To date, there have been no reported cases of co-concretion of ECASA and APAP. Liberation of pills in both vomitus and rectal effluent 20 hours after ingestion could support both hypotheses.
Conclusion: Polypharmaceutical ingestions that include APAP may result in unpredictable pharmacokinetic behavior. In the absence of agents that slow gastric motility, agents that promote pylorospasm or pharmacobezoar formation should be considered as a cause for persistently elevated drug levels. While the course of sole APAP ingestions is predictable, reliance on the Rumack-Matthew nomogram in setting of co-ingestions may lead to treatment error.
Keywords: Acetaminophen (paracetamol), Aspirin, Nomogram Failure

193. Bupropion exposures: seizures and severe toxicity

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Background: There has been only one review of bupropion poisonings reported in the literature. This review of Texas Poison Center Network data included 385 intentional bupropion poisonings with no effect in 80 (21%) cases, minor effects in 98 (25%) cases, moderate effects in 62 (16%) cases, major effects in 35 (9%) cases and death in 2 (1%) cases with 41 (11%) patients

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experiencing seizures. Anecdotally, severe toxicity including seizures, hypotension, hallucinations, QRS widening, or intubation are more common in intentional bupropion overdoses. Our objective was to evaluate the incidence of severe toxicity, interventions and clinical outcomes associated with bupropion overdose.

Methods: Retrospective review of patients presenting to a large academic medical center between 1/2011–4/2014 seen by the toxicology service. An independently maintained medical toxicology consultation database was queried for cases with bupropion listed as an exposure. Patients with an exposure including bupropion were reviewed and extracted information included demographics, exposure and medical history, supportive care, interventions and clinical outcomes.

Results: Out of a total of 2116 toxicology consultations we evaluated 52 cases of bupropion exposures including 41 (79%) intentional and 8 (15%) accidental. Mean age was 26 ± 13 years and 35 (67%) patients were female. Mean dose ingested was 2564 mg (range 300 mg – 15 g); 27 cases (52%) had known co-ingestions. Agitation or delirium occurred in 25 (48%) cases with 6 (12%) experiencing hallucinations, and 13 cases (25%) of seizures. 11 of the 41 (27%) intentional bupropion exposures experienced seizures. Sinus tachycardia was the most common abnormality on electrocardiogram with 31 (60%) cases; QTc $>$ 500 msec and QRS $>$ 120 msec occurred in 8 (15%) cases and 3 (5.7%) cases, respectively. A total of 10 (19%) patients required intubation. Interventions included activated charcoal in 11 (21%) cases, benzodiazepines in 40 (77%), phenobarbital in 2 (4%), propofol in 9 (17%), dexmedetomidine in 5 (10%), magnesium in 9 (17%), sodium bicarbonate in 4 (7%), and lipid rescue therapy in 3 (6%). Severe toxicity occurred in 23 (44%) cases with one death (2%).

Conclusions: A previous review describes major adverse effects following intentional bupropion overdose occurring in 35 (9%) cases and seizures in 41 (11%) of 385 cases. We found a much higher rate of severe toxicity (hallucinations, hypotension, QRS prolongation, seizures and intubation) which occurred in 44% of patients. Seizures occurred in 11 (27%) of our intentional overdose patients compared to 11% previously reported. Intentional bupropion overdoses are associated with a higher incidence of severe toxicity than previously reported.

Keywords: Antidepressant, Seizure, Overdose

194. Oral epinephrine overdose

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Background: Epinephrine is a potent vasopressor when given parenterally. When taken orally epinephrine produces no significant systemic effects however ingestion of large quantities of highly concentrated epinephrine may cause local vasoconstriction, irritation, and ulceration of the gastrointestinal mucosa.

Case Report: A 28-year-old male presented after a cocaine binge and several self-mutilation superficial cuts. His initial examination was otherwise normal and he remained under observation overnight because of suicidal thoughts to see psychiatry. A few hours later, a nurse found an empty bottle of epinephrine 1:1000, 30 mL bottle (30mg/mL) in the emergency department cubicle assigned to this patient. The patient admitted to drinking the entire bottle 60 minutes prior to discovery. He was asymptomatic and brought to the resuscitation area and placed on a cardiac monitor. Complete blood count, liver function, renal function and electrolytes were within normal limits. The electrocardiogram was normal. His heart rate was 95 beats/minute and his blood pressure was 145/95 mmHg. The local Poison Centre was contacted to obtain advice. Epinephrine was not expected to be significantly absorbed from the gastrointestinal track but local vasoconstrictive effects were a concern thus endoscopy was recommended. Four hours later, the patient vomited coffee-grounds. A gastroscopy was performed and showed extensive hemorrhagic esophagogastroduodenitis without evidence of necrosis or perforation. The patient was placed nil per os and a proton pump inhibitor was started intravenously. He was discharged 4 hours later to the care of the psychiatry department. He did not require transfusion. Unfortunately, he did not present for follow-up.

Case Discussion: Small doses of intragastric or intraperitoneal epinephrine (4 mg to 8 mg) were used in the past to treat upper gastrointestinal bleeding. This is the first reported case of intentional or non-intentional oral epinephrine ingestion. Our patient ingested 900 mg of epinephrine and developed symptoms of hemorrhagic esophagogastroduodenitis 4 hours later.

Conclusions: Oral epinephrine overdose was not associated with systemic sympathomimetic effects but caused extensive hemorrhagic esophagogastroduodenitis. Observation for a minimum period of 4 to 6 hours post epinephrine ingestion is advised and endoscopy should be considered.

Keywords: Epinephrine, oral ingestion, hemorrhagic esophagogastroduodenitis

195. Lacosamide-associated QRS widening and cardiac arrest

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Background: Lacosamide treats partial seizures by enhancing slow inactivation of voltage-gated sodium channels. Cardiac toxicity of lacosamide has been mostly limited to atrioventricular blocks, atrial flutter, atrial fibrillation, and sinus pauses. Cardiac sodium channel blockade with cardiac arrest has been previously reported in only one overdose case with lacosamide; that patient also ingested the sodium channel blockers carbamazepine and lamotrigine. We present a case of lacosamide overdose resulting in QRS widening and cardiac arrest.

Case Reports: A 16 year-old girl with history of a seizure disorder was found unresponsive after ingesting lacosamide 4.5 g, cyclobenzaprine 120 mg, and an unknown amount of levetiracetam as a self-harm attempt. Upon paramedic arrival, she was in pulseless ventricular tachycardia, which was converted to sinus tachycardia with one unsynchronized defibrillation shock. She then had a tonic-clonic seizure terminated by benzodiazepines. The initial electrocardiogram (EKG) in the emergency department demonstrated sinus tachycardia at 139 beats per minute, QRS duration 112 ms, and terminal R-wave in lead aVR $>$ 3 mm. The patient was intubated and received 150 mEq of sodium bicarbonate. She

remained tachycardic but otherwise hemodynamically stable. Her serum lacosamide level was elevated when measured 9 hours after presentation: 22.8 mcg/mL (reference range: 1–10 mcg/mL). Serum cyclobenzaprine and levetiracetam levels were mid-therapeutic: cyclobenzaprine 16 ng/mL (10–30 ng/mL) and levetiracetam 22.7 mcg/mL (12–46 mcg/mL). The patient was successfully extubated on hospital day two. An EKG eight days after her overdose demonstrated resolution of the terminal R-wave with QRS duration 78 ms. The patient recovered without physical or neurologic sequelae and was discharged to inpatient psychiatry.

Discussion: In this case, lacosamide overdose was associated with QRS widening and a terminal right axis deviation, suggesting sodium channel blockade as a likely etiology for her cardiac arrest. Cyclobenzaprine, an agent structurally similar to tricyclic antidepressants, has potential for sodium channel blockade, but cyclobenzaprine alone has not been associated with severe cardiac toxicity. The combination of cyclobenzaprine with lacosamide, a slow sodium channel inactivator, may have resulted in cardiovascular collapse.

Conclusions: Overdose of lacosamide combined with therapeutic levels of sodium channel blocking antiepileptics can cause cardiac conduction delays and cardiac arrest.

Keywords: Lacosamide, Cardiac arrest, Wide qrs

Disclosure: Do you have relevant financial or other relationship(s) with the commerical supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

196. Delayed onset bradycardia with a trazodone overdose

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Background: Trazodone is a phenylpiperazine antidepressant that inhibits serotonin reuptake and is an antagonist at 5HT2A, histamine, and α-1 receptors. The most frequent adverse effects are sedation and orthostatic hypotension. Reported cardiovascular effects are rare. We present a case of symptomatic bradycardia 9 hours after reported trazodone overdose.

Case Report: A 41-year-old female with a history of depression presented to the Emergency Department (ED) after ingestion of 1.5 grams of trazodone and a "handful" of ibuprofen/diphenhydramine in a self-harm attempt 3 hours prior to arrival. The patient had a history of HIV and was taking ritonavir, atazanavir, raltegravir, and maraviroc. She had no known history of cardiovascular disease and denied co-ingestants.

The patient presented to the ED drowsy but oriented. Her vitals were blood pressure (BP):116/84mmHg and heart rate (HR): 80bpm. Physical examination was otherwise normal. EKG on arrival showed a normal sinus rhythm at a rate of 69 with a QRS of 84 and a QTC of 452. Electrolytes, renal, and liver function tests were within normal ranges. CBC was normal except for a hemoglobin of 10 g/dL. Aspirin, acetaminophen, and ethanol were below detectable levels. No events occurred on telemetry during ED observation.

Approximately 6 hours after arrival, the patient reported chest pain and lightheadedness. Repeat EKG showed sinus bradycardia at 40–45 bpm. She was given 0.5mg of IV atropine with improvement of heart rate into the 70's and symptom relief. The patient was observed for 24 hours with no further events and CK and troponin trended overnight did not show elevation. A serum quantitative trazodone level of 730 ng/mL was obtained shortly after the episode of bradycardia.

Case Discussion: This is a case of delayed onset bradycardia in the setting of a trazodone overdose. Prior cases have reported bradycardia with therapeutic trazodone use in the setting of concurrent cardioactive medications. Several cases of death after overdose have been attributed to toxicity from the cardiovascular effects of trazodone but with time of patient becoming symptomatic in relation to time of ingestion unknown. The patient in this report was on multiple antiretroviral medications which have known inhibition of CYP3A4. Trazodone is metabolized to m-chlorophenylpiperazine, an active metabolite, by CYP3A4 and it is unclear to what extent this effect on metabolism may have had in our case. Though we were able to obtain a trazodone level, our report is limited by an inability to obtain a serum concentration of m-chlorophenylpiperazine.

Conclusion: Clinicians should be aware of the possibility of delayed onset symptomatic bradycardia in the setting of trazodone overdose.

Keywords: Antidepressant, Cardiac toxicity

197. Cardiovascular collapse & death resulting from tilmicosin injection

B Tae

Background: Human exposure to the bovine macrolide antibiotic Micotil (Tilmicosin) is uncommon, but can result in severe toxicity progressing to fatality. It is parenterally administered & approved for veterinary use only for the treatment of bovine respiratory disease. Human exposure cases have ranged from mild/moderate effects of localized skin reactions to severe effects of dysrhythmias, cyanosis, & cardiovascular collapse and death.

Case Report: A 51 year old male with history of hypertension & severe depression injected himself with 5 ml Tilmicosin to his right hip. When paramedics arrived the patient had hypertension with agonal respirations at rate 8–12 per minute which rapidly deteriorated to a rate of 4 breaths per minute. The patient was intubated & airlifted to the hospital arriving with good respiratory sounds bilaterally, but mottled skin from shoulders up through neck and head, HR 160 on monitor with no palpable pulse. Chest compressions were done for 15–20 minutes, but no pulse identified. Atropine, calcium, dopamine & epinephrine were administered, pulse rate dropped to 120–130's and feeble pulse felt, BP 70/57. EKG showed ST elevation in all leads. Patient was admitted to ICU, for supportive care. Significant labs included elevation of AST & ALT, BUN & creatinine, & metabolic acidosis. On echocardiogram, EF was 30–35% with no previous comparisons. The patient had seizures on days 1–2 that were treated with ativan & phenytoin. On day 5, the patient was extubated, but remained confused, agitated, & uncooperative with muscle weakness, short term memory deficits, & bilateral vision loss, but with LFT's trending downward

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& renal function improving. On day 7, there was evidence of a bilateral occipital stroke attributed to anoxic encephalopathy. On day 9, patient was transferred out of ICU for end of life care, placed on hospice and expired on 11th day after self-inflicted exposure.
Discussion: This case highlights a parenteral Tilmicosin exposure in a human. Although used therapeutically with very few adverse effects to bovine hosts, even after numerous interventions, this medication can be ultimately fatal to humans from a potent calcium channel blockade effect. Although used on this patient, epinephrine is generally contraindicated in symptomatic patients with this exposure as it has been shown in pigs to potentiate the cardiovascular toxicity of the drug.
Conclusion: An intentional overdose of Tilmicosin in a patient with only medical history of hypertension showed symptoms of severe cardiovascular toxicity ultimately leading to death. Treating as a calcium channel blocker has been shown promising results in animals and could be considered in life-threatening human exposures.
Keywords: Cardiac toxicity, Overdose, Antibiotic

198. Case series of fatal calcium channel blocker overdoses treated with veno-arterial extracorporeal membrane oxygenation for refractory hypotension and shock

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Background: The use of extracorporeal membrane oxygenation (ECMO) for refractory shock in poisoned patients has been described in the literature. There is a paucity of literature describing treatment failures associated with ECMO.
Case Series:
Case 1: A 28 year-old woman presented after ingestion of approximately 2,000 mg of immediate release verapamil and 1,000 mg of trazodone. She presented with a systolic blood pressure in the 60s and a heart rate in the 40s. She was intubated and resuscitated with crystalloid infusion, aggressive titration of epinephrine (15 mcg/kg/min), dopamine (5 mcg/kg/min), vasopressin (0.1 U/min), 1% methylene blue (240 mg), insulin (4 units/kg/hr), sodium bicarbonate boluses and infusion, calcium chloride (2 gm/hr), continuous veno-venous hemofiltration, and intravenous fat emulsion (IFE). Thirty-two hours after ingestion, veno-arterial ECMO (VA ECMO) was initiated for refractory cardiogenic and vasoplegic shock and worsening hypoxic respiratory failure. Electrolyte levels and pH normalized but hypoxemia and hypotension worsened despite maximal ECMO and ventilator support. The patient suffered PEA arrest and died 48 hours after ingestion and 16 hours after initiation of ECMO.
Case 2: A 47 year-old woman presented after ingestion of an unknown amount of extended release diltiazem. Exam revealed hypotension, bradycardia, and third degree heart block. Care included intubation as well as crystalloid, glucagon, high-dose insulin, methylene blue, IFE, and calcium infusions. Norepinephrine and epinephrine were titrated to 1.5 mcg/kg/min and 4 mcg/kg/min respectively; vasopressin was titrated to 0.06 U/min. Twenty hours after ingestion the patient suffered two PEA arrests. After return of spontaneous circulation, VA ECMO was initiated. Her course was complicated by acute lower extremity ischemia requiring bedside fasciotomy and abdominal compartment syndrome resulting in diffuse intra-abdominal necrosis. Maximum support including dialysis was continued but acidosis and respiratory failure worsened and the patient died 53 hours after ingestion and 34 hours after initiation of ECMO.
Discussion: ECMO has been reported previously to improve hemodynamic parameters and outcome in calcium channel blocker (CCB) poisoning. Case reports have been generally positive. We believe this may represent a publication bias. In this case series, we present two patients with CCB poisoning who succumbed despite appropriate care and ECMO.
Conclusion: In this case series of two fatal CCB poisonings with refractory shock, ECMO failed to improve hemodynamic status or outcome.
Keywords: Calcium channel blocker, Extracorporeal membrane oxygenation, Cardiac toxicity

199. Prevalence of QT/QTc prolongation, TdP and VTach in citalopram/escitalopram PC exposures

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Background: QTc prolongation can be a sensitive but nonspecific predictor of torsades des pointes (TdP), a polymorphic type of ventricular tachycardia (VTach). We determined the prevalence of QT/QTc prolongation, torsades des pointes (TdP) and ventricular tachycardia (VTach) in one poison center's (PC) citalopram/escitalopram exposures.
Methods: PC computerized records collected over 14 + years (1/1/99–2/28/13) were searched. Screening criteria were human exposures with any coded cardiovascular symptom and seen at a health care facility (HCF). Selection criteria were a prolonged QTc [i.e. >450 for males (M) and >470 ms for females (F)], "prolonged QT" or TdP or VTach reported. Exclusion criteria was another specified cause for QTc prolongation. Clinical data were abstracted and EKGs requested.
Results: Of 4,863 citalopram or escitalopram PC exposures, 671 (13.8%) met screening criteria and 90 (1.9%) met selection criteria. Of 6 with QT/QTc recorded only as "prolonged", 2 had TdP. The 2 others with VTach had no QT/QTc data in their PC record. Of 82 cases with abnormal QTc data, 38% had QTc <500, 31% QTc from 500–549, 11% QTc from 550–599 and 11% QTc ≥ 600 ms. The mean age was 34 years. 78.9% were females. Seizures were coded in 20%, hypokalemia in 20% and hypomagnesemia in 12% of cases. Mg was given in 21%, potassium in 12%, Calcium in 6%, and HCO3 in 20% of cases. Exposure was to a single ingestant in 19% of selected cases. At least one "Torsadogen" was a coingestant in 45 cases (62% of coingestant cases), and included 3 drugs classified as "substantial", 8 "conditional", 7 "possible" TdP risk (torsades.org) and 7 other drugs reported in literature to prolong QTc. 22% of cases had hypo-K and/or -Mg. 54/90 (60%) cases had either co-ingested torsadogens and/or had hypo-K and/or hypo-Mg. EKGs were obtained in 71/90 (79%) cases.
Conclusions: QT prolongation occurs relatively commonly in serious citalopram/escitalopram ingestions and commonly with coingested torsadogens and/or other risk factors. Citalopram and escitalopram induced TdP/VTach is uncommon but not rare.
Keywords: Intoxication, Antidepressant, Arrhythmia

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200. Changing trends in call routing to 8 regional poison centers

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Introduction: The national 800 number for poison centers (PC) is routed based on area code and exchange. However with mobile phones you can keep your number (area code and exchange) but physically relocate to a new geographic area served by a different regional PC. This may cause the routing of the call to a PC based on a previous geographic location (old address) rather than where the caller is at the time of the call. We sought to look at the percentage of calls to a regional PC over time that originated from within and outside of the designated region and whether the percentage had changed over time

Methods: Retrospective review of total calls and human exposures reported to a convenience sample of 8 regional PCs covering 9 states from Jan 2000 through April 2014 1) from within their designated region and 2) from outside their region, as a percentage of their total calls and Human Exposures.

Results: For 7 of the 8 centers (88%) the mean in-region percentage remained $>98.19\%$ from 2000 to 2007, beginning at 99.75% and staying steady for the 8 year period dropping to 98.19%. From 2008 there was a linear decline of 0.5% annually: from a mean percentage of in-region calls for human exposures of 98.00% in 2008 to 94.89% in 2014. One center (12%) began 2000 with 88% in-region calls and showed no pattern through the 15 year study period. Total call volume (including information calls) showed a similar pattern: falling from 99.54% in-regional total calls to 95.13% with a 0.5% linear annual drop after 2007.

Discussion: Several trends may be converging to affect this trend. 1) In November 2003 wireless number portability was implemented in the US, allowing an increasing number of customers to take their "number" with them as they relocate to new areas of the country. 2) In 2007 the IPhone 3G was introduced and in 2008 the Android smart phone was introduced. Since that time increasing numbers of population have smart phone service only. In 2012 The CDC estimates 40% of children and 34% of adults live with wireless service only and the trend is increasing. We have seen an increasing trend toward out of region calls for human exposures being received by PCs. A temporal trend between increasing smart phone use and out of region calls is appearing. Poison centers may have to adapt by allowing a more geographic based routing of cell phones.

Conclusion: In the sample of 8 regional PCs covering 9 states, we saw a decreasing trend of in-region and increasing trend of out-of-region calls for human exposures, beginning in 2007 with a clear linear trend. As of April 2014 more than 5% of human exposures calls are being received by these poison centers from outside their geographic region.

Keywords: Poison center, Call Routing, call phones

201. Pediatric ingestions of duloxetine – what is a "safe" dose?

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Background: Duloxetine (Cymbalta®, Eli Lilly) is a dual-selective serotonin and norepinephrine reuptake inhibitor that is used in the management of depression, anxiety, and pain. Currently, the safety and efficacy of duloxetine in pediatric patients have not been established. The purpose of this study is to identify an amount of duloxetine ingested by children that can be safely managed outside of a healthcare facility (HCF).

Method: All calls to this regional poison center (RPC) involving children <7 years of age with a reported ingestion of duloxetine for the years 2003 through 2013 were extracted for analysis. Cases involving multiple substances were excluded. Cases were analyzed by medical outcomes, effects, therapies provided, and reported amount ingested per weight (mg/kg) as exact, estimated, and maximum amounts ingested.

Results: Of 254 total cases identified, 205 were included in the study; 82% were 2 years of age or younger, and 51% were male. On-site management was utilized in 64%. Seventy-two (35%) were followed to a known outcome; 63 had no effects, 7 had minor effects (vomiting, drowsiness and agitation) at reported doses of 5.3–35.1 mg/kg, and 2 had moderate effects (marked agitation, tachycardia, and hypertension) at reported doses of 6.6–8.3 mg/kg. There were only 24 cases out of 205 with an exact amount of duloxetine ingested per caller history, ranging from 0.8 to 6.2 mg/kg. Of these, 7 were followed to a known outcome of no effect at reported doses of 1.7 to 6.2 mg/kg.

Conclusion: Based on this study, ingestion of duloxetine in children in amounts less than 6 mg/kg are unlikely to cause any clinically significant effect and could be safely managed outside a HCF. Additional studies may be useful to determine more precise pediatric triage guidelines for the management of pediatric duloxetine ingestions.

Keywords: Poison center, Pediatric, Duloxetine

202. Measuring increasing complexity of cases of a regional poison center

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Background: Like many Regional Poison Centers (RPC), this RPC has experienced a decrease in calls from 2000–2013, with concomitant decreases in funding. Staffing has not been able to be reduced proportionately to the decrease in call volume without adversely affecting customer service metrics. The annual report of the AAPCC NPDS addresses increases in severity in outcomes. The purpose of this study is to determine a way to measure change in the complexity of the cases called into a RPC.

Method: All calls to this RPC from 2000–2013 were analyzed for the following: Caller Site, Substances, Effects, Therapies, Management Site, Follow-Ups and Medical Outcomes. Trends were calculated between the years 2000 and 2013.

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Results: Between 2000–2013, there was a 10.4% decrease in human exposures reported to this RPC. This reflected a 20.9% decrease in calls from the lay public but a 51.6% increase in calls from Health Professionals. Calls involving more than 1 substance increased from 7.35% of exposure calls to 10.76%. Cases with more than 1 reported clinical effect increased by 27.6%. While there was a 14.5% decrease in calls referred to a HCF for treatment, there was a 60.9% increase in calls about patients already in the HCF. The number of follow-up calls has increased from 0.52 calls per human exposure in 2000 (40930/78225) to 0.73 calls per human exposure in 2013 (51292/70124). Cases coded by SPIs as "critical" increased 200%. There was a 50% increase in reported fatalities. Allowing appropriate time factors for call completion, documentation, and consultation with medical backup, average workload per call increased 8.4%. Total workload (including 10.4% lower call volume) decreased 2.2%.
Conclusion: Despite a decrease in call volume to this RPC, there has been a significant increase in the complexity of those cases based on several variables, including caller site, number of substances involved, number of clinical effects and treatments, number of follow-ups required, and severity of medical outcomes. These factors combined to increase the time required by the RPC staff in handling each case. Workload measures based solely on call volume fail to accurately reflect SPI time needed to operate the RPC.
Discussion: Funding of RPCs that is based solely on the number of calls handled does not correctly assess the amount of work required. Appropriate staffing should be determined both by call volume and call complexity, and financial support for RPCs should reflect both factors. Further study is needed to refine the time units associated with each measure of complexity.
Keywords: Poison center, Workload, Productivity

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203. Internet impact on call volume to a U.S. regional poison center

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Background: Call volume to United States poison control centers has decreased over the last 5 years. A main suspect behind this decline is increased access and availability of the Internet. In 2009 a statewide regional poison center (RPC) experienced an increase in deodorant exposure cases originating from out of state. It was subsequently found that the RPC's direct telephone number had been posted on the website Yahoo! Answers in response to an online question about deodorant exposure in a child. The aim of this study was to determine if this phenomenon could be replicated to further support the assumption of Internet use affecting call volume to poison centers.
Methods: Data collection occurred October 2011 through October 2012. A scenario of a child ingesting the contents of a "glow stick" was posted on the websites: WikiAnswers, Answers, Yahoo! Answers, and Ask. Using a second online account a response to this scenario was immediately posted directing readers to call the RPC's direct toll-free telephone number for information and recommendations regarding the exposure. The post did not identify a RPC as the information source. Calls regarding glow products (GP) during the study period were handled in the usual manner. At the conclusion of each GP interaction callers were asked specific questions related to the study. These included: the source of the number, targeted questions if number was found on the Internet and type of phone they were using to call the RPC. Case management or caller attitudes/beliefs were not investigated by the study.
Results: For the year prior to the study period there were 202 total GP calls including 3 originating from out-of-state. During the study period, total GP call volume increased 46% to 295 cases, and out-of-state cases dramatically increased 2,067% to 65. This spike in calls continued into the one year post study period, in which total GP volume totaled 313, and out-of-state cases amounted to 79 for that period. Furthermore, there were an additional 2 cases from outside the United States. In-state callers obtained the number used to call the RPC from various sources: the Internet 24%, a magnet/poster 21%, phonebook 18%, a 3rd party (healthcare facility, family, or other person) 18%, and undocumented source 19%. In comparison 92.3% of out-of-state callers obtained the number from the Internet.
Conclusion: This study shows an increase in both in-state and out-of-state call volume to a RPC as a confirmed result of caller's Internet use. This finding supports the hypothesis that the Internet is being utilized to obtain information in response to accidental poisonings and can directly impact call volume to US poison centers.
Keywords: Internet, Poison center, Call volume

204. Toxicology teleconsultation for deployed U.S. military personnel: a 10-year experience

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Background: Military medical providers deployed to combat zones or other austere environments overseas frequently encounter patients with medical conditions or exposures that they are not accustomed to dealing with. For that reason, various specialties within the U.S. Department of Defense (DoD) have established medical teleconsultation services via email, whereby deployed providers can submit an email request for assistance from experts in one or more medical subspecialties. A small group of medical toxicologists within DoD has been fielding such consultations for the past 10 years. Over that time, providers have sought assistance for a wide variety of cases, but up to this point, the database of these consultations has not been comprehensively studied.
Objectives: To comprehensively review the DoD database of medical toxicology teleconsultations from its inception to the present day.
Methods: Data from medical toxicology consultations contained within the DoD Teleconsultation Database in San Antonio, TX were abstracted into a standardized data collection sheet. Data analyzed included date/time of exposure, age/sex of patients, general location (country or afloat) of patient, service branch of patient and consultant, type of exposure, time period from initial consultation to first expert response via email, and final diagnosis (if available).

Table 1. Number of consults by year.

Year	# of Consults
2005	2
2006	20
2007	17
2008	14
2009	5
2010	20
2011	12
2012	10
2013	3
2014	1

Data from the time of database inception (2005) to the present were analyzed.

Results: A total of 104 consults were placed over 10 years. Consults by year are shown in the Table 1. Mean time from initial consult placement to first expert response was 3 hr 53 min (median 2 hr 3 min); 70% of consults were answered within 5 hours. Patient locations included Iraq (42%), Afghanistan (35%), Kuwait (5%), Qatar (4%), U.S. Navy afloat (3%), and Other (11%). Service branches of patients included Army (44%), Navy (7%), Air Force (3%), Marine Corps (3%), civilian contractor (3%), civilian non-combatant (11%), and Other/Not Stated (30%). Common consultations involved snakebites (14.4%), scorpion envenomation (8.7%), pesticide exposure (2.9%), acetaminophen overdose (1.9%), and jet fuel exposure (1.9%).

Conclusions: Over the past 10 years, military toxicologists have provided assistance to many deployed medical providers on a wide range of topics. Nearly 25% of consultations involved envenomations. Use of this service appears to correlate generally with peak troop activity in Iraq and Afghanistan. We believe that the use of such remote consultation services should continue to be made available to deployed medical personnel.

Keywords: Public health, Medical toxicology, Occupational

205. Lack of association between drug overdose related deaths and population density

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Background: Drug-overdose related deaths (DRD) have been rising nationally over the past 15 years. Many of these deaths have been attributed to the increasing use and abuse of prescription pain medications. The general public often perceives drug abuse as an epidemic seen mostly in the urban setting. The aim of this study is to characterize the setting of increasing drug overdose related deaths at the state level by population density.

Methods: Utilizing the Multiple Cause of Death Data, available for query by the Center for Disease Control, Wide-ranging Online Data for Epidemiologic Research (CDC WONDER), we analyzed DRD and crude rate (CR) between 1999–2010 for all 50 states. Crude rate represents the number of DRD per 100,000 persons. Population density for each state was calculated as people per square kilometer and averaged over the 12-year study period. Each state's CR was plotted from 1999–2010 and the slope of the best-fit trendline was then used to determine the average rate of rise for each state. Population density for each state was the plotted against the average rate of rise in CR.

Results: Forty-eight states had an increase in the reported DRD over the 12-year study period. During this time, the population in the US increased by 11%, while the DRD and CR increased by 127% and 106% respectively. New Jersey (rate of CR = -0.021) and North Dakota (rate of CR = -0.74) were the only two states that had declining rates of DRD, although 7 years of data from North Dakota was deemed unreliable by the CDC and not included in this study. Maryland had the lowest rate of increase (rate of CR = 0.014) and West Virginia had the high rate of increase (rate of CR = 1.61). The average rise in CR nationally was an increase of 0.68 per year. The relationship between population density and average change in CR was constant, as defined by the trendline $y = -0.0001x + 0.7053$ for the scatter plot.

Conclusions: DRD is a national epidemic and is attributable to the growing use and abuse of prescription pain medications. Our study indicates that varying rates of increase in CR is seen both high and low population density states. Analysis of population density is inadequate to accurately define urban or rural populations and a more directed analysis of these geographic subgroups would be needed to further characterize the geographic setting of DRD.

Keywords: Epidemiology, Public health, Opioid

206. Safety of lacosamide ingestions – a retrospective poison control center review

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Background: Lacosamide (Vimpat®) is an antiepileptic approved in October 2008 as an adjunct in the management of partial-onset seizures in patients ≥ 17 years. There is limited data regarding its toxicity. The purpose of this study is to describe the epidemiology and clinical course of non-therapeutic ingestions of lacosamide.

Method: This was a retrospective database review of lacosamide exposures reported to the National Poison Data System (NPDS) between 10/08 and 12/13. Data collected included demographics, route, reason for exposure, clinical effects, management site, medical outcome and co-ingestants. Only single agent exposures were used to report symptoms. Cases involving adverse drug reactions (ADR) and confirmed non-exposures were excluded from clinical effect analysis.

Results: A total of 1,402 cases were reported. 460 involved lacosamide alone. Of these, 454 were ingestions. The exact dose in milligrams was reported in 102 cases. Cases in which the dose was reported as a number of tablets were converted to milligrams based on the poisindex code used.

The median age was 27 years (interquartile range [IQR] 14 years, 45.5 years) and 44.3% were males. Children ≤ 5 years accounted for 148 (32.1%) exposures. The yearly case total steadily increased from 0 in 2008, to 17 in 2009, 67 in 2010, 130 in 2012 and 156 in 2013.

The most common reasons for exposure were unintentional therapeutic error (239), unintentional general (89), intentional suicide (69), adverse drug reaction (34), and unknown (12). 225 (48.9%) were referred or already en route to a health care facility

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and 219 (47.6%) were managed on site. Symptoms were reported in 208 of the analyzed cases. Drowsiness, vomiting and dizziness were the top 3 reported symptoms followed by nausea, seizures, tachycardia, ataxia, agitation, coma and confusion. Seizures accounted for 17% of symptoms reported. The highest reported dose in a pediatric exposure was 3,500mg in a 5 year old child who remained asymptomatic. There were 16 (3.5%) cases with a major outcome, 54 (11.8%) with a moderate outcome, 104 (22.6%) with a minor outcome and 111 (24.1%) had no effect. No deaths were reported in the single agent group. 3 deaths were reported when at least 1 co-ingestant was involved. The primary co-ingestants were anticonvulsants, atypical antipsychotics and benzodiazepines.
Conclusion: Lacosamide ingestions reported to US poison control centers indicate that overdoses generally had good outcomes with few significant clinical effects. Seizures were seen in a relatively large number of cases.
Keywords: lacosamide, Anticonvulsant, Overdose

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207. Retrospective analysis of propofol use for toxin-related seizures: case series

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Background: Propofol has been used as an adjunct for cessation of seizures. There is very little evidence-based medicine to support its use for toxin-related seizures. The intent of this study was to characterize the use of propofol within a poison center population and evaluate efficacy and adverse effects in toxin-induced seizures.
Methods: This study is an IRB approved retrospective case series reviewing electronic records from a poison system from 2009–2012. Inclusion criteria: 18 years of age or greater, cases coded with "seizure" and containing the free text "propofol". Cases were excluded if there was no clear history of any of the following: toxin exposure, witnessed seizure or use of propofol. The age, sex, reported xenobiotic exposure(s), reoccurrence of witnessed or EEG confirmed seizure activity while propofol in use, use of mechanical ventilation, and mortality were extracted from medical charts.
Results: 235 cases of the original 405 cases queried matched inclusion criteria. The age range was 18 to 82 years; average was 38. Males composed 48.9% (n = 110). The mortality rate was 6.8% (n = 16) and 7 cases were lost to follow up in terms of survival outcome. 155 different toxins were noted as suspected toxic exposures. Single substance exposures were seen in 131 cases and polysubstance in 104. The most common single substance was diphenhydramine (n = 13) and the most common polysubstance exposure was bupropion (n = 33). Bupropion (n = 7) was the most common substance associated with seizure recurrence. 99.6% (n = 234) were mechanically ventilated. Recurrent seizure was only noted in 15.7% (n = 37) of the cases while propofol was in use. In one case, propofol was implicated as the precipitating cause of seizure. This patient, with history of seizure disorder, was administered propofol for procedural sedation. It resolved without intubation or significant clinical consequence.
Discussion: Despite much scientific evidence, propofol is being utilized in the management of toxin-related seizures for a wide variety of toxins. Given the retrospective nature of this study, there is an inability to make a concrete determination regarding propofol's role in treating toxin-induced seizures. An overwhelming majority (99.6%) were mechanically ventilated during their hospital course. Given this, it could be assumed that propofol may be reserved for refractory cases and in cases in which the airway needed to be secured. It may also reflect the deep level of sedation achieved with the use of propofol. The relatively low seizure recurrence rate of 16.7% suggests that propofol may be effective as an adjunct for seizure cessation with a broad spectrum of toxins.
Keywords: Seizure, Anticonvulsant, Overdose

208. A retrospective analysis of phenytoin toxicity

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Background: Phenytoin has a narrow therapeutic index and delayed clearance at elevated concentrations resulting in toxicity that can lead to prolonged hospitalization. The goal of this study was to characterize the hospital course, outcomes and complication rates in patients admitted for isolated phenytoin toxicity.
Methods: A retrospective cases series was obtained from poison system (PS) electronic records of isolated phenytoin exposures from years 1998–2005. Patients were included if they were observed in the emergency department or admitted solely for phenytoin toxicity. Exclusion criteria included: admission for other medical conditions and cases lost to follow up. Age, sex, intentionality, serum concentrations, symptoms, treatments, duration of PS follow up, maximum level of care, and serious events, defined as occurrences after arrival requiring immediate intervention, were identified.
Results: Among ages 0–5 years there were 24 cases. The average initial and maximal serum concentrations (mg/L) were 39.63 and 41.34. The average duration of PS follow up was 2.46 days. 54.2% (13) cases were treated with activated charcoal. 4 were admitted to intensive care unit (ICU). The lone complication was an infiltrate seen on chest x-ray which was treated with antibiotics. Among ages ≥ 6 years there were 457 exposures, 149 were intentional overdoses (INT), 297 unintentional overdoses (UN) and 11 unknown reasons. The average duration of PS follow up for INT and UN were 3.48 days and 3.21 days respectively. The average peak INT and UN serum concentrations (mg/L) were 43.65 and 47.01 respectively. Only 14% of the UN had peak concentrations greater than initial, compared to 36.9% for INT. ICU admission occurred in 24.2% of INT 8.4% of UN. 85.2% of INT and 41.8% of UN were treated with single or multi-dose activated charcoal. The complication rate of INT was 2% and UN was 4.3%. No mortalities occurred. The serious events were seizure (4), infection (4), fluid responsive hypotension (3), intubation (1), laceration (1), non-operative subdural hematoma, no new fall after arrival (1) diagnosis of leukemia (1).

It is unclear if these events were directly caused by phenytoin toxicity. No deaths were observed.
Conclusions: The majority of patients admitted for isolated phenytoin toxicity had no significant complications during their hospitalization. Given the rarity of complications and absence of arrhythmias, these patients may not require ICU care. The most

common associated events appear to be seizures, respiratory infection as well as increased risk of fall and related injuries. If patients can be protected from traumatic injuries, are able to tolerate oral feeds, and can be safely observed, many of these cases may not require hospitalization.

Keywords: Anticonvulsant, Overdose, phenytoin

209. Electronic cigarettes: A safe way to light up?

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Background: An electronic cigarette (E-CIG) is a battery-powered device that vaporizes liquids and is typically used to simulate tobacco smoking. E-CIG juice, or e-juice, is the liquid used in these tobacco vaporizers. In recent years Poison Centers have seen an increase in exposure calls involving E-CIGs and e-juice. While marketed as a safe alternative to tobacco products, this e-juice often contains amounts of nicotine known to be fatal to children. The e-juice often also contains flavors that may be enticing to a child, raising the risk of poisoning. As these products become more popular, the risk of a deadly exposure continues to rise. Other tobacco products contain amounts of nicotine that also may be fatal to a child and provide a control group. We present data that characterizes E-CIG exposures compared to tobacco products at a regional poison center over a three year period.

Methods: A retrospective review was performed for all human exposures to E-CIGs and tobacco products (TOB) that were reported to a regional poison center from January 2011 to December 2013. Data was analyzed for age, sex, management site and medical outcomes.

Results: Of the 657 cases reported, 87 were in the E-CIG group – 5 cases in 2011, 8 cases in 2012 and 74 cases in 2013; 570 in the TOB group – 175 cases in 2011, 210 cases in 2012 and 185 cases in 2013. The majority of both E-CIG and TOB exposures occurred in children < 6 years old (50.6% E-CIG, 84.4% TOB) and males (55% E-CIG, 54% TOB). More E-CIG cases (33.3%) were managed at a healthcare facility (HCF) than TOB cases (11.1%). Of the cases managed in HCFs, 65.5% of the E-CIG group and 87.3% of the TOB group were treated and released from the Emergency Department (ED), while 3.4% vs 3.2% were admitted to the ICU, 0 vs 3.2% admitted to non-ICU, 3.4% vs 0 to psychiatry and 27.6% vs 6.3% were lost to follow-up/left AMA. Over half of the cases experienced no effect (21.8% vs 26.8%) or minor effects (31.0% vs 27.4%) for E-CIG and TOB groups, respectively.

Conclusion: Although nicotine has been around for decades, our data indicate that E-CIG exposures are on the rise and more likely to require HCF management than exposures to other tobacco products. Our data show no serious outcomes have yet been reported from these exposures, but E-CIG products continue to become more popular and more available. The majority of these exposures occur in children < 6 years old, and given the known toxicity of nicotine and the concentration of nicotine in e-juice, a significant event seems inevitable. Poison Centers will continue their surveillance efforts and provide ongoing education to alert the public of the potential nicotine dangers.

Keywords: Nicotine, Pediatric, Public health

210. Changing the acetaminophen overdose thresholds: economic implications on poison center referrals

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Background: Recently, the UK's MHRA lowered the threshold for N-acetylcysteine (NAC) therapy to a 4-hour concentration above the 100 mg/L line. This study examined the pharmacoeconomic implications of this decision on poison center referrals.

Methods: A retrospective convenience sample of consecutive acetaminophen (APAP) cases from two Canadian and one US poison control center (PCC) was collected. A case was defined as an acute non-suicidal ingestion not referred to or already in hospital. Ingestion histories were divided in mg/kg strata to contrast the number of cases that would be referred to hospital under the UK National Poisons Information Service referral threshold of 75 mg/kg but were not sent to hospital under current guidelines. The Canadian Acetaminophen Overdose Study database was analyzed to obtain known rates of hepatotoxicity, fulminant hepatic failure and death for APAP OD without NAC treatment for 4-hour APAP concentrations below 100 mg/L and between 100 and 149 mg/L. A pharmacokinetic model calculated the predicted 4-hour APAP concentration. A simplified decision-tree economic model was used to evaluate the economic and health implications of a reduction in the referral threshold to predict the proportion of additional cases referred for APAP measurements and the proportion that would require NAC treatment with the new UK thresholds. Costs were assigned based on available fees converted to US dollars.

Results: A total of 1631 cases were obtained. 734 were excluded because they either were suicidal, already in hospital, non-acute ingestions, or had ingested doses above traditional referral thresholds. An additional 277 were excluded due to incomplete data. This left 620 cases for analysis, of which 180 were adults with APAP ingestions between 75–149 mg/kg and 440 were children with APAP ingestions of 75–200 mg/kg. None had predicted 4-hour APAP concentrations above 100 mg/L to require NAC therapy. None would have developed fulminant hepatic failure or died. 3 could have had transaminases above 1000 UI/L. Based on new UK threshold, for every 1000 APAP-related calls to a PCC, 154 children and 33 adults would have to be referred to hospital compared to 10 and 9, respectively, if today's guidelines were followed. This would imply an additional health care cost of $86 281, or $513 per additional case referred. If applied to the US NPDS data for the annual number of APAP calls, the direct annualized cost for the US would exceed $6 million.

Conclusions: In this model, lowering the APAP treatment threshold to a 4-hour equivalent of 100 mg/L and the referral threshold to 75 mg/kg would significantly increase health care costs for APAP calls to PCCs without clear health benefit.

Keywords: Acetaminophen (paracetamol), economic implication, treatment threshold

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211. Utilization of a poison control center by critical access hospitals – one state's experience

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Background: Critical access hospitals (CAH) are defined by the federal government as health care facilities with less than 25 beds and an annual length of stay of 96 hours or less per patient for acute care case. The state of Kansas has more CAHs than any other state. Typically these hospitals lack specialty care, are geographically isolated, and serve a rural populations spread over a large area. The utilization of poison control center (PCC) by CAH has not been well characterized. We sought to evaluate how CAH utilize the poison control center compared to larger rural hospitals (LRHs) and urban hospitals (UHs).
Methods: We performed a retrospective review of the University of Kansas Hospital Poison Control Center's 2013 database. CAH were defined as above. Fifety-five were included in the study. The LRH were defined as having 150 or more inpatient beds but being >60 miles from an urban population center. The three largest LRH by ED visits were selected for this study. Three UH were selected and were defined as the largest hospitals by ED visits in each of Kansas'three main urban population centers (Wichita, Kansas City, Topeka). All population data was from the United States 2010 census and ED visit data from Kansas Association of Hospitals. Data collected included: number of calls, outcome, number of follow up calls, rate of transfer, intentional vs unintentional exposure, involvement of a toxicologist, single vs multiple exposure(s), age of patient, and caller profession. Tests for significance was performed using Paired T-test for utilization rates, Chi-squared test for categorical variables and ANOVA for continuous variables.
Results: There were 840 total cases. Two hundred ninety-nine cases came from CAH, 301 from LRH and 240 from UH. When corrected for emergency department (ED) visits, CAH and LRH utilized the PCC more frequently than urban centers ($p = < 0.001$). Severity of calls were significantly higher at UH with more severe cases and deaths reported than with CAH and LRH cases ($p = < 0.05$). UH cases required more follow up calls ($p = < 0.05$). There was no significant difference in toxicology consults between the three groups. Significantly more patients were transferred from CAH than LRH or UH ($p = < 0.001$). CAH had less intentional and multiple substance exposures than LRH ($p = < 0.001$) but not UH.
Conclusions: CAH utilized the PCC more than UH but calls were associated with less severe outcomes but more transfers. Further studies are warranted to optimize PCC services for rural hospitals.
Keywords: Poison center, Public health, Rural medicine

212. Pediatric exposures to topical preparations containing methyl salicylate

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Background: Unintentional ingestions of methyl salicylate are frequently reported within the pediatric population mostly as topical preparations of various concentrations. Although there are several case reports of toxicity and death resulting from ingestion of oil of wintergreen (OOW- 98% methyl salicylate), there are few case reports of toxicity from less concentrated methyl salicylate topical preparations. Our primary aim is to report the minimum dose of methyl salicylate ingested by a child 6 years or less that resulted in a supratherapeutic serum salicylate level.
Methods: This is a retrospective chart study of a regional poison center (RPC) from 2000 to 2011 for all cases involving children age 6 years or less with a single acute ingestion of a methyl salicylate preparation. OOW exposures were excluded. Other inclusion criteria required management within a healthcare facility, a documented serum salicylate level result, and a historical amount of methyl salicylate ingested per weight (mg/kg).
Results: Out of 524 cases identified, 94 cases met all inclusion criteria. There were 44 females (47%) and 50 males (53%). Five were <12 months of age (5%), 45 12 months to <2 years (48%), 36 age 2 years (38%), and $8>3$ years (8%). The known concentration of methyl salicylate ranged from 0.2% to 55%, with 95% of cases involving a 30% or less methyl salicylate product. One product was reported to contain $<70\%$ methyl salicylate. Reported doses ingested ranged from 1.25 gm to 60 gm. By history, 19 had ingested <150 mg/kg (20%) and 75 ingested >150 mg/kg (80%); 46 of these cases reported >240 mg/kg (49%). The most common symptoms reported were oral irritation (8%), vomiting (3%), and drowsiness (3%). No symptoms were reported in 71% of the cases. Of 94 cases, 93 cases had a documented salicylate level of <10 mg/dL; 71 of the 94 levels were obtained within 2 to 4 hours post ingestion. Only 1 case had documented elevated salicylate levels (31 mg/dL and 34 mg/dL at 2 and 4 hours post ingestion, respectively) after reportedly ingesting 5 gm of a $<70\%$ methyl salicylate preparation (potential max of 426 mg/kg). This sample size provides statistical support that this no-effect finding is predictive at $>95\%$ confidence (Kilbourne et al, JTCT 2008).
Conclusions: Based on this 10-year evaluation of cases of methyl salicylate at concentrations up to 55% with documented salicylate levels, referral to a HCF for asymptomatic unintentional pediatric ingestions of methyl salicylate preparations $<55\%$ seem to be unnecessary regardless of the reported amount ingested. Preparations containing $>55\%$ methyl salicylate were not evaluated and may continue to warrant HCF evaluation after reportedly large ingestions or when the amount ingested is uncertain.
Keywords: Salicylate, Pediatric, triage

213. Acute oral methotrexate ingestions: A thirteen-year poison center review of acute oral methotrexate exposures

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Background: Methotrexate (MTX) is a folic acid analogue and inhibitor of dihydrofolate reductase. It is widely used in the treatment of cancer and rheumatoid arthritis; it is also commonly used

following organ transplantation and therapeutic abortions. While intravenous and intrathecal MTX overdose may result in severe toxicity, symptoms following oral overdose are generally mild. Available treatment options include gastrointestinal decontamination, hydration, urinary alkalinization, and leucovorin rescue. In our experience, significant toxicity from acute oral MTX overdose is uncommon and specific antidotal therapy is generally not required.

Hypothesis: Acute oral MTX exposure does not result in clinically significant toxicity and can be safely managed in the outpatient setting.

Methods: We conducted a retrospective review of all MTX exposures reported to a single poison center from January 1, 2001 through December 31, 2014. The data extracted included: method of exposure (oral, injection, ocular, etc), amount of drug, co-ingestants, symptoms, treatments, disposition, and outcome.

Results: Thirty-five MTX exposures met inclusion criteria. Of these, 25 (71%) were acute oral exposures. The exposure dose ranged from 1.25 mg to 60 mg. Nineteen patients (76%) were managed at home and were not referred to a healthcare facility. Three patients were evaluated in an ED and discharged home without treatment. Of the patients that were admitted (N = 3, 12%), two were admitted for toxicity unrelated to MTX; none developed MTX toxicity or required leucovorin rescue. The first patient ingested unknown amounts of methotrexate, donepezil, memantine, furosemide, lisinopril, fluoxetine, and alcohol, and was admitted for altered mental status. The second patient ingested methotrexate, carvedilol, cyclobenzaprine, and carisoprodol, and was admitted to the PICU for somnolence and tachycardia. Both patients recovered fully without sequelae. The third patient was admitted for psychiatric treatment only.

Discussion: This retrospective study supports previously published literature that significant toxicity from acute oral MTX ingestion is uncommon. In this largest case series to date, there were no fatalities associated with MTX, no patient required leucovorin therapy, and no patient experienced clinically significant sequelae directly related to ingestion of MTX.

Conclusion: Acute oral MTX ingestions up to 60 mg do not result in significant toxicity and can be safely managed in the outpatient setting.

Keywords: methotrexate, Ingestion, Poison center

214. A dashboard for health information exchange between poison control centers and emergency departments: the poison control center view

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Background: Poison control centers (PCCs) and emergency departments (EDs) rely on telephone communication to coordinate care for poison exposed patients, which can lead to miscommunication, data loss, and error. Health information exchange (HIE) can improve information sharing between PCCs and EDs, resulting in reduced error, improved decision-making, and improved continuity of care. However, current PCC information systems are not designed to facilitate information exchange. Therefore, we are developing an electronic communications dashboard system for PCC use. PCC dashboard functionality includes messaging and displaying information such as lab values, vital signs, progress notes, and medications exchanged between the PCC and ED systems. The purpose of this study was to conduct iterative and formative usability testing on the PCC dashboard with PCC users.

Methods: To engage users early in system design, we conducted iterative usability testing on an interactive prototype of the PCC dashboard. A patient case vignette was presented to anticipated end users of the system, specialists in poison information (SPIs). Qualitative testing consisted of think aloud sessions where the user was asked to accomplish specific tasks related to the case vignette. Then, the participant completed a survey using the System Usability Scale (SUS). SUS is a 10-question, 5-point Likert scale, subjective measurement of system usability with scores that range from 0 to 100. Higher SUS scores represent better usability, scores above 68 show better than average usability. We solicited open-ended comments and recommendations from users as part of the questionnaire and testing.

Results: Three users tested the dashboard with an average SUS score of 77.5. Users indicated high satisfaction with the ability to access lab values, vital signs, medication information, and progress notes in one location, along with notification and messaging features. Users suggested some areas of improvement, including changes to the display of medications, lab values, vital signs, and messaging indicators. Specific specialist comments on usability and the updated prototype will be presented.

Conclusions: The SPIs that participated in the study found the dashboard to be very useful in displaying information between the PCC and ED, such as lab results and vital signs. Development and testing of the PCC HIE dashboard are ongoing, and this iterative design approach has facilitated active user engagement and invaluable input during the formative stages. Future, larger-scale usability testing with a larger number of users is planned for when the prototype nears finalization.

Keywords: Information exchange, Public health, Usability testing

215. Survey of us poison center surge capacity planning

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Background: Terrorism, chemical spills, disease outbreak, as well as food and water contamination have caused surges in demand for poison control center (PCC) services; many US PCCs have been planning to handle such surges.

Methods: We twice invited all US PCC directors to an online survey about surge plans.

Results: Responses came from 25 PCC directors and 1 state health official representing 6 PCCs, for a net response rate of 31 of 56 PCCs (55%). Directors' perceptions of PCC surge capacity vary widely. Most centers (88%) have a surge plan, though not all exist as a single document, and one PCC (2%) reported having a surge plan only in the director's mind. Most PCCs (100%) plan to get more work out of their own SPIs, either at the PCC (68%) and/or via telework (60%). Some PCCs (23%) plan to divert calls to other centers, especially those PCCs that already networked and share a common database and call distribution tools. Some PCCs have

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arranged to divert calls to unattached PCCs. Some PCCs would bring in other health care professionals, from a sponsoring hospital (44%) or affiliated nurse call center (2%). Regarding getting more work from their own SPIs, some pay overtime, some provide comp time, and some pay SPIs at their normal rate. Some PCCs plan to increase surge capacity by one of several telephone options: IVR (26%), pre-recorded information messages (13.8%), pre-recorded information messages with an option to reach a SPI (2%). Besides increased use of SPIs, some PCC plans include using volunteers (28%), physicians including fellows rotators and off-duty consultants (3.6%), medical and managing directors (2%), public health workers (2%), and pharmacy students (2%). To route surge calls to non-SPI call-takers, most PCCs use technology (71%), but some require the SPI to triage the call (6%). Most PCCs planned to capture surge calls for NPDS via standard data entry (61%), IVR capture (39%), and/or later transcribing of paper records into NPDS (13%). Some PCCs would not capture calls handled only by IVR (2%). Developing and maintaining surge capacity appears to be very expensive, often consuming preparedness grants: federal 33%, state 67%, host institution 14%, other grant 19%, local 5%, other 14%. While most PCCs with surge plans report their plans have been tested (69%), some respondents commented that only parts of the surge plan was tested, or the testing was limited to a tabletop or functional exercise.

Conclusion: The preparedness of PCCs for call surge is variable, but several models exist. Significant investment of time and money will be needed to maintain and enhance preparedness. Future research should measure the efficacy and cost:benefit ratios of the various tools available.

Keywords: Poison center, surge planning, disaster preparedness

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216. Use of poison center follow-up surveys to investigate health-seeking behavior

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Background: Effective public health threat detection and consequence management planning requires accurate modeling of Health Seeking Behavior (HSB). Currently, little published data exists to provide quantitative evidence for HSB assumptions. US Poison Centers (PCs) provide a national framework for real-time public health (PH) surveillance and routinely respond to a variety of poisoning and PH threats. In support of the US EPA's Water Security Initiative, the Cincinnati Drug & Poison Info Center (DPIC) and Rocky Mountain Poison Center (RMPC) partnered to prospectively conduct caller satisfaction surveys in an attempt to further evaluate HSB patterns among populations that utilize PC services.

Method: An IRB approved follow-up phone survey was developed and prospectively conducted by DPIC and RMPC. HSB guided questions included method used to obtain PC phone number, self-research prior to calling PC, actions taken if PC were not available and patient/caregiver insurance status. PC calls involving potential public health events (e.g. food poisoning, environmental contaminants) were preferentially selected over more typical PC calls (e.g. medication errors, accidental pediatric ingestion). Survey responses were merged with the coded PC exposure record. Statistical analysis (descriptive, Chi-square) were performed by the US EPA in collaboration with PC partners.

Results: 480 phone surveys were conducted between Sep 2012 and April 2013. The majority of exposures surveyed did not warrant escalated medical care (N = 469, 98%). Approximately 1 in 4 respondents consulted a separate information source prior to calling the PC. Insurance was the only statistically significant variable for determining how the PC phone number was obtained ($p = 0.002$). Respondents with government-based insurance were more likely to be referred by a healthcare provider as compared to employer-based insurance (18% vs 10% respectively). Age and insurance status were statistically significant for predicting aggressive health seeking behavior ($p = 261$ and 0.004 respectively). Young children and government-based insureds were most likely to seek care in an ED (58% and 52% respectively).

Conclusions: PC surveys provided new insights into predictors for HSB. Results suggest that the government-insured demographic might benefit from more targeted PC outreach strategy

Keywords: Surveillance, Health Seeking Behavior, PoisonCenter Utilization

217. The role of poison centers in pregnancy and public health

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Background: Poison control centers are integral to the core functions of public health, including: assessment, assurance, and policy development. Poison centers offer opportunities to assess human exposures during pregnancy; and have the potential to provide information for assurance of maternal child health services and public health policy development. Poisoning during pregnancy can threaten the well-being of the maternal-fetal environment, and may necessitate the use of resources of healthcare facilities and services.

Methods: Using a retrospective descriptive design, data was examined from records of the California Poison Control System (CPCS), a participating center in the National Poison Data System (NPDS) surveillance database. As part of an ongoing study on maternal – fetal exposures, pregnancy-related calls were reviewed from the CPCS, years 2000 through 2007 (n = 9101). Exposure groups were divided into < 19 years and > 20 years of age, in those cases where age was reported.

Results: Pregnancy-related calls accounted for 0.35% of total poison center calls; and teratogen information accounted for 0.04% of total information calls. The maternal age range was 16–47 years. In the < 19 years age group, 52% required management in a health care facility, in contrast to 20% in the 20 years and older group. Select exposures that were potentially harmful to the maternal-fetal environment included: salicylates, acetaminophen, iron, rattlesnake bites, antiseizure medications, drugs of abuse, carbon monoxide, lead, and mercury. The information was evaluated for national and global policy implications for maternal-child health. Poison control center data could contribute to Title V HRSA provisions

needed for construction of community-based systems. Further, prevention efforts and education on exposures in pregnant women addresses Goal 5 of the Millennium Development Goals: "Improving Maternal Health."

Conclusions: Maternal-fetal surveillance is paramount for the analysis of potential risks from poisoning, and providing data for assuring maternal-child health services. Future studies should include an evaluation of birth outcomes, which was unavailable from this data. There is a significant need and opportunity for poison control centers to partner with other public health agencies to accurately assess maternal and fetal implications, and participate in national and global health policy decisions.

Keywords: Public health, Poison center, Surveillance

218. Testosterone exposures reported to poison centers

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Background: In recent years, there has been a dramatic increase in the use of testosterone in healthy middle aged and older men for decreased energy, sexual interest and treatment of "LowT" or low testosterone; with US sales projected to reach $5 billion by 2017. Ads for testosterone products often include warnings not just for the male user but also that women and children should avoid exposure to the product. This study describes testosterone exposures reported to poison centers.

Methods: All testosterone exposures reported to a statewide poison center system during 2000–2013 were identified. Exposures involving other substances in addition to testosterone and exposures not followed to a final medical outcome were included. The distribution by selected demographic and clinical factors was determined. Analyses of management and outcome were limited to those exposures not involving other substances.

Results: There were 251 total cases. The annual number tended to increase with 45% reported during 2011–2013. 50% of the patients were males 20 + years in age, 14% females 20 + years, 35% age < 20 years, and 1% unknown. 75% of the exposures were unintentional (22% therapeutic error), 15%intentional (12% misuse/abuse), 6% adverse reaction, and 3% unknown reason. The exposure route was 44% ingestion, 26% injection, 22% dermal, and 13% ocular. 225 (90%) did not involve other substances. Of these cases, the management site was 80% on site, 12% already at/en route to healthcare facility, 7% referred to healthcare facility, and 1% unspecified other. The medical outcome was 16% no effect, 10% minor effect, 2% moderate effect, 15% not followed-nontoxic, 47% not followed-minimal effects, 6% unable to follow-potentially toxic, and 4% unrelated effect. The most frequently reported clinical effects were ocular irritation/pain (8%), chest pain (2%), hypertension (2%), tachycardia (2%), erythema (2%), nausea (2%), dermal irritation/pain (2%), unspecified pain (2%), agitation (2%), and red eye (2%). The most common treatment is dilution/wash (42%).

Conclusion: Testosterone exposure calls to poison centers are increasing. A large proportion of the patients are likely to be women and children, individuals explicitly advised to avoid contact with testosterone. Most of these exposures will not have serious outcomes and may be successfully managed outside of a healthcare facility.

Keywords: Testosterone, Exposures, Poison Centers

219. Send-out acetaminophen levels: Poison Centers' perceptions of risk and liability and the community standard of care

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Background: Acetaminophen (APAP) toxicity is a diagnosis with a time-dependent intervention. Signs and symptoms of toxicity rarely manifest until after the window of maximally effective treatment. Diagnosis often relies solely on serum APAP concentration ([APAP]) assays, which are not universally available. In a 2009 survey of hospitals in 3 Midwestern states, only 50.6% (126/249) had access to real-time [APAP] assays. Little is known regarding Poison Center recommendations to providers without access to real-time APAP assays; less is known regarding perceived liability when recommending send-out [APAP] assays.

Methods: A survey sent to the American Association of Poison Control Centers Managing Directors' listserv querying practices and opinions regarding APAP testing in undifferentiated overdose (OD) patients when a) intentional OD is suspected and b) intentional OD is suspected and [APAP] is a send-out test. Respondents described practices and perceived liability regarding testing and empiric treatment of APAP toxicity in both cases.

Results: 41 responses resulted (by region):

16 (39.02%) Midwest
5 (12.20%) Northeast
13 (31.71%) South
7 (17.07%) West

40/41 respondents recommend [APAP] on undifferentiated OD patients; 33/41 recommend [APAP] when that test is a send-out ($p = 0.0156$, 2-sided Sign test, Table 1). 3/41 respondents recommend empiric treatment of APAP toxicity without immediately available [APAP]. With a high index of suspicion or suggestive history, 10/41 would recommend empiric treatment. Nearly 22% perceive some degree of liability when recommending send-out [APAP] on undifferentiated intentional OD patients.

Table 1. Respondents' practice variability and perception of liability.

n (%)	Midwest	Northeast	South	West	All
Recommend [APAP] in all overdoses	14/15 (93.75)	5/5 (100)	13/13 (100)	7/7 (100)	40/41 (97.56)
Recommend [APAP] in all overdoses if a send-out assay	12/16 (75.00)	4/5 (80)	11/13 (84.62)	6/7 (85.71)	33/41 (80.49)
Recommend empiric treatment if send-out [APAP]	1/16 (6.25)	0/5 (0)	2/13 (15.38)	0/7 (0)	3/41 (7.32)
Recommend empiric treatment if send-out [APAP], with caveats	3/16 (18.75)	1/5 (20)	3/13 (23.08)	3/7 (42.86)	10/41 (24.39)
Perceive liability when recommending send-out [APAP]	5/16 (31.25)	1/5 (20)	2/13 (15.39)	1/7 (14.29)	9/41 (21.95)

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Conclusions: Most respondents in this survey recommend [APAP] in undifferentiated intentional ODs; fewer recommend send-out assays. Management of potential APAP toxicity in the absence of real-time [APAP] testing is not uniform and largely depends on clinical history. Recommending "send-out" [APAP] assays carries at least some perceived legal risk.
Keywords: Acetaminophen (paracetamol), Poison center, Overdose

220. Human intoxications with superwarfarins – a 10-year survey

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Background: Superwarfarins are readily available as long-acting anticoagulant rodenticides in unlimited quantities from trade stores. Human intoxications with these substances are an increasingly recognized, serious public health issue with potential lethal outcome. We retrospectively evaluated cases with superwarfarin intoxication from the Berlin poison center.
Methods: Superwarfarin intoxication cases with diagnostic samples sent to the Berlin poison center were retrospectively assessed. Superwarfarins were identified and quantified by HPLC-MS in blood samples. Clinical and therapeutic data were retrieved from the primary referring physicians.
Results: Since 2004, 46 patients (age: 19–78 years, median 41; male 19, female 20, no data 7) were recorded. Twenty-nine patients (pts) had an intoxication with a single superwarfarin (2 with additionally detectable phenprocoumon levels), 11 had dual and 6 had triple intoxications. Brodifacoum was identified in 20, difenacoum in 16, flocoumafen in 8, difethialone in 7, bromadiolone in 6 and coumatetralyl in 3 pts. Superwarfarin blood levels varied widely: 3.09–3050 ng/mL brodifacoum, 2.4–523 ng/mL difenacoum, 5.09–273 ng/mL flocoumafen, 9–89.6 ng/mL difethialon, 9–440 ng/mL bromadiolon, 9–120.9 ng/mL coumatetralyl. In 28 pts detailed data were unavailable for legal reasons. Clinical and therapeutic data could be compiled from 18 pts: Ingestion in suicidal attempt was reported in 8 and an underlying psychiatric disorder in 9 pts. Clinical signs of hemorrhage were present in the majority (13/18 pts) of cases. The reported times from ingestion until therapeutic intervention ranged from 3 hours to 2 months (median: 1 day; unknown 8 pts). The reported INR values at presentation ranged from 1.2 - >7 (median: >7). Vitamin K was given to 17 pts at a median daily dose of 40 mg (range: 10–100) for 3–84 days (median: 20). Six patients received plasma components (PPSB 6, FFP 2). No deaths or sequelae were reported.
Conclusions: In this large series of patients, a variety of superwarfarins were identified with frequent dual and triple intoxications. Superwarfarin blood levels ranged widely. This emphasizes the need for a sensitive assay in intoxications with low blood levels, which otherwise could remain unrecognised. In a subset of pts, intoxications were associated with suicidal attempts and psychiatric disorders. Although there were no deaths or sequelae, superwarfarins carry the potential of life-threatening hemorrhage and restrictions in the availability should be considered.
Keywords: Superwarfarin, Rodenticide, Anticoagulant

221. Emergency Medical Services (EMS) utilization of a poison control center

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Background: During an initial poisoning/toxin exposure, Emergency Medical Services (EMS) protocols in the region assigned to our poison control center instruct EMS personnel to "Consider contact with Poison Control Center (PCC) en route or on scene after substance is identified." Additional protocols in our region state to "contact medical command", another state-wide protocol does not offer guidance as to what to do in the event of a poisoned patients. The purpose of this study was to determine the frequency, reason for exposure, and disposition of calls reported to a single regional poison control center from emergency medical personnel.
Methods: Cases originating from Emergency Medical Services (911, EMTs, EMS, and paramedics) were identified in in the poison control center's database, Toxicall® from January 1, 2011 to December 31, 2013. Exposures coded with reason of "Intentional-Suspected Suicide" were excluded from outcome analysis as such patients should be referred to a medical facility.
Results: From 2011–2013, the PCC received 1,611 total calls from emergency medical personnel

- 1,577 (98%) of the calls were exposure calls
- 382 of the exposures resulted from attempted suicides

The remaining 1,195 exposure cases were managed in the following manner:

- 605 (50.6%) were Managed On-Site
- 283 (23.7%) were In (or en route to) Health Care Facility
- 302 (25.3%) were Referred to a Health Care Facility
- 5 (0.4%) Treatment Site Other/Unknown

Conclusions: The poison control center helped to manage 50% of calls originating from EMS personnel from 2011–2013 on-site without transport to a health care facility. Involvement of a poison control center within EMS triage guidelines may potentially save resources and health care expenses. The safety and cost-effectiveness of such a relationship warrants further consideration.
Keywords: Poison center, Cost, Public health

222. Investigation of patient disposition following ingestion of super absorbent polymer toys

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Background: Superabsorbent Polymers (SAPs) can absorb and retain extremely large amounts of a liquid relative to its own mass. In recent years, SAPS have worked their way into the toy industry because of their "magical" growth in water. Exploratory ingestion of these products by young children has resulted in bowel obstruction necessitating surgical intervention, which has led some GI

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specialists to recommend endoscopic removal of all SAP objects, regardless of a confirmed obstruction. The objective of this study is to determine the clinical outcomes and severity of morbidity and mortality after ingestion of an SAP.

Methods: We performed a retrospective observational review of a single poison center's data from January 2011 to February 2014. De-identified cases with substances coded as toys, other or unknown types of foreign body, toy, or miscellaneous substance were extracted from Toxicall®. A web-based cross reference of all substance verbatim terms was performed to eliminate non-SAP toys. The following verbatim text field's descriptions were included in this study: Orbeez®, Orb* like substances, Water-Balz®, water balls, gems, beads, expanding in water toys, and some grow- in-water toys (non-sponge type). As this study was focused on toy ingestions, tampons, diapers, beads for soil, and other non-toy SAPs were excluded.

Results: Over the 73 month study period, we had 50 cases with substance field coded with an SAP toy. Of the 50 cases, eight resulted from reported ingestion of the water submerging the toy, five from chewing and partial ingestion of the toy, two were non oral route exposures, and 35 cases involved ingestion of the entire, non-expanded SAP toy. Of the 35 cases involving a SAP toy swallowed whole, seven were followed to a known outcome, all of which were coded as no effects. The PCC did not receive any calls from care givers reporting delayed symptoms in cases closed without follow-up.

Conclusions: Although the majority of the cases were not followed, the patients were asymptomatic at time of call and the PCC did not receive any feedback from care givers or health care providers reporting delayed symptoms. This study suggests that SAP ingestions may be managed at home after appropriate education regarding signs and symptoms of bowel obstruction, without the need for universal emergent endoscopic removal. Further study is needed to confirm this practice as safe.

Keywords: Foreign body, Poison center, Pediatric

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223. Comparative analysis of exposure substances in the Toxicology Investigators Consortium case registry versus National Poison Data System

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Objective: National Poison Data System (NPDS) and Toxicology Investigators Consortium (ToxIC) Case Registry collect data from overlapping yet distinct populations using differing exposure classification schema. We sought to identify and characterize the differences between the top 10 exposure substances from NPDS and ToxIC to better understand the populations tabulated by poison centers versus those seen by medical toxicologists.

Methods: We retrospectively analyzed all cases in the NPDS and ToxIC Registry from 1/1/2010–12/31/2013. Substances involved in the exposure were categorized using NPDS generic codes and ToxIC standardized substance nomenclature and sorted by frequency.

Results: A total of 11,085,874 exposures in the NPDS and 11,380 exposures in the ToxIC were analyzed. The most common exposures managed by both poison centers and medical toxicologists were acetaminophen (APAP), ethanol and benzodiazepines (BDZ) – Table 1. Diphenhydramine, atypical antipsychotics and selective serotonin reuptake inhibitor (SSRIs) were also among both top 10 exposures. Exposures to atypical (non-TCA/SSRI) antidepressants, cocaine, oxycodone and aspirin (ASA) were among the most common exposures in ToxIC, whereas multivitamins, hypochlorite and antihistamine (other than diphenhydramine) exposures made up a larger proportion of cases in NPDS.

Limitations: ToxIC registry data may represent a highly urban population as compared to NPDS. Substance categories do not fully match due to innate data structure differences.

Conclusions: Medical toxicologists manage more cases involving atypical antidepressants, cocaine, oxycodone and ASA, which may reflect greater toxicity. The prevalence of substances in the ToxIC may provide toxicologists-in-training a focus for their studies. Analysis of the NPDS/ToxIC Top 10s provides the practicing toxicologist with the most likely substances to be encountered. Conformation of the different product databases is recommended.

Keywords: National Poison Data System, Exposures, Toxic Investigators Consortium

Disclosure: Do you have relevant financial or other relationship(s) with the commerical supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

Table 1. Top 10 Exposures for NPDS & ToxIC.

NPDS - Substances	Count	% of Cases	Rank on ToxIC List	ToxIC - Substances	Count	% of Cases	Rank on NPDS list
APAP	639158	5.8	1	APAP	3401	8.9	1
Ethanol	342576	3.1	3	BDZ	3000	7.8	3
BDZ	336632	3.0	2	Ethanol	2572	6.7	2
Ibuprofen	336035	3.0	13	Atypical Antipsychotics	1897	5.0	8
Multivitamins	201439	1.8	121	SSRI	1409	3.7	7
Antihistamines*	195820	1.8	32	Non-TCA/SSRI Antidepressants	1202	3.1	19
SSRI	189680	1.7	5	Diphenhydramine	1129	2.9	9
Atypical Antipsychotics	173438	1.6	4	Cocaine	924	2.4	130
Diphenhydramine	168330	1.5	7	Oxycodone	921	2.4	33
Hypochlorite	161291	1.5	79	ASA	804	2.1	30

*Excluding Diphenhydramine and Cough & Cold Preparations

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224. A survey of poison center knowledge and utilization among urban and rural residents of arizona

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Background: Poison control centers (PCCs) hold greater potential for saving health care resources particularly by preventing unnecessary services. We developed a survey to better identify the knowledge and experience of our rural and urban service community with hope to improve outreach education and overall use of our services.
Method: A written questionnaire was developed in English and translated into Spanish. Subjects agreeing to participate were asked two questions (verbally, in English): Are you at least 18 years of age? And; would you prefer to complete the questionnaire in English or Spanish? All questionnaires completed by subjects ≥ 18 years were included. Questionnaires with missing responses, other than zip code, were analyzed. Data collected included gender, age, zip code, primary language, ethnicity, education, health insurance status and experiences with the PCC. State zip codes were divided (a priori) into "rural" or "urban" based on a census data website.
Results: A total of 330 subjects were enrolled; all surveys were included in the analysis. Although several trends were noticed, no statistically significant differences between rural and urban responders were identified for most variables (Table 1). Odds ratios for awareness and past use of the PCC will be determined.
Conclusions: Rural and urban residents within one PCC's regional area share similar experience and knowledge of the PCC. Further work is needed to better identify outreach opportunities.
Keywords: Poison center, Public health, Education

Table 1. Knowledge and use of poison center services based on zip code.

Knowledge/Use of PCC (percentages)	Overall ($n = 330$)	Urban ($n = 253$)	Rural ($n = 77$)	p-value[a]
Heard of the PCC:				
Yes	78	76	83	0.24
No	22	23	17	0.30
Ever called the PCC:				
Yes	16	16	18	0.75
No	82	81	82	0.99
If yes, the reason:	37	45	14	0.08
Medication related	7	5	14	--
Chemical exposure	6	5	7	--
Work related	17	13	29	--
Envenomation				
Prior poisoning at home:				
Yes	20	19	21	0.91
No	80	81	79	0.91
If yes, action taken:	40	39	44	0.95
Call 911	51	51	50	0.99
Visit ED	9	10	6	--
Visit urgent care	9	10	6	--
Visit doctor's office	3	4	0	--
Visit or call pharmacy	3	2	6	--
Stay home	28	29	25	--
Call PCC				
Why wasn't PCC called:				
Do not know about PCC	34	40	17	0.12
Do not have PCC number	43	35	33	0.99
Do not have a phone	8	2	11	--
Do not trust info	8	4	6	--
Fear of calling gov. agency	3	5	0	--
Do not speak English	3	2	0	--
Would call PCC in the future:				
Yes	84	84	83	0.96
No	5	6	4	0.78
Know the 800 number:				
Yes	7	8	3	0.17
No	87	85	92	0.17

[a] = Chi-square test. (--) = insufficient number of observations for inferential analysis.

225. Verification of a knowledge-based system for computerized differential diagnosis of human toxic exposures involving a single substance

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Background: A knowledge-based system (KBS) is a computer program that utilizes stored information to provide solutions or advice within a domain, such as toxicology. Leveraging the data stored in fields required by the National Poison Data System, a prototype KBS capable of generating differential diagnoses for human exposures to unknown substances was created.
Methods: Using data mining techniques, the KBS is automatically generated by extracting human exposure data from cases managed by a statewide poison control system. For substances with at least 10 exposures, a pre-test probability is calculated along with likelihood ratios associating the diagnosis with observable signs and symptoms. Given a set of clinical effects, the KBS uses these pre-test probabilities and likelihood ratios to produce a ranked list (i.e., differential diagnosis). For verification, the KBS was trained and tested using 10-fold cross validation at various exposure severities as well as different levels of identification (diagnosis by substance, major and minor categories, and major category alone), and system accuracy was computed as the percentage of correct diagnoses in the top 10% of all viable diagnoses.
Results: In previous work, the KBS was tested as a proof-of-concept using 4 years of data from a single poison control center. The dataset consisted of 30,152 single exposure cases and the system achieved accuracies as high as 79.8%. To validate the KBS design, this study expanded the dataset to include 11 years of data from three poison control centers, yielding 232,130 usable single exposure cases. When diagnosing toxic exposures producing severe symptoms (e.g., life-threatening, etc.), the system obtained accuracies of 85.9% when diagnosing the substance, 82.4% when diagnosing by major and minor categories, and 77.4% when diagnosing by major category alone. These accuracies improved upon the accuracies obtained during the original study by + 6.1% for substances, + 3.5% for major and minor categories, and + 2.6% for major category alone.
Conclusions: The improved accuracies achieved in this study validate the KBS design. The current implementation assumes no prior knowledge in the field of toxicology, so many improvements are forthcoming. It is hoped that in the near future the system can

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be implemented as a real-time diagnostic consultant, serving as a decision support system for specialists in poison information.

Keywords: Decision support, Computer-assisted patient care, Differential diagnoses

226. Baclofen overdose: Case series with serum concentrations

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Objective: For patients with baclofen overdose, the relationship between serum baclofen concentration and symptoms and signs is unknown. The reference serum concentration for baclofen is 0.08–0.4 mcg/ml. This case series aims to describe the clinical presentation of baclofen overdose and determine if there is a correlation between serum concentration and clinical effects.

Methods: All patients with intoxication related to suspected baclofen overdose from 2012 to 2014 presenting to a single tertiary care emergency department were reviewed. Blood samples for serum baclofen concentration were sent at the time of presentation. A comprehensive drug screen was also performed. Demographic data, medical history, medication history, clinical and laboratory data were evaluated for each patient.

Results: There were 60 patients suspected of baclofen ingestion. Of these, 43 patients were positive for baclofen and 32 had serum baclofen concentrations above the reference concentration, ranging from 0.42 to 7.92 mcg/ml. The mean and median concentrations were 1.4 and 0.77 mcg/ml. Five patients presented twice and one patient three times. Eighteen patients had previously been prescribed baclofen and 22 had not. These data were not available for the others. Sixteen patients (50%) presented with decreased level of consciousness (LOC) with a Glasgow coma scale ranging from 3 to 11 (mean GCS of 7). Baclofen concentrations ranged from 0.230 to1.770 mcg/ml. Six patients (19%) required intubation for airway protection secondary to decreased LOC. All intubated patients had a baclofen concentration of greater than 0.94 mcg/ml (mean 1.37 mcg/ml). Ten patients (31%) presented with fluctuating LOC requiring physical and chemical restraints for agitation. Baclofen concentrations ranged from 0.29 to 1.44 mcg/ml. No seizure activity was documented. Hypotension occurred in two patients (6%), and hypertension in eight patients (25%). The only cardiac abnormality was sinus tachycardia in eleven patients (34%). Laboratory screening for drugs of abuse was positive in all but 2 patients and included benzodiazepines, codeine, gabapentin, dimenhydrinate and cocaine. Ten patients were admitted to an ICU. There were no deaths.

Conclusions: At supratherapeutic serum concentrations, baclofen causes mainly central nervous system effects with minimal cardiovascular toxicity other than hypertension and sinus tachycardia. Agitation, delirium and decreased LOC were the most common neurologic presentation. However there does not appear to be a correlation between serum concentration and type of CNS effect.

Keywords: Baclofen, Overdose, Substance abuse

227. Lessons learned from the reimbursement profile of a mature private toxicology practice: Outpatient Pays

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Background: We previously reported the financial data for the first five years (2002 to 2006) of one of the author's medical toxicology practice. The practice has matured; changes have been made. The practice is increasing its focus on outpatient encounters and reducing inpatient and emergency department (ED) encounters with the aid of electronic medical record order sets. We report the data of the current practice.

Methods: Financial records from 10/2009 through 3/2013 were reviewed. This is a period of 3.5 fiscal years. Charges, payments, and reimbursement rate (RR) were recorded according to the type of medical toxicology encounter: outpatient encounters, non-psychiatric inpatient consultations (IP), ED consultations, and inpatient psychiatric consultations (IP psych). All patients were seen regardless of ability to pay or insurance status.

Results: The number of outpatient encounters increased over the study period; the number of inpatient and ED consultations decreased. Outpatient encounters demonstrate a higher reimbursement rate and higher payments. In FY 2012, outpatient revenue exceeded IP revenue by almost $200,000 despite a similar number of patients in both settings, and outpatient payments were 2.88 times higher than IP, IP psych, and ED payments combined. There was an overall reduction in patient volume between FY 2010 and FY 2012. Despite this there was an increase in total practice revenue. There was no change in payor mix, practice logistics, or billing/collection service company.

Conclusion: In this medical toxicology practice, outpatient encounters demonstrate higher reimbursement rates and overall payments compared to inpatient and ED consultations. While consistent with

Table 1.

	FY 2010			FY 2011			FY 2012			FY 2013 (6 mos)		
	n	RR (%)	Payments ($)	N	RR (%)	Payments ($)	n	RR (%)	Payments ($)	n	RR (%)	Payments ($)
Office	520	80	200,946	600	73	206,508	628	73	240,939	305	78	132,227
IP	1120	43	72,935	803	44	62,648	631	40	46,585	234	35	17,043
ED	157	50	23,809	138	54	22,076	118	49	18,641	77	37	8,194
IP Psych	135	58	12,565	136	63	16,416	163	54	18,262	153	44	14,316
Total	1932		310,255	1677		307,648	1540		324,427	769		171,780

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our previous studies, these differences have been accentuated. This study demonstrates the results of changes to the practice—reduced inpatient/ED consultations, increased outpatient encounters. These practice changes resulted in higher overall revenue despite a lower patient volume.

In this study, the outpatient practice of medical toxicology has higher reimbursement rates and nearly 3 times higher overall total office-based payments when compared to corresponding IP, IP psych, and ED consultations.

Keywords: Billing, Medical toxicology, reimbursement

228. Establishing a telemedicine toxicology service using an established interactive audio-visual consult network

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Intro: Telemedicine provides access to specialists in real time; encounters can occur in various hospital settings. Telemedicine was established internally at PinnacleHealth for neurologists in 2012. In 2013 the program expanded to include infectious disease, and a rural Pennsylvania hospital offered the telemedicine services. In 2014, wound care and toxicology were added and a second rural hospital contracted with the program.

Hypothesis: Describe how a telemedicine toxicology service can be effectively established while demonstrating usage trends.

Methods: Describe the usage trends of a multispecialty telemedicine network before and after adding toxicology. Describe the CMS codes used from 03/2014 to 9/2014 for the toxicology telemedicine services. Results: G0425 (30 min), G0426 (50 min), G0427 (70 min) were the CMS telemedicine codes used for initial inpatient encounters at rural hospital sites. G0406 (15 min), G0407 (25 min), and G0408 (35 min) were used for subsequent encounters. Critical care telemedicine encounters were submitted as 0188T (< 75 min) and 0189T (additional 30 min). Since telemedicine codes are not yet recognized at urban centers, CMS codes for prolonged services without direct care were used (99358 and 99359).

Discussion: Usage trends may be influenced by availability of telemedicine services (e.g. 24 hour coverage), need for telemedicine services (e.g. a rural wound care clinic is active on weekdays) and marketing (e.g. in April, a billboard appeared alongside a major highway in route to one of the rural hospitals).

Conclusion: Toxicology telemedicine with appropriated institutional support and structure may contribute to productivity and reimbursement; encounters may generate additional salary support. Future studies will analyze reimbursement trends.

Keywords: telemedicine, teletoxicology, tox

230. The accuracy of self-reported therapeutic drug ingestion history in ED patients

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Background: Patient self-report of drug ingestion has been shown to be inaccurate by pharmacy claim data. While this has been corroborated by comprehensive drug screening (CDS) in overdose patients, CDS has not been utilized to confirm ingestion history in therapeutic settings. Our objective is to determine the accuracy of self-reported drug ingestion history in Emergency Department (ED) patients.

Methods: This is a convenience sample of patients presenting to an urban academic ED over 8 months. Patients were included if they reported pain or nausea during initial nursing evaluation. A structured drug ingestion history was taken for the 48 hours preceding ED visit by the principal investigator or one trained research assistant; data collected included drug name, dose, and time of ingestion. Ten percent of patients were randomized to provide a urine sample for analysis by the Quest Diagnostics™ LC MS/MS comprehensive drug screen, which detects 142 prescription (Rx), over-the-counter (OTC), and illicit drugs or their metabolites. A report of drug ingestion was considered "accurate" if detected by CDS, and the drug was ingested within 2 half-lives of urine sampling. A report of drug ingestion was considered "inaccurate" if a drug was detected by CDS that was not self-reported, unless 5 half-lives of the detected drug exceeded the 48 hours preceding ED visit. Logistic regression was used to determine factors associated with an accurate ingestion history.

Results: 502 patients were enrolled, of which 55 were randomized to provide a urine sample. The majority of patients were female (55%), and median age was 50 years (IQR 32–63). The median number of drugs ingested by report was 4 (IQR 3–8); the percentage of patients who endorsed taking a Rx, OTC, or illicit drug were 87%, 75%, and 1%, respectively. The CDS confirmed reported drug history in only 31% of the total cohort. Neither age nor sex was associated with CDS accuracy ($p = 0.23$ and 0.32, respectively). The only factor predictive of an accurate overall CDS was patient report of taking an OTC drug ($p < 0.05$); report of prescription or illicit drug use was not predictive ($p = 0.71$ and $p = 0.40$, respectively). Report of taking a specific drug class (Rx, OTC, or illicit) was not predictive of accurate CDS for that specific drug class (OR 0.51, CI 0.09–2.92; OR 0.32, CI 0.08–1.30; OR 0.19, CI 0.02–1.5, respectively).

Conclusions: Only one third of this cohort had an accurate self-reported drug ingestion history. Patient self-report was most accurate for OTC drugs, where a positive self-report of OTC ingestion was associated with an accurate CDS overall. Clinical studies that rely on accurate medication ingestion histories should consider utilizing CDS.

Keywords: Drug Monitoring, Ingestion, Drug of abuse

231. Provider knowledge, attitudes, and practice surrounding emergency department rescue dosing of opioid replacement therapy

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Background: No standard practice exists when it comes to treating opioid withdrawal in Emergency Department (ED) patients on methadone maintenance treatment (MMT), and the literature on methadone administration to ED patients who have missed their dose(s) is scant. In this study, we evaluate the knowledge, attitudes, and practice of emergency medicine practitioners on methadone replacement therapy in the ED.
Methods: This IRB-approved study surveyed Emergency Medicine (EM) residents and attending physicians, in a large, urban, university-based medical center. A written questionnaire assessed provider training, attitudes, and pharmacological strategies. Three unique clinical scenarios, each representing a typical ED presentation of opioid-dependent patients on MMT, further probed ED providers' management approaches.
Results: 61 ED providers participated (24 attending physicians and 37 EM residents). Of these 61 ED providers, 75% (46/61) believe that methadone is an appropriate treatment for heroin addiction/dependence. Their responses illustrated variability in the expected time of onset for withdrawal signs and symptoms from methadone. 3% (2/61) reported withdrawal onset at 16 hours, 50% (31/61) at 24 hours, 28% (17/61) at 36 hours, and 16% (10/61) at greater than 48 hours. ED providers also reported variable initial approaches to management of patients enrolled in MMT programs who present to the ED with a chief complaint of opioid withdrawal, with 11.5% (7/61) giving no pharmacologic intervention, 31% (19/61) giving anti-emetics, 11.5% (7/61) clonidine, 49% (30/61) methadone, and 16% (10/61) other interventions. In a clinical vignette of a patient with obvious opioid withdrawal, normally receiving 140mg of methadone daily, the dose and route of methadone administration varied significantly. Of those respondents who would administer methadone (74%, 45/61), 51% (22/45) would give a full 140mg dose, 30% (13/45) would give 10mg, and 12% (5/45) would give 20mg. Of these same respondents, 22% (10/45) would administer methadone intramuscularly, 84% (38/45) would administer it orally, and 15.5% (7/45) would administer it intravenously.
Conclusion: ED providers' practice patterns showed great variability in the treatment of patients on MMT who present to the ED with opioid withdrawal. Future research should focus on the development of treatment protocols to assist ED providers in their care of patients on MMT.
Keywords: Methadone, Methadone Maintenance Treatment, Withdrawal

232. Topical capsaicin cream used as a therapy for cannabinoid hyperemesis syndrome

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Background: Patients with cannabinoid hyperemesis syndrome (CHS) frequently present with refractory nausea, vomiting, and abdominal cramping. This results in extensive diagnostic testing, use of multiple medications and long hospital stays. We report a patient with CHS who had a dramatic response to topical capsaicin.
Case: A 35-year-old man presented to the ED with nausea, vomiting and abdominal cramping. The patient had smoked marijuana for the past 7 years and had at least 3 similar episodes following periods of heavy marijuana smoking. Most recently, he had smoked a large amount two days prior to his emergency department visit. The patient was initially given one dose of ondansetron 4 mgs intravenously and simethicone orally. An abdominal x-ray was unremarkable. He had mild improvement of his symptoms and he was discharged with instructions to take ondansetron for the vomiting.

The following morning, he returned to the ED with persistent nausea, vomiting, and abdominal cramping which only improved by a hot shower. The rest of his physical examination was benign, with no abdominal tenderness, rebound or guarding appreciated; however, he was noted to be actively retching. Two doses of ondansetron 4 mgs were administered intravenously with minimal relief of symptoms. Approximately two hours after the last dose of ondansetron, capsaicin 0.025% was applied topically to his abdomen, bilateral arms, as well as his back. The patient's symptoms started to improve within ten minutes and they had completely resolved within 30 minutes of application. The patient was observed in the emergency department and given intravenous hydration. Four hours later, he had recurrence of the nausea and abdominal cramping. Capsaicin 0.025% was again applied, and 20 minutes later, his symptoms abated. The patient was discharged home with capsaicin 0.025% cream and instructions to avoid marijuana smoking.
Case Discussion: The etiology of CHS is not fully established at this time. Furthermore, capsaicin has been reported to lead to symptomatic improvement; however the mechanism of action is not entirely clear. Patients' with CHS will commonly comment that hot showers improve their symptoms. This is believed to be due to the high number of cannabinoid type 1 receptors in the hypothalamus, which are activated by hot water. It is possible that this may also explain the improvement with capsaicin. Another proposed mechanism for the improvement of symptoms is the TRVP-1 receptor, capsaicin's only known receptor, interacts with endocannabinoids.
Case Conclusion: Topical capsaicin may serve as both a diagnostic and therapeutic intervention in patients with CHS and may help decrease imaging performed on these patients.
Keywords: Antiemetic, Marijuana, Hyperemesis

233. Use of continuous infusion FabAV to obtain initial control of rattlesnake bite symptoms

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Background: CroFab (Crotilidae polyvalent immune Fab (ovine) (FabAV) package insert recommends an initial dose of 4–6 vials infused over 1 hour, with repeat doses as needed until initial control of symptoms is achieved. However, optimal dosing in patients who fail to obtain initial control after one dose remains debatable. The reported number of patients requiring more than one loading dose varies in the literature, ranging from 20–50%. A previous report of 5 patients suggests continuous infusion FabAV (CI-FabAV) is a safe and effective treatment of late hematologic abnormalities. This poison control center has utilized various dosing regimens of

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CI-FabAV in over 20 patients. Here we describe our experience with CI-FabAV in early therapy to achieve initial control.
Cases: We identified 5 cases in which 4 vials FabAV were given over 4–6 hours to achieve initial control from August 2012 to October 2013. Cases included 1 mild, 2 moderate, and 2 severe envenomations. All patients failed to achieve initial control and had worsening or progressing symptoms after at least 1 loading dose. One patient received 3 loading doses prior to initiation of CI-FabAV. All patients obtained initial control after completion of 1 CI-FabAV dose, and no significant coagulopathies were seen during hospitalization after CI-FabAV therapy. One patient developed coagulopathy 10 days post-bite, but did not require subsequent treatment. No adverse events related to continuous infusion of FabAV were seen.
Discussion: CI-FabAV after bolus therapy may decrease the total number of vials needed to obtain initial control. We infused 4 vials over 4–6 hours, which circumvented any need for additional bolus infusions. Maintaining antivenom levels early in therapy, by providing a continuous infusion, may result in increased venom neutralization and thus better control of symptoms. All patients were monitored for recurrence of initial symptoms and development of coagulopathies immediately after CI-FabAV, throughout hospitalization, and after discharge for up to 22 days. Initial control was achieved after completion of 1 dose of CI-FabAV in all cases. CI-FabAV may be particularly useful in patients with severe envenomation to achieve initial control after a bolus dose has been given. Our observations are consistent with previous accounts of infusions beyond the reported 4 hour stability of FabAV, as increased infusion times were not associated with any additional adverse effects.
Conclusions: Patients with mild to severe rattlesnake bites with advancing or worsening symptoms after an initial loading dose of FabAV may benefit from CI-FabAV. Further research into early use of CI-FabAV in snakebites is warranted.
Keywords: Rattlesnake, Snake bite, Antivenom

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234. An analysis of opioid prescribing practices for non-chronic pain by emergency department providers

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Background: More than half of patients who present to the emergency department(ED) do so in pain. Recently, adequately treating patients' pain has been emphasized and provider treatment of pain is measured and scored. In addition, the rates of opioid misuse have increased. Opioid prescribing practices vary among practitioners. Limited published data report what influence provider type and demographics have on provider prescribing patterns with almost no data specific to non-chronic pain patients. Our objective was to describe opioid prescribing practices of ED providers for non-chronic pain related visits.
Methods: In our retrospective study we evaluated opioid prescriptions from EDs at two military facilities between 2009 and 2012. We queried the outpatient medical record database to obtain a list of opioid medications prescribed and ICD-9 codes associated with ED visits for non-chronic pain only. We collected provider type and gender, number of pills prescribed, opioid type, and opioid refills. For statistical analysis we compared the incidence with chi-square or Fisher's exact tests. Wilcoxon test was used for non-parametric continuous variables. Data were reported as mean ± SD; median[IQR]. A $p < 0.05$ was considered significant.
Results: Over 3 years, ED providers wrote 27,671 oral opioid prescriptions. 6,914 (25%) prescriptions were associated with a visit attributed to non-chronic pain. Providers were 83% emergency physicians, 17% physician assistants (PAs), and 82% male. Medications prescribed were 46% hydrocodone, 39% oxycodone, 6% codeine, 6% tramadol and 3% other. The number of pills prescribed was 21 ± 13; 20[15–20], the morphine equivalent (ME) dose per pill was 7.6 ± 3.7; 7.5[7.5–7.5], and the ME per prescription was 160 ± 203; 150[90–150]. Oxycodone was more likely to have been prescribed by a physician than by a PA (41% vs 35%, $p<.0001$) as was hydrocodone (49% vs 42%, $p<.0001$). Codeine was more likely to have been prescribed by a PA than by a physician (12% vs 2%, $p<.0001$) as was tramadol (8% vs 5%, $p = .0002$). Physicians prescribed a higher dose per pill than PAs (7.8 ± 3.5; 7.5[7.5–7.5] vs 7.3 ± 4.1; 7.5[7.5–7.5], $p<.0001$). PAs prescribed a larger number of pills compared to physicians (23 ± 12; 20[20–30] vs 19 ± 13; 20[12–20], $p<.0001$) and a larger total ME dose per prescription (170 ± 128; 150[112.5–225] vs 153 ± 239; 150[90–150], $p<.0001$).
Conclusions: Physicians were more likely to prescribe more potent opioids (oxycodone and hydrocodone) compared to PAs. PAs were more likely to prescribe tramadol and codeine. Physicians prescribed a higher dose per pill than PAs but PAs prescribed more opioid pills per prescription and a higher ME dose per prescription.
Keywords: Opioid, Non-chronic Pain, Emergency Department

235. A comparison of lisdexamfetamine and dextroamphetamine exposures reported to U.S. poison centers

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Background: Lisdexamfetamine is a pro-drug stimulant that requires the enzymatic hydrolysis of lysine from dexamphetamine for pharmacologic effects. There is limited information comparing non-therapeutic lisdexamfetamine and dextroamphetamine exposures.
Objective: The objective was to compare lisdexamfetamine (LD) exposures with dextroamphetamine extended-release (DXR) and immediate-release (DIR).
Methods: The study was a retrospective case series of acute single substance exposures to LD, DXR, or DIR reported to the National Poison Data System from 2007–2012. Data were analyzed for demographics, reason, clinical effects, disposition, and outcomes.
Results: There were 23,553 exposures: LD (7,113), DXR (6,245), and DIR (10,195). The most frequent clinical effects observed for LD, DXR and DIR respectively were: agitation (19.8%; 21.7%, 25.1%), tachycardia (19.2%; 22.8%; 23.9%) and hypertension (7.2%; 9.6%; 9.1%). In 10,421 children < 6 years, most (93.4%) were exploratory exposures. In 4,245 children 6–12 years, reason for exposure was mainly therapeutic error (65.6%) or exploratory (12.6%). In 8,686 cases 13 years or older most were suicide attempts

(28.7%) and therapeutic errors (27.3%). In this age group, abuse and intentional misuse were the 3rd and 4th most common reasons overall, but more frequently reported for DXR (30.3%) and DIR (38.3%) than for LD (21.2%). Distribution of management sites and medical outcomes were significantly different ($p < 0.0001$) with higher levels of care and more serious outcomes for DXR and DIR than for LD. Management sites were home (40.5%; 34.4%; 29.4%), emergency department (41.2%; 41.6%; 45.7%), ICU admission (5.3%; 7.7%; 8.1%), or non-ICU admission (6.2%; 8.1%; 7.8%) for LD, DXR and DIR. The majority of cases (76.0%) had no or minor effects (LD: 78.9%; DXR: 75.3%; DIR: 74.5%). Moderate and major effects occurred, respectively, in 20.5% & 0.8% LD, 23.6% & 1.1% DXR, and 24.4% & 1.1% DIR. There were 4 deaths (1 DXR, 3 DIR). Intentional exposures (abuse, intentional misuse, suicide, or unknown intentional reason) to LD more frequently led to no or minor effects (56.7%) than more serious (moderate, major, or fatal) effects (43.3%). Intentional exposures to DXR or DIR were more evenly distributed between no or minor effects (49.0%, 50.8%) and serious effects (51.0%, 49.2%).

Conclusions: LD exposures display a similar, but less toxic profile than DXR and DIR. LD may also have less abuse potential.

Keywords: Stimulant, Amphetamine, National Poison Data System

236. Toxicology fellows career goals and needs: A national survey

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Background: For the Medical Toxicology Fellows-In-Training Association, the American College of Medical Toxicology (ACMT), and the individual training programs to meet the needs of toxicology fellows, an understanding of their career goals and expectations is required. American and Canadian toxicology trainees were surveyed with regards to their career goals, their perceived competencies, and the chances they will achieve various competencies by the end of their training.

Methods: An online survey was emailed to all fellows registered in an American or Canadian toxicology fellowship program. It queried the participants' demographics, the practice areas where they foresee their career pursuits, the areas they would like to know more about, how competent they currently feel in each area, how they perceive the support received by their fellowship program to develop competencies, and what they believe are the chances of practicing in different areas.

Results: 56% (40 participants) of fellows responded. The majority of participants hoped to utilize their toxicology training in the areas of medical education (65%) and inpatient clinical care (57%). However, respondents wanted to learn more about forensic toxicology (57%) and working within the pharmaceutical industry (41%). They evaluated their competency in inpatient clinical care, medical education, and poison control center consultation as being thorough to advanced; their competency in research, administration, medication safety, public health, occupational, and environmental toxicology was rated as acceptable to thorough. Areas rated as partial to acceptable included competency in addiction medicine, pharmaceutical industry, and forensic toxicology. Participants felt less supported by their fellowship program in the areas of forensic toxicology, the pharmaceutical industry, and addiction medicine. The respondents felt their chances of practicing toxicology in an inpatient service, medical education, research, administration of a clinical service, or as a consultant for a poison control center were good to excellent. Greater than 30% of participants were not interested in practicing in addiction medicine (35%) or within the pharmaceutical industry (31%).

Conclusion: The majority of toxicology fellows envision a toxicology career in medical education or inpatient clinical care, but would like to learn more about forensic toxicology and the pharmaceutical industry. They feel less competent and less supported by their training program in those areas. Initiatives in the future could include national webinars, symposia, or lectures at national conference within these areas to fill this perceived gap.

Keywords: Education, fellowship, career goals

237. A rare and unexpected clinical effect from a disc battery ingestion

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Background: The clinical consequences of disc battery ingestions have been well described in several large case series. Although the batteries can cause obstruction in the esophagus or the trachea, the most frequent and serious effects result from prolonged contact in the esophagus. Complications have included fistulas, perforations, mediatinitis, pneumomediastinum, strictures and gastrointestinal bleeding including exsanguination from the erosion into large blood vessels. Only on rare occasions have other complications been reported.

Case Report: A 3 year old male with a history of an undiagnosed genetic syndrome including VP shunt dependent hydrocephalus, hypotonia, developmental delay, and pulmonary hypertension presented to the ED with tachypnea, decreased feeding tolerance and low grade fevers. He had been treated 5 weeks earlier for an esophageal foreign body that was found to by a disc battery on esophagoscopy. At the time of its removal, it had likely been in place for 24 hours but visualization of the esophagus revealed only a "relatively minor electrical burn." A contrast esophagram at the time did not reveal evidence of extravasation or esophageal perforation. Upon this repeat presentation, he was noted to have significant fussiness with feeds, pain with sitting up or rolling over, increased work of breathing, and intermittent fevers. He had no known recent traumas or other procedures. He was unable to localize pain due to his developmental status. Lab studies revealed CRP 22.3 mg/dL, WBC of 4.4 (34% bands), normal CSF. Radiologic studies included a CXR with stable peribronchial thickening, KUB without evidence of obstruction, neck CT with findings suspicious for discitis and osteomyelitis at T3–4 anteriorly, and MRI confirmed this with extensive paraspinous phlegmon. A repeat esophagram then demonstrated extravasation into a contained leak posterior to the esophagus. He required prolonged IV antibiotics and esophageal rest. He ultimately developed a mild esophageal stricture.

Case Discussion: Vertebral osteomyelitis is a rare example of osteomyelitis in children, and is usually a result of hematogenous seeding of the vertebral bodies by vessels. In this case, it is likely related to the delayed development of an esophageal perforation and phlegmon within the mediastinum after a disc battery ingestion.

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Conclusions: This case describes a delayed presentation of esophageal perforation and mediastinitis after an esophageal disc battery removal. The patient also developed discitis and vertebral osteomyelitis as a complication of the battery ingestion, which has rarely been described.
Keywords: Foreign body, Pediatric, Disc batery

238. Falsely elevated salicylate level in a patient with hypertriglyceridemia

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Background: Salicylate toxicity is a clinical diagnosis, and the serum concentration should be interpreted in conjunction with the clinical presentation. As concentrations are measured by colorimetric techniques, hyperlipidemia may lead to artificially high salicylate concentrations.
Case: A 26-year-old man presented to the ED with diffuse lower abdominal pain. He had been drinking alcohol the night prior to admission and the admitting physicians were concerned about alcoholic pancreatitis, which was supported by a significantly elevated lipase concentration. He was also found to have extremely elevated serum triglycerides at >7000 mg/dL. Ethanol, acetaminophen, and salicylate concentrations were also checked because of concern of self-injurious behavior, which returned at 13.1 mg/dL, undetectable, and >100 mg/dL respectively. His basic metabolic panel revealed a bicarbonate of 23 mEq/L and an anion gap of 11. An arterial blood gas was subsequently performed and showed a pH 7.39 and a PCO2 of 36.6 mmHg. The toxicology and nephrology services were consulted. Serum and urinary alkalinization, multiple dose activated charcoal, and hemodialysis were recommended upon initial telephone consultation. On physical examination, however, the patient was awake and alert, and was breathing comfortably at a respiratory rate of 12–14/min. He had no complaints at the time of examination. Furthermore, the patient denied having used any salicylate containing products. In the absence of clear symptoms or other laboratory findings attributable to salicylate toxicity, the possible effect of hyperlipidemia to falsely elevate the salicylate concentration was recognized. The bicarbonate infusion was discontinued and dialysis and multiple dose charcoal were withheld. He was treated for severe hypertriglyceridemia with an insulin drip and kept NPO. As his triglyceride level dropped his repeat salicylate concentration was <1mg/dL.
Discussion: Different sized lipid molecules may contribute variably to serum sample turbidity. There are reports of variability in laboratory results measured on lipemic samples. The most common mechanism of erroneous laboratory results is likely related to the ability of lipoprotein particles to absorb light. The amount of absorbed light is inversely proportional to the wavelength and decreases from 300 to 700 nm.
Conclusion: Clinicians need to be aware of the implications of severe hyperlipidemia and interference to prevent clinical errors based on false positive laboratory results. The use of polymer-based lipid-clearing reagents should be considered when the clinical picture does not match the laboratory values in the setting of overt and severe hyperlipidemia.
Keywords: Salicylate, Laboratory, Laboratory Error

239. Laundry detergent pod ingestions: Is there a need for endoscopy?

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Background: Laundry detergent pod (LDP) exposures in children have resulted in several referrals to the Emergency Department and hospital admissions. Signs and symptoms can range from minor to severe; some even requiring intubation. They can include gastrointestinal symptoms (vomiting, drooling), neurological symptoms (depressed sensorium) or metabolic changes (lactic acidosis). There is limited literature on esophageal injury following LDP ingestions.
Case Series: We reviewed three cases of pediatric LDP ingestions who underwent an upper endoscopy in a tertiary care pediatric hospital. Our first patient was a 13 month old who ingested an All® pod and subsequently developed a lactic acidosis, altered mental status, and respiratory failure. An upper endoscopy revealed superficial esophageal erosions. A modified barium swallow was obtained and revealed aspiration of thin liquids. Six weeks after the event an esophagram and a repeat upper endoscopy were normal. The patient failed to show for his follow-up appointment.

The second patient was a 2 year old male who ingested a Tide® pod. He was admitted for persistent vomiting. An upper endoscopy revealed superficial sloughing of the esophageal mucosa. No changes in labs or mental status were appreciated. He was discharged home on omeprazole and sucralfate. A follow up esophagram did not show any narrowing.

The final patient was a 3 year old male who ingested an All® pod. He developed perioral cyanosis and was brought to the Emergency Department. His oxygen saturation was reassuring, but his lactate was 13.5 mmol/L. He had persistent drooling and thus an upper endoscopy was performed. It showed only mild erythema in the proximal esophagus. At follow up 4 weeks later, the parents felt his oral intake was not back to baseline. An esophagram did not show any narrowing. The patient did not return for follow up.
Case Discussion: Our three patients ingested laundry detergent pods and all of them developed some degree of esophageal injury. Two of them developed swallowing dysfunction. None of our patients had oral erythema, ulcers, or lip and tongue swelling. Despite one patient having mild symptoms, his esophageal injury was the most significant of the three. The two patients who ingested All® pods had more signs and symptoms than the one who ingested a Tide® pod. In a literature review, no esophageal strictures have been reported after LDP ingestion.
Conclusion: Our case series demonstrates it is hard to predict esophageal injury based on signs and symptoms. Different brands of LDP appear to develop diverse sequelae. Long-term esophageal stricture is unlikely, but if gastrointestinal symptoms persist, it is reasonable to evaluate with an upper endoscopy.
Keywords: Ingestion, laundry pod, Caustic

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240. Ultrasound diagnosis of portal venous gas after hydrogen peroxide ingestion

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Background: The toxicity of hydrogen peroxide ingestion is related to direct caustic effects, oxygen gas formation and lipid peroxidation. Complications related to rapid oxygen gas formation include viscus perforation, air in the portal venous system, and embolism in the cerebral arterial systems. We report a case of hydrogen peroxide ingestion, found to have portal venous gas (PVG) on bedside ultrasonography (US).
Case Report: A 39 year-old male without significant past medical history presented to the Emergency Department about 1 hour after drinking food grade (35%) hydrogen peroxide that he bought at a local health and nutrition store in an attempt to "cleanse" his colon. He estimated diluting 5 mL of the product in 5 ounces of water, although this quantity varied amongst providers. Within minutes of ingestion, he had multiple episodes of streaky hematemesis. His initial vital signs were: temperature 98.3°F, pulse 61 beats/min, blood pressure 105/58 mm Hg, respiratory rate 20 breaths/min, oxygen saturation 98% on room air. The physical examination and laboratory values were unremarkable. Bedside US of the abdomen revealed findings suggestive of PVG. This was subsequently confirmed on computed tomography (CT). The patient was observed for 24 hours and repeat CT on day 2 of admission demonstrated near complete resolution of PVG.
Case Discussion: PVG is defined as gas within the portal veins and its branches. The most common underlying pathology includes bowel ischemia, alteration of the gastrointestinal lining, inflammation and sepsis. The high mortality commonly associated with a finding of PVG ultimately stems from the mortality of the most common underlying cause of the PVG, which historically has been necrotic bowel. Therefore, it is important to make a rapid diagnosis in a severely ill or unstable patient. The real time and bedside use of US is advantageous to detect the PVG and may be of comparable accuracy to the CT scan. However, the literature directly comparing CT and US to diagnose PVG is lacking. CT scan is valuable in detecting PVG and to exclude potentially lethal pathologies. US, on the other hand, does not require the patient to be moved. Intravenous contrast used with CT scan can be nephrotoxic, or radiation. As the use of CT and US has expanded, more benign causes of PVG have been described. Many of these are amenable to conservative management. Therefore, it may be preferable to perform baseline and subsequent imaging with bedside US when serial exams are required on a stable patient.
Conclusion: We describe successful use of US to identify PVG after peroxide ingestion. US may be a useful tool to document the presence of PVG, and possibly to follow improvement or resolution of the PVG.
Keywords: Hydrogen peroxide, Ultrasound, Portal venous gas

241. Retrospective review of desmopressin exposure

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Background: Desmopressin is widely prescribed as treatment for diabetes insipidus and nocturia. Desmopressin is available in several forms including nasal spray, tablet and intravenous. Potential side effects include hyponatremia, seizures, nausea and headaches. Although widely prescribed, there are only case reports describing the effects after overdose to date. The purpose of this study was to clarify the clinical manifestations that occur after desmopressin overdose.
Methods: A search of regional poison center data was performed using the key words: desmopressin and ddavp from 2000 to 2013. Cases involving pill identification or animal exposure were excluded. The epidemiology of ingestions, dosage, co-ingestions, signs, symptoms, and treatment were described.
Results: The search returned a total of 104 calls/cases meeting criteria. 50% were acute ingestions without history of chronic medication use. 49% of the cases were acute on chronic and 1% chronic. Most (93.3%) were oral ingestions while 6.7% were via nasal spray. Ingestion dose was recorded in 83.5% of oral cases and 71.4% of nasal spray exposures and ranged from 0.1mg-6mg. The mean age was 12.7 years with 85% of cases age 19 years and younger. 59% were male. Sodium levels were obtained in 10.6% of cases reported with a range of 134–142mEq/L. 14.4% of reported cases were hospitalized, of which 86.6% had co-ingestions. Signs and symptoms reported for admitted patients included: nausea, tinnitus, tachycardia, drowsiness, slurred speech. However, the 2 patients admitted without co-ingestion had no symptoms. All cases, except for two, were followed up with a repeat phone call usually about 12–24 hours after initial contact.
Conclusion: In this review of desmopressin exposure, significant adverse effects were uncommon. Seizures did not occur and the lowest reported sodium level was 134mEq/L. Co-ingestions were likely to have accounted for clinical manifestations that did occur.
Keywords: Desmopressin, Ingestion, DDAVP

242. Benefits of radiation/nerve agent exposure electronic medical record order set construction

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Background: With the advent of Electronic Medical Records (EMR), the use of preformed computerized order sets has enabled the physician to treat patients with medical toxicology issues uniformly and efficiently. In 2008 at NACCT, we presented such an order set results with regard to acetaminophen toxicity. We now present our experience relating to the construction of two potential mass exposure scenarios: radiation and nerve agents.
Method: Through a subcommittee of our medical center's Emergency Preparedness (EP) committee, a preformed radiation and nerve agent order set was constructed. The subcommittee consisted of representatives from Medical Toxicology (leader), Pharmacy, Nursing, Laboratory, Nuclear Medicine, Environmental Safety, Public Safety, Emergency Department (ED) and EMR personnel. All of the departments along with the Emergency Preparedness committee were to sign off before implementation. The order sets were organized as to ED admission (first 6 hours post-admission), decontamination, personal protection, laboratory ordering and therapeutic administration covering the first 72 hours of inpatient

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admission. Separate adult and pediatric order sets for each exposure were created. The Weapons of Mass Destruction and the Radiation Special Interest Groups of AACT also provided input.

Results: Both order sets took several months to complete due to their complexity and the involvement of several diverse departments. Established order sets, such as the neutropenic order set, were incorporated into the radiation protocol. The most time consuming aspect was the integration of order set into the EMR and medication procurement. Of particular interest was the laboratory's hesitation to sign off on the radiation order set, due to the concerns of specimen secondary radiation contamination to their equipment.

Discussion: Construction of mass exposure order sets is a very useful exercise in bringing together diverse departments to coordinate care. In our experience, issues such as laboratory specimen contamination were brought out in this forum that had not been articulated in any previous table top poster or disaster drill involving these scenarios. Thus EMR order set construction can be thought of as an adjunct to the disaster drill component for Hospital-Based EP since it requires active leadership involvement of several departments that are stakeholders (as opposed to passive involvement of less senior personnel in typical disaster drills).

Conclusion: Construction of mass exposure EMR based order sets can be looked upon as a vital component to Hospital-Based EP and will elicit issues and concerns that are not seen in typical disaster drills.

Keywords: Radiation, Electronic Medical Records (EMR), Nerve Agents

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243. Factitious snake envenomation and narcotic seeking behavior

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Background: The American Association of Poison Control Centers reported 6919 snake bites in 2012. Native North American snakes accounted for 4139 of the reported bites and 3821 of these required treatment in a healthcare facility. This represents a small fraction of all Emergency Department (ED) visits in 2012. A patient presenting with a factitious snake envenomation in search of opioid pain medication is an even rarer occurrence. Here we present a case of a factitious snake bite and highlight the impact the local poison control center (PCC) had on linking cases that crossed an entire state.

Case: A 47 year-old man presented to the ED with five snake bites on both forearms. He reported being bitten while milking venom from an eastern diamondback rattlesnake for the zoo. On ED arrival, he had punctures on both forearms, swelling on the right forearm, tachycardia, hypertension and leukocytosis. He requested CroFab® (Crotalidae Polyvalent Immune Fab) by name and pain medication. Prior to antivenom administration, the attending toxicologist learned that the patient was seen at least 12 times for snake bites in EDs across the state. In fact, 8 visits occurred within the last 6 months. His prior visits consistently led to parenteral narcotic administration and four visits included antivenom administration for a total of at least 42 vials. Review of other ED encounters found additional visits for unsubstantiated trauma including being stomped by rodeo bull and crushed by a giant tractor tire. On each of these visits, he had tachycardia and leukocytosis. He later disclosed using an epinephrine auto-injector at time of presentation, explaining both findings. While this was his first visit to our facility for a reported snake bite, he was well known to our PCC for this behavior. Communication between PCCs in neighboring states revealed his pattern of hospital presentations, and PCC recommendations helped limit his receipt of antivenom on several later visits.

Case Discussion: This is an unusual case of snake envenomation as the central feature in factitious disorder. CroFab® is an expensive antidote with a potential risk of sensitization with multiple exposures, and is best reserved for patients with true pit viper envenomation. The repetitive nature of this patient's presentation was detected by an astute PCC specialist, which helped prevent unnecessary treatment. This patient's series of hospital visits strongly resembles a previous series reported in Louisiana.

Conclusion: Our patient had factitious disorder and narcotic-seeking behavior with repeated ED visits and hospital admissions for alleged pit viper bites. Poison Control Centers play an essential role in detecting high risk individuals who change location frequently.

Keywords: Snake bite, Factitious Disorder, Drug Seeking Behavior

244. Extracorporeal life support (ECLS) for patients in shock or cardiac arrest secondary to cardiotoxic poisonings: a cost-effectiveness analysis

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Background: A recent systematic review looking at treatments for patients poisoned with calcium channel blocker (CCB) revealed that extracorporeal life support (ECLS) was one of the most strongly supported interventions in the literature. Before promoting the therapy in guidelines that are currently under development, cost-effectiveness needed to be assessed.

Methods: The objective of this cost-effectiveness analysis was to assess the incremental cost-effectiveness ratio (ICER) using ECLS for adults in shock or cardiac arrest secondary to cardiotoxic poisoning compared to standard care. ECLS cost-effectiveness was analyzed using a decision making tree from a Ministry of Health perspective. The population of adults in shock or in cardiac arrest secondary to a cardiotoxic poisoning treated in Canadian hospitals was studied over less than one year. The effect of the intervention and the probabilities used in the decision model were taken from an observational study identified by a systematic review as being the highest level of evidence available. The costs were documented with interviews, consultation of official provincial documentation or published articles. A series of one-way sensitivity analysis and a probabilistic sensitivity analysis using the Monte Carlo simulation were used to evaluate the uncertainty in the decision model.

Results: The cost per life-year gained in the ECLS group was 77,568$/21LY (77,301$/21LY if patients were not transferred)

compared to 44,368$/12LY in the non-ECLS group. The ICER (3,689$/LY) was mainly influenced by the costs associated with the ICU length of stay in the group receiving ECLS compared to the group that did not and the probability of survival. The probabilistic sensitivity analysis identified an increase in cost without a clear increase in effectiveness with an ICER inferior to 50,000$/LY 100% of the time.
Conclusion: This cost-effectiveness analysis conducted with a Ministry of Health perspective may support the use of ECLS in the treatment of cardiotoxic poisonings, but its effectiveness should be confirmed. This will be considered in future guidelines development.
Keywords: Calcium channel blocker, Cardiac toxicity, Beta blocker

245. A lethal case of DEET toxicity due to intentional ingestion

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Background: N, N-Diethyl-meta-toluamide (CAS number 134–62-3), commercially known as DEET, is one of the most commonly and widely utilized active ingredients in insect repellent products. According to the Environmental Protection Agency (EPA), an estimated one third of the U.S. population uses a form of DEET annually. (1) Originally developed for the United States Army in 1946, the agent has become readily available for consumer use in a variety of forms such as liquids, lotions, sprays, and impregnated materials with formulations ranging in concentration from 5 to 100% DEET.
Case Report: A 37 year old male with prior medical history of profound developmental delay and pica experienced seizure and cardiac arrest following ingestion of 6 ounces of a 40% N, N-Diethyl-meta-toluamide (DEET) containing solution. The patient was unresponsive, acidemic, hypothermic, tachycardic and hypotensive on presentation. Over 3 hospital days the patient's vitals recovered to baseline but he remained unresponsive and areflexic with fixed and dilated pupils. Electroencephalogram (EEG) demonstrated diffuse background with little appreciable brain activity and non-contrast brain magnetic resonance imaging (MRI) showed cerebral edema, transtentorial and tonsilar herniations. Neurology declared the patient brain dead on hospital day 3.
Discussion: In the case reported here; whole blood level (9.21 mg/dl) and serum level (10.18 mg/dl) are lower than that recorded in in the previous ingestion fatalities but higher than the peak level of 6.30 mg/dl reported by Fraser, et al in a surviving intentional ingestion. The urine level (0.642mg/dl) was considerably lower than in previously reported cases but that would be expected given the short time post-ingestion that the urine was collected. Absorption rate is unknown but appears to be quite rapid. Our patient had full arrest in 20 minutes suggesting significant levels absorbed. This is similar to the previous fatal reports. To our knowledge this is the first oral DEET exposure fatality report with laboratory verification since 1987, the lowest recorded fatal fluid levels and the only case with such early post-ingestion fluid levels. Although seizures and cardiac toxicity have been described in other case reports, this case is atypical due to the exceptional dose ingested and the timing of the fluid test samples being drawn so soon following exposure.
Conclusion: Though a widely used and extremely safe insect repellent, DEET can be highly toxic in large but easily obtainable doses.
Keywords: Pesticide, Medical toxicology, Death

246. School exposures: Expanding knowledge, identifying trends, connecting resources

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Background: Children and adolescents spend a majority of their typical day in a school environment where they are exposed to a wide variety of substances. This study aims to identify factors that are involved in school exposures reported to poison centers and the types of exposures, trends by males versus females, exposure reasons, medical outcomes, and emerging drug trends that impact the school age population.
Methods: School exposures reported to a statewide poison center system from 2000–2013 were analyzed. Data was broken down by year, month, patient age, gender, route, exposure reason, management site, medical outcome, and substance.
Results: A total of 27,338 school exposures occurred between 2000 thorough 2013. There were no significant variations by months during the school year. Of these, 58.5% occurred in males versus 38.7% in females, with the remaining 2.8% coded as unknown. A majority of school exposures had route of exposure as ingestion (67.5%), and the highest percentage by age group occurred in 12-yr-olds (11.3%), 13-yr-olds (10.3%), followed by 14-yr-olds (10.1%). The reason for the school exposure was 70.9% unintentional and 23.8% intentional. 67.3% of school exposures were able to be managed on site, 11.8% of patients were already en route to a healthcare facility when the poison center was contacted, and only 7.7% of patients were referred to a healthcare facility by the poison center. 91.4% of school exposures were not serious and little to no effects were anticipated.
Conclusion: Utilizing poison center services is an essential health component that is key to assisting school health professionals such as school nurses who work to quickly manage the exposed student. An important element in utilizing poison center services is that a majority of students are able to be managed on site via telemedicine provided by the poison center in communication with the school health professional. The data suggests that there are very few exposures reported to poison centers each year. Reducing unnecessary emergency department and healthcare facility costs is the fundamental benefit of utilizing poison center services. By understanding poison center data, school health providers will be able to understand the importance of utilizing poison center services and gain a better understanding of the important topics needed to gear health prevention strategies on their school campus.
Keywords: Education, Pediatric, Public health

247. Esophageal obstruction with pharmacobezoar: A complication of glucagon?

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Background: Pharmacobezoar causing esophageal obstruction is a rare complication of overdose. A literature review reveals this has not been described in association with glucagon administration. We present a case of esophageal obstruction with

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pharmacobezoar in the context of glucagon administered for beta-blocker (BB) overdose.

Case Report: A 43 year old man called 911 immediately after taking an unknown quantity of labetalol, quetiapine, and trazodone. The patient was initially alert but in route became obtunded and hypotensive. EMS gave 1 mg of glucagon IV with subsequent violent retching without production of emesis. Upon hospital arrival the patient was intubated and an arterial line placed. Initial vitals were: heart rate (HR) 92 bpm, mean arterial pressure (MAP) 80 mmHg. Placement of an orogastric (OG) tube was unsuccessful; chest x-ray showed the OG tube in the mid esophagus and collapsed right upper and middle lobes. Endoscopy was performed and a thick white paste obstructing the distal esophagus was removed. At 2 hours post-ingestion the patient's HR and MAP fell to 60 and 49, respectively. The patient was given a 1 U/kg bolus of high dose insulin (HDI) and an infusion of 1 U/kg/hr. MAP rose to 80 within 20 minutes. Urine drug screen (with chromatography) was positive for labetalol, quetiapine, and caffeine. HDI infusion was stopped at 24 hours. Aspiration pneumonitis was suspected and pill fragments were removed during bronchoscopy. The patient was extubated on hospital day (HD) 2 and transferred to Psychiatry on HD 3 with no sequelae.

Discussion: Glucagon is used for the treatment of hypoglycemia as well as induction of lower esophageal relaxation in obstruction. In the late 1960's, animal models demonstrated cardiac inotropic properties of glucagon via nonadrenergic elevation of cellular cyclic-AMP. Glucagon is often referenced as the primary treatment for BB toxicity despite studies showing its inferiority to HDI. The emetic properties of glucagon are well documented. Pharmacobezoars in overdose are rare and almost exclusively gastric. To our knowledge, a pharmacobezoar causing esophageal obstruction and aspiration after glucagon administration is unique in the literature. The temporal relationship in this case of glucagon administration, retching, and the subsequent esophageal bezoar is difficult to ignore. Evidence exists that HDI alone is superior to glucagon for BB toxicity. When monitored appropriately, adverse events with HDI are infrequent and minor. The major adverse event described here, likely related to glucagon, should be noted.

Conclusion: Clinicians should be aware the emetic properties of glucagon may contribute to esophageal obstruction from pharmacobezoar.

Keywords: Bezoar, Beta blocker, Overdose

248. Initial severity and prognostic markers of ischemic injury after acute carbon monoxide poisoning

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Background: In acute carbon monoxide (CO) poisoning, a hyperbaric oxygen therapy is a recommended treatment and its application is decided based on the carboxyhemoglobin (COHb) level and clinical findings of vital organ injury. However COHb level could not be measured in many acute care hospitals and the level is decreased as time goes. So, it is needed an indicator that could estimate the severity of ischemic injury regardless of the interval from injury scene to emergency department. In addition, we need the prognostic markers could expect vital organ injuries including heart and brain. Serum ischemia-modified albumin concentration is a marker of global ischemic injury in many diseases. We tried to find severity and prognostic markers of ischemic injuries after acute CO poisoning.

Methods: In a university hospital emergency department (EM), acute CO intoxicated patients were consecutively recruited. COHb levels were classified as initial value at acute care hospitals and delayed value. We measured COHb, CK, CK-MB, cTnI, BNP, D-dimer and ischemia-modified albumin at admission. Myocardial injury was diagnosed by the follow up values of CK, CK-MB, cTnI and/or echocardiography. Brain injury was diagnosed by the abnormalities of neurological examinations and/or MR diffusion image that could be explained by. Statistical analysis were performed by X2-test, Student t-test, Pearson correlation and its significant difference was defined when P value was less than 0.05. Also, ROC curve was used for evaluating the diagnostic accuracy.

Results: 84 patients (male: female = 47: 37, 39.6 ± 16.4 y-o) were included in the final analysis. Laboratory values and outcomes were as follows; initial COHb level at acute hospitals $29.7 \pm 12.8\%$ (65 patients), myocardial injury 9.5% (8/71 patients), brain injury 16.7% (14/80 patients). At admission to a university hospital, delayed COHb was $16.7 \pm 14.6\%$ (81 patients). The concentration of ischemia-modified albumin showed weak positive correlation between initial COHb at acute hospital (Pearson correlation coefficient 0.234, $P = 0.042$). The area of under the ROC as indicator of the diagnostic accuracy for myocardial injury was 0.947 of lactate and for brain injury was 0.932 of BNP.

Conclusions: In acute CO intoxicated patients, the concentration of ischemia-modified albumin could give some additional information for severity of ischemic injury with less influence of the time interval from scene. Initial serological markers could give some prognostic information for myocardial injury with initial lactate level and for brain injury with BNP concentration.

Keywords: Carbon monoxide, poisoning, prognosis

249. Scorpion stings experience at King Fahad Hospital University (1997–2012)

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Objectives: is to determine the incidence, outcome and clinical presentation of scorpion stings admitted at the King Fahad Hospital University at Al-Khobar from 1997 to 2012.

Methods: This retrospective Descriptive study was conducted at king Fahd University Hospital from January 1997 and December 2012.

Result: 198 patients presented to the emergency department as a case of scorpion sting, A fifty six of them were admitted to the hospital during a period of 15 years (January 1997 to December 2012) 84%(47) were male and 45%(25)below age of 10years. Most of the stings happened on the summer at night time and the lower extremities were more effected (78%). local pain was the most common symptoms at presentation followed by arrhythmia. The yellow color scorpion was the most common. Twenty patients (36%) presented to the hospital within 30 minutes .53% of the admitted patients did not received anti-venom and there is no mortality or ICU admission.

Conclusion: most of the scorpion sting in our region is with mild signs and symptoms without any mortality. The role of anti-venom is still not clear.

Keywords: Scorpoion sting, Environmental, Venom

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250. Acute methadone-related cerebellitis with ante-mortem drug concentration

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Background: Acute cerebellitis occurs mainly in children. It is frequently associated with an infectious agent (e.g. varicella, Mycoplasma), the post-infectious period or an autoimmune disease (Sjogren's). Only four cases of overdose-related acute cerebellitis were found in the literature. We report a case of methadone-induced acute cerebellitis.
Case report: A one year old child with lethargy and peri-oral cyanosis was brought to the emergency department. Urine drug screen was positive for methadone and the child received two intramuscular doses of naloxone with a reported improvement in mental status. A naloxone infusion at 25 mcg/kg/hr was started and the child was admitted to the ICU. Approximately 18 hours after admission, the child was intubated for respiratory distress, bradycardia and neurological deterioration. Head CT revealed extensive edema or infarction of the cerebellum, consistent with acute cerebellitis. Emergent craniectomy was performed with extensive resection of the cerebellum. Epinephrine and norepinephrine were needed to maintain blood pressure while vasopressin was started to treat diabetes insipidus. The patient's condition rapidly deteriorated until, by hospital day three, continuous EEG showed no activity and the pupils were fixed and dilated. The patient expired on hospital day 4. Autopsy was significant for extensive edema and necrosis of the cerebellum. Pre-mortem blood obtained approximately 12 hours after presentation to the ED had methadone and EDDP (the primary metabolite of methadone) concentrations of 248 ng/mL and 13 ng/mL respectively.
Discussion: Four other cases of acute cerebellitis associated with overdose or poisoning were found in the literature: a 4 year old with an ingestion of amitriptyline who survived (1), a 3 year old with carbon monoxide exposure who died (2), a three year old with methadone exposure who died (2) and a 3 year old with a methadone ingestion who survived (3). In neither methadone case were drug levels reported.
Conclusion: We report a case of fatal cerebellitis associated with methadone in which antemortem methadone levels were obtained.
Keywords: Methadone, Cerebellitis, Postmortem

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251. An 11-year review of levetiracetam ingestions in children less than 6 years of age

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Background: Levetiracetam is a newer anticonvulsant that works to block high-voltage-activated (HVA) Ca++ channels in children for partial onset seizures. Reports of clinical experience with pediatric ingestions are minimal.
Methods: This was an 11-year retrospective cohort study of pediatric (<6 years old) levetiracetam ingestions reported to a Poison Control System from 2002 to 2013. Case narratives were reviewed and assessed for patient demographics, levetiracetam dose, formulation, acuity of exposure, time since exposure, reason for exposure, symptoms, therapy, hospitalization period, and final outcome. Institutional Review Board approval was obtained and the cases were assessed in a blinded fashion. Inclusion criteria were levetiracetam as a single ingestant, age less than 6 years, treatment in a health care facility (HCF), and followed to a known outcome.
Results: Eighty-two cases met inclusion criteria. Demographics include 55% female patients and overall median age 2.0 years (range: 1–60 months). Of the 82 cases, 17 (20.7%) developed adverse effects of drowsiness and/or ataxia. Eighty patients (97.6%) were treated and released from the emergency department and two patients (2.4%) were admitted. The two patients admitted included a two month-old who was accidentally given a dose 10 times that of her usual dose and a three year-old who was lethargic on arrival to the HCF with an unclear history of the ingested dose. The levetiracetam dose ingested was reported in 69 cases with an exact-dose reported in 37 patients (45.1%). Of these, thirty-three cases (89%) involve the suspension formulation and 31 cases (84%) were unintentional therapeutic errors as the cause of the exposure. No dose-response relationship was demonstrated, however levetiracetam-naive exposures were 3.5 times more at risk of developing drowsiness or ataxia compared to patients who were not naïve to levetiracetam (Relative risk [RR], 3.5; 95% confidence interval [CI], 1.02–15.15).
Conclusions: Pediatric levetiracetam exposures were associated with few transient adverse effects. Poison Control Centers may wish to consider acuity of ingestion when developing send-in protocols.
Keywords: Pediatric, Anticonvulsant, Ingestion

252. Pediatric exposure to cough/cold medications: Understanding contributing factors to medication errors

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Background: Medication errors, the improper use or inadvertent misuse of medications, can cause adverse events (AEs) in children. In 2008, an ongoing surveillance system was initiated to monitor serious AEs associated with cough/cold (CC) medications. This analysis describes the characteristics of medication errors detected among CC AE cases.
Methods: Cases detected from 1Q08–1Q13 were systematically collected from 5 data sources: NPDS, FDA Adverse Event Reporting System, English language medical literature, news/media reports, and manufacturer internal safety reports. Case inclusion criteria: age < 12 y; oral exposure to ≥ 1 CC index ingredient; ≥ 1 AE; event occurred in US between 2008–2012. The Pediatric

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CC Medication Safety Surveillance Expert Panel assessed causal relationship between exposure and event, estimated dose ingested, assessed intent of administration, and identified contributing factors associated with each case. The Expert Panel evaluated dose (therapeutic, supratherapeutic, or unknown) based on established monograph dosing guidelines (21 CFR Part 341).

Results: Of the 3009 cases determined by the Expert Panel to be at least potentially related to an index ingredient, 680 (23%) involved a medication error: 678 (>99%) non-fatal; 2 (<1%) fatal. The proportion of all potentially related cases decreased each year from 25% in 2008 to 20% in 2012. The majority (62%) of errors involved supratherapeutic dosing and a child <6 years of age (60%). Medications were most commonly administered by parents (43%) or other caregivers (41%), but 8% of cases involved an older child who self-medicated for a labeled indication. Among non-fatal cases, the most common contributing factors were administration of a wrong dose (n = 329), dose administered with wrong unit of measure (n = 81), use of an adult product (n = 65), and use of the wrong product (n = 51). Among the 2 fatal cases, contributing factors were involvement of a grandparent caregiver (n = 1) and multiple caregivers (n = 1).

Conclusions: Medication errors accounted for 23% of all serious pediatric AE cases associated with CC products. The majority (62%) of medication errors involved supratherapeutic dosing, suggesting that despite the intention to use the medication appropriately, dosing errors may still occur. Targeted interventions, like standardizing packaging technology and educational campaigns about safe use, are important in preventing medication errors and subsequent AEs. Ongoing surveillance is warranted to track the apparent decrease in medication errors and to understand the long term impact of interventions.

Keywords: Medication error, Cough/Cold medication, Pediatric

Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

253. Neurologic complication of a massive acetaminophen overdose in a toddler

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Background: Acute massive acetaminophen (APAP) overdose commonly presents with gastrointestinal upset, vomiting, hyperglycemia, and coma. We report a case of a massive overdose of approximately 37g of acetaminophen in a toddler with seizure-like activity and decerebrate posturing.

Case Summary: A previously healthy 18 month-old male presented to the emergency department five hours post-ingestion of approximately seventy-five 500mg sweet-coated acetaminophen tablets from a bottle with an easy twist-off cap. The patient arrived in the ED actively vomiting pill fragments, unresponsive with witnessed seizure-like activity lasting less than one minute and decerebrate posturing. This was followed by a post-ictal period and return to baseline mental status. Initial vitals signs included: HR 120 bpm, BP 114/71 mm Hg, RR 18 bpm, SpO2 100% on room air, and afebrile. Initial labs revealed APAP 588.6 µg/mL, INR 1.4, CO2 16.0 mmol/L, glucose 267 mg/dL, serum iron 23 µg/dL, and salicylate <0.3 mg/dL. Liver enzymes, head CT, and chest x-ray were normal. The child had no history of seizures, and the family asserted there were no other medications or vitamins in the home. After initiating IV N-acetylcysteine (NAC), the patient was stabilized and transferred to the Pediatric ICU. His INR peaked at 2.12 and his AST and ALT peaked at 436 IU/L and 486 IU/L, respectively. NAC was continued until AST, ALT, and INR returned to normal parameters. He experienced no further neurologic sequelae and was discharged home on day # 6.

Discussion: Previous case reports have described less common findings of APAP overdose that are often associated with massive ingestions. Although CNS depression, metabolic acidosis, and hyperglycemia have been reported, seizure-like activity and posturing are not well-described findings in isolated acetaminophen overdoses. This case highlights a significantly large overdose of acetaminophen in an 18 month-old with an unusual neurologic finding. Due to the unanticipated clinical finding of seizure-like activity, additional labs and imaging were performed to ascertain an alternative etiology, though no other etiology was determined.

Conclusion: We report a unique presentation of massive acetaminophen toxicity that manifested as seizure-like activity and decerebrate posturing. Although seizure activity has been reported in animal models with massive acetaminophen overdose and as a late complication associated with cerebral edema, there is little reported in human literature of such early neurologic complications.

Keywords: Acetaminophen (paracetamol), Seizure, Pediatric

254. Pediatric iatrogenic deferoxamine overdose causing prolonged vasopressor responsive hypotension

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Background: Deferoxamine is a water soluble parenteral chelator of iron used for both acute iron overdose and chronic iron overload. Its use is associated with potential pulmonary and renal toxicity and risk of opportunistic infection; however, it is rate related hypotension that limits effective chelation in massive iron overdose. Case reports of deferoxamine overdose are limited. We present a pediatric case of acute iatrogenic deferoxamine overdose causing prolonged vasopressor responsive hypotension without additional toxicity.

Case: An 8 year old female with Beta thalassemia intermedia was admitted for initiation of deferoxamine chelation for transfusion related iron overload (16.7 mg/g dry hepatic tissue, normal <1.8mg/g). Due to infusion pump malfunction, 3 grams (154 mg/kg) of intravenous deferoxamine were administered as an intravenous bolus instead of a 15mg/kg/hr infusion. The patient rapidly became hypotensive (50/41mm Hg) and tachycardic (pulse 160) with a depressed mental status and 1 + peripheral pulses. Facial edema was noted and prompt treatment with intravenous (IV) methylprednisolone, diphenhydramine and 40cc/kg of normal saline was initiated without improvement. Dopamine was started

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and titrated for the next 12 hours reaching a maximum rate of 5mcg/kg/min to maintain a systolic blood pressure of 90mmHg. IV fluids were continued at twice maintenance rate. Admission creatinine was 0.35mg/dl and discharge creatinine 42 hours after admission was 0.24mg/dl. There were no respiratory or infectious symptoms. Future infusions of deferoxamine were tolerated without complication.

Discussion: The maximum safe infusion rate of deferoxamine is unknown. Based sparse data from the 1960's 15mg/kg/hr is the maximum recommended infusion rate, not to exceed 6 g/day; however, rates as high as 25mg/kg/hr have been advocated since. Rate related hypotension is likely in part due to histamine release based on a canine study from the 1960's though other mechanisms are probable. This case demonstrates that hypotension requiring vasopressor support may be prolonged for 12 hours or more after a single bolus of 3g (154 mg/kg). The rate of renal and pulmonary injury in deferoxamine overdose is unknown and published cases are few.

Conclusion: Clinicians should be aware for the potential of prolonged hypotension after a single IV bolus overdose of deferoxamine.

Keywords: Chelation, Shock, Pediatric

255. A review of tapentadol exposures in adult patients as reported to U.S. poison centers

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Background: Tapentadol (Nucynta®) is a scheduled II controlled-substance and a centrally-acting synthetic analgesic. Tapentadol's mechanism of action is understood to exert analgesic activity by binding to mu-opioid receptors and inhibiting norepinephrine reuptake. It is indicated for moderate to severe acute and chronic pain as well as for pain associated with diabetic peripheral neuropathy. The goal of this study is to describe the reasons, outcomes and clinical effects of tapentadol exposures in adults. There are no studies published on the toxicity of tapentadol in overdose.

Methods: This retrospective observational study utilized data from the National Poison Data System (NPDS) that has been compiled from calls to U.S. poison centers. Inclusion criteria: exposure to tapentadol, date: 1/1/2010 to12/31/13, age: 18 years and older, single ingestion only, and followed to a known outcome. IRB approval of the study was obtained and all the data that was received was de-identified summary data from NPDS.

Results: 440 patients met the inclusion criteria. Of the 440 patients in the study, 171 remained asymptomatic and had no effect. 90 patients (20.5%) reported minor effects. 153 (34.8%) and 24 (5.5%) of the patients had moderate or major effects, respectively. Two deaths were reported. 180 patients (40.9%) reported drowsiness/lethargy, 67 patients (15.2%) reported hypertension or tachycardia, and 5 patients (1.1%) had a seizure. Clinical effects reported for the 26 patients with major outcomes or death were coma (11), drowsiness/lethargy (11), respiratory depression (10), tachycardia (6), seizures (4), and agitation/irritable (4). Other effects reported in that group included confusion, dizziness/vertigo, nausea/vomiting, slurred speech, hallucinations/delusions, ataxia, mydriasis and miosis. 116 (26.4%) exposures were unintentional-therapeutic error and 32 (7.3%) exposures were intentional-abuse. 4 patients (0.9%) had a parenteral exposure and 1 patient (0.2%) had an inhalational exposure.

Conclusion: This is the first study examining the effects of tapentadol in overdose. 261 of 440 patients in this study (59.3%) had minor or no effects. 24 patients (5.5%) had a life threatening event and two patients died. Most patients had opiate-like effects; however, sympathomimetic effects were also observed and five patients had a seizure. This study is limited by its retrospective nature, passive reporting and reliance on caller information. Additional research is needed to better clarify the toxic dose, clinical effects and treatment following tapentadol exposure.

Keywords: Tapentadol, National Poison Data System, Overdose

256. Pediatric exposures to cough/cold medications: Characterization of accidental unsupervised ingestions

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Background: To monitor adverse events (AEs) associated with cough/cold (CC) medications in children, an ongoing surveillance system was initiated in 2008. This analysis focuses on the exposure characteristics of pediatric accidental unsupervised ingestions (AUIs) involving CC medications.

Methods: Cases detected from 1Q08–1Q13 were systematically collected from 5 data sources: NPDS, FDA Adverse Event Reporting System, English language medical literature, news/media reports, and manufacturer internal safety reports. Case inclusion criteria: age < 12 y; oral exposure to ≥ 1 CC index ingredient; ≥ 1 adverse event (AE); event occurred in US and occurred between 2008–2012. Using pre-determined definitions, eligible cases were evaluated by The Pediatric CC Medication Safety Surveillance Expert Panel to assess the causal relationship between exposure and event and judge exposure dose, intent of administration, and potential contributing factors/scenarios for each case. The Expert Panel evaluated dose (therapeutic, supratherapeutic, or unknown) based on established monograph dosing guidelines (21 CFR Part 341).

Results: 3009 eligible cases were reviewed by the Expert Panel and judged to have AEs at least potentially related to a CC ingredient. Of these potentially related cases, 1865 (62%) were associated with AUI. The number of AUIs peaked in 2009 (n = 397) and then decreased each year to a low of 331 in 2012. The majority (n = 1864; 99.9%) of AUIs resulted in non-fatal adverse events. Most AUIs occurred in children aged 2 to < 4 years (63%) and more often involved a male child (55%). The 1 fatal AUI occurred in a male child < 2 years of age. The majority of AUIs occurred in the child's own home (95%) and involved a supratherapeutic dose (81%). The most common contributing factors/scenarios of AUIs were: involvement of an adult formulation product (n = 297), presence or involvement of another child (n = 71), involvement of child protection services/police (n = 39), improper product storage (n = 34), and AUI following administration by a caregiver (n = 30).

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Conclusions: AUIs account for 62% of pediatric CC AE cases detected in this surveillance program. The majority (63%) of AUIs occurred in children aged 2 to < 4 years which may be due to increased mobility and curiosity of young children. While the majority of AUIs also involve the ingestion of a supratherapeutic dose, severe outcomes, like death, are rare. To minimize unintentional pediatric CC medication exposures, further educational campaigns to target AUI contributing factors, are warranted. Furthermore, ongoing surveillance is needed to evaluate the impact of interventions to minimize these exposures.

Keywords: Accidental unsupervised ingestion, Cough/Cold medication, Pediatric

Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceutical	Contract	Contract

257. Triiodothyronine-associated cardiomyopathy

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Background: Cardiac complications from exogenous thyroid hormone may be due to changes in β-adrenergic receptors, changes in signaling mechanisms, and catecholamine excess. We report the first case of T_3 associated cardiomyopathy demonstrated on an echocardiogram.

Case report: A 21 y/o male presented to the ED after an ingestion of liquid triiodothyronine (T3). He was using T3 twice a day for 3 days before he presented with chest pain and dyspnea. On arrival, he was in shock with a HR in the 140s, BP 99/57, RR in the 30s with an oxygen saturation of 97% on a venti-mask, and temperature of 98.8. His exam was notable for crackles and frothy sputum, capillary refill of 3 sec, and no peripheral edema; his neuromuscular exam was unremarkable. He was intubated due to respiratory distress. EKG demonstrated sinus tachycardia with normal intervals. Initial laboratory evaluation was remarkable for a troponin of 47.94 (nml < 0.07), TSH < 0.03, Free T_4 0.06, Free T_3 > 20 pg/ml (nml 2.3–4.2), CK 1760, and WBC 25 with a left shift of 94%. His CO2 was 32 with an anion gap of 6 and Cr of 1.27 with an AST 95 and ALT 144. CXR demonstrated pulmonary edema.

Due to concerns for thyroid storm, an esmolol infusion was initiated, which was complicated by hypotension (BP 84/67). A phenylephrine infusion was then initiated. A cooling blanket was placed for hyperthermia. Due to persistent tachycardia, esmolol was discontinued, and a propranolol infusion was initiated. An echocardiogram demonstrated global cardiac dysfunction with an EF of 21% but no signs of chronic cardiomyopathy. Propranolol was discontinued and a dobutamine infusion was initiated. Due to oliguria, acute renal failure (Cr of 1.97), and a potassium of 6.6, continuous venovenous hemodialysis was initiated.

Blood cultures demonstrated no growth, viral testing was negative, and no source of infection was identified. Autoimmune serologies were non-diagnostic. He improved over 3 days, vasoactive medications were weaned, and he was extubated. Five days later, his EF was 64%, T_3 was 5.4, troponin was 0.29, and renal function had normalized. At that time, he admitted to taking T_3 for weight loss and denied recent use of other supplements or steroids.

Discussion: Death, seizures, and thyrotoxicosis are all reported following exogenous ingestion of thyroid hormone. Myocardial infarction and cardiac failure are both associated with thyroid hormone ingestion; however, previous reports did not include echocardiographic evidence of cardiomyopathy. Our patient used amphetamines and androgen precursors in the past but denied any recent use or other new exposures aside from the T_3.

Conclusion: We report the first case of thyroid storm associated cardiomyopathy from exogenous T_3 that was confirmed by an echocardiogram.

Keywords: triiodothyronine, cardiomyopathy, Overdose

258. A prospective multicenter poison center study of therapeutic errors made with rapid or short acting insulin

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Background: Poison centers (PCs) often manage accidental insulin overdoses using clinical study data not validated for overdosed patients. This study of therapeutic errors made with rapid or short acting insulin (RSAI) was conducted to provide management guidance.

Method: Two PCs obtained institutional review board approval. Inclusion requirements were: dose (units) of RSAI (glulisine, aspart, lispro and regular) and subsequent timed blood glucose (BG) measures (mg/dL) until the lowest BG (BG_{nadir}) was verified. Hypoglycemia was defined as BG_{nadir} < 70 mg/dL. Correlations between predictors and outcomes were calculated using single variable linear regression.

Results: Data collection over 2 years found 511 cases of RSAI therapeutic error. Data adequate for regression analysis was found in 240 cases (included) and not found in 271 cases (excluded), shown in Tables 1 and 2.

Errors were usually a substitution for a long-acting insulin resulting in an RSAI overdose. Included cases obtained a first BG (BG_{start}) within 7 minutes of exposure and followed with an average of 6 BG measures at mean intervals of 67 (SD 37) minutes.

Table 1. Means (SD = standard deviation).

	Included (n = 240)	Excluded (n = 271)
Age (years)	62 (14)	61 (14)
RSAI dose	46 (39)	46 (33)
BG_{nadir}	110 (49)	157 (91)
Managed at home	90%	64%

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Table 2. Distribution of $BG_{nadir} < 70$ mg/dL.

BG_{nadir} range	Included (n = 240)	Excluded (n = 271)
60–69	15	12
50–59	12	9
40–49	12	8
30–39	3	8
20–29	0	1
All < 70 mg/dL	*42 (17.5%)	38 (14%)

*For included cases, time to hypoglycemia ranged from 25–423 minutes (mean 173 SD 99).

Table 3. Regression variables, means (SD) for included cases (n = 240).

BG_{start}	216 (96)
BG_{nadir}	110 (49)
$BG_{drop} = BG_{start} - BG_{nadir}$	105 (98)
T_{nadir} = minutes from RSAI exposure until BG_{nadir}	178 (106)

Mild to moderate symptoms were reported for 29 of the 80 hypoglycemia cases. Severe symptoms (coma, seizures) did not occur. Food was the most common treatment.

In practice T_{nadir} was known only after BG was trending up, so confirming BG_{nadir} required up to 4.4 hours in 50% of patients, up to 6.1 hours in a further 25% of patients and up to 12 hours for the remaining 25% of patients. Single variable regression showed RSAI dose was not linearly correlated to either BG_{drop} or BG_{nadir} ($r^2 < 0.05$). The BG_{drop} was best predicted by BG_{start} ($r^2 = 0.76$), but the correlation was insufficient to predict BG_{nadir} ($r^2 = 0.05$).

Conclusion: This 2-year prospective study of RSAI errors found no well-correlated predictors for BG_{nadir}. Rather, patients were best monitored over time with 75% of included cases having a BG_{nadir} verified within 6 hours of the exposure. Overall, 76% of cases were managed at home and had a hypoglycemia incidence of 16%.

Keywords: Insulin, therapeutic error, hypoglycemia

259. Imidazoline exposures in children 1–19 years of age from 2000–2012

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Background: Topical imidazolines (i.e. tetrahydrozoline (Visine®)) exhibit local alpha-1 agonist and systemic alpha-2 agonist activity. While indicated for topical use only, oral ingestion increases systemic exposure resulting in the potential for serious adverse events. To provide accurate education to healthcare providers regarding the prevalence and dangers of imidazoline ingestions, data was obtained from the American Association of Poison Control Centers (AAPCC) National Poison Data System to assess the characteristics of pediatric ingestions.

Methods: A retrospective review of exposures reported to the AAPCC for children under the age of 19 for the years 2000–2012 was conducted. Information included: case start date, case year code, the type of call (exposure, information, etc.), patient age, patient gender, major category, reason for ingestion, caller location (own residence, health care facility, etc.), treatment site (home, health care facility, etc.), medical outcome, and recommended treatment. Trade names were unknown to the investigators as the data was reported by generic code. SPSS was utilized to generate descriptive statistics for the AAPCC imidazoline cases. Logistic regression was used to examine the relationship between age group and medical outcome. Age was grouped into five categories, including < 1 years, 1–3 years, 3–6 years, 6–12 years, and 12–19 years. Medical outcome was grouped as None/Minor, and Moderate/Major.

Results: Between the years 2000–2012 a total of 22,978 cases (53% male) were identified. Of these reported exposures, the majority occurred in children from 1–3 years of age (57%), followed by 3–6 years (15.6%), and 12–19 years (11.9%). Most of these reported cases (70%) were managed on site (non-health care facility), while 20% were referred by the poison control center to a healthcare facility. Single-dose activated charcoal and dilution/irrigation wash were the most commonly recommended treatments. Unintentional exposures accounted for the majority of cases (86%). Exposures classified as Malicious or Intentional occurred with greatest frequency in children 12–19 years of age (87.5% and 80.8%, respectively). Furthermore, children between 12–19 years of age were found to be at a significantly ($p < 0.05$) increased risk of experiencing a moderate or major adverse effect when compared to younger children.

Conclusions: While most imidazoline exposures occur in younger children and are unintentional, the intentional use of imidazolines in older children coincides with an increased risk for experiencing moderate or major outcomes.

Keywords: Pediatric, National Poison Data System, Ingestion

260. Severe hyperkalemia caused by salt substitute ingestion in a child

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Background: Potassium chloride is available in over-the-counter salt substitutes that are used by patients following a sodium-restricted diet. Despite such availability, toxicity from these preparations is infrequently reported in children.

Case Report: A 3-year-old boy with cystic fibrosis presented to a local ED after ingesting an unknown quantity of salt substitute. The ingestion was not witnessed, but rather was discovered when his grandfather's salt shaker was found to have half of its contents suddenly missing; the child then reported that he had poured it into his soup. On arrival to the hospital, his serum potassium was 9.7 mEq/L. EKG showed markedly peaked T-waves with normal PR, QRS, and QTc intervals. The patient was treated with calcium gluconate, D10W, insulin, sodium bicarbonate, and Kayexalate. He was transferred to a pediatric tertiary care center for further management, where repeat potassium was 5.4 mEq/L and EKG had normalized. No additional treatment was administered at the accepting facility. The third measured serum potassium was 3.3 mEq/L, and the patient was discharged home the following morning with no adverse sequelae.

Discussion: Though hyperkalemia following ingestion of potassium-containing products has been previously described, it often occurs in the setting of renal insufficiency or with concurrent use of drugs that alter potassium balance. In contrast, hyperkalemia

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caused solely by acute ingestion of potassium in patients with normal renal function is unusual, due to rapid renal adaptation to an oral potassium load. To our knowledge, there is only one published case report of pediatric toxicity from salt substitute ingestion. In adults, as little as 2.0–2.5 mEq/kg has been reported to cause toxicity. With approximately 60 mEq of potassium in 5 g (one typical teaspoon) of salt substitute, a healthy, "average-sized" 15-kilogram 3-year-old with no underlying renal impairment could feasibly become hyperkalemic after ingesting as little as 2.5 g of such a product.
Conclusion: This case illustrates the potential for toxicity after pediatric exposure to salt substitutes. This information may assist in triaging similar cases in the future.
Keywords: Salt substitute, Hyperkalemia, Potassium

261. Fatal leukoencephalopathy associated with chronic borate ingestion

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Background: Borates are a group of compounds that contain the elements boron and oxygen. Common forms include boric acid (H_3BO_3) and borax (sodium borate, $Na_2B_4O_2$-$10H_2O$). Borax is commonly used in pesticides, detergents, and household products. Acute exposure to large doses of borates usually causes self-limited gastrointestinal complaints. Chronic toxicity is less well-described, but may present with varying degrees of CNS, renal, hepatic, and dermal involvement.
Case Report: A 40-year-old woman with type 2 diabetes presented to the hospital with progressive mental status changes, gait instability, and loss of visual acuity in the setting of more than three months of daily ingestion of Willert Bowl Fresh® toilet bowl cleaner. Each 48-gram tablet of this product contains $<5\%$ – 25% sodium tetraborate and $<5\%$ aluminum sulfate. The patient reportedly ate one tablet per day, and had experienced bloody diarrhea several months prior to hospitalization. During her hospital course, she developed coma and a diffuse desquamating rash. The poison center was consulted 3 weeks after admission, at which time urine boron (undetectable; reference range, <5 mg/L) and urine aluminum (9 mcg/L; reference range, 0–7 mcg/L) were sent. An MRI demonstrated diffuse leukoencephalopathy, EEG was negative for seizure activity, and CSF studies did not demonstrate evidence of infection. Despite aggressive supportive care, the patient continued to worsen and died from cardiopulmonary arrest on hospital day 31.
Discussion: Borate poisoning is uncommon. Chronic exposure results in multi-system toxicity. Prior reports have described renal failure following massive acute borate overdose; the absence of renal injury in this case may be related to the chronic nature of her exposure. Boron is rapidly cleared from the blood, with $>90\%$ excreted in the urine within 96 hours of ingestion; the remainder concentrates in the brain and liver. As our patient did not have boron levels tested until 22 days after admission, it is likely that any ingested boron both had been distributed into the tissues and eliminated by the kidneys prior to sample collection. Lastly, though aluminum is also a component of the ingested toilet bowl cleaner, the lack of renal failure and seizures make aluminum toxicity a less likely etiology for this patient's presentation.
Conclusion: This is an unusual case of toxic leukoencephalopathy and death associated with chronic ingestion of borate-containing toilet bowl cleaner. The history, along with symptoms in three of the four organ systems classically affected by boron, strongly suggests a clinical diagnosis of borate toxicity, though elevated serum or tissue boron levels could not be confirmed in this case.
Keywords: Borate, Encephalopathy, Chronic overdose

262. Outcome of unintentional exposures to diethylene glycol

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Background: Ingestion of diethylene glycol (DEG) can cause altered mental status, acute kidney injury, metabolic acidosis, respiratory compromise, coma, and death. Inappropriate use as an excipient was responsible for epidemic toxic catastrophes. However, the risk from single, acute, unintentional exposures has not been described. The objective was to assess the burden of disease (major outcomes or deaths) from unintentional ingestions of DEG called to US poison centers.
Methods: No comprehensive generic code identifies all DEG-containing products. NPDS was queried for human exposure cases between 1/1/2000 and 12/31/2013, involving any of 61 individual product codes that included DEG. Only unintentional, single substance, one-time ingestions were included. Individual poison centers were contacted for details on cases coded as a major effect or fatality.
Results: 12,628 cases were identified, though only 11,531 involved a single substance (3,077 <6 yo, 2,578 ≤ 2 yo). Only 14 of these were coded for a major medical outcome, and there was one death (0.0087%). Eight reports were found to have been miscoded and were excluded. Details were not available on two cases coded as major. Of the 6 reports included in our final analysis, age ranged from 14 months to 77 years and all were male. Three of these were aged less than 6 years – two were admitted to a critical care unit, one was admitted, but the level of care was unknown, and there were no pediatric fatalities. Interestingly, all 3 pediatric cases were less than 2 years old. Detailed breakdown of the major effect cases was as follows:

Age	Quantity	Outcome	Fomepizole	Dialysis	AMS/Intubated
14 mo	Mouthful	Major	Yes	No	Yes
18 mo	Taste	Major	Yes	No	Yes, intubated
22 mo	Sip	Major	Yes	Yes	Yes
47 yo	Unknown, 2 L soda bottle	Death	Unknown	Yes	Yes
59 yo	Unknown	Major	Yes	Yes	No
77 yo	40 oz	Major	Yes	Yes	Yes, intubated

The single fatality involved a mentally disabled person who mistook DEG for a soft drink. There was no correlation between reported dose and outcome. Fully 96% of the ingestions involved brake fluid.
Conclusion: NPDS houses over 11,000 cases of unintentional, one-time ingestions of DEG. Of these, only one fatality has been recorded, occurring in a mentally disabled patient who confused it for a beverage. Three toddlers suffered a "major effect," out of over 3,000 exposures.
Keywords: Diethylene glycol, Acidosis, Toxic alcohol

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263. Ingestion of compounded ointment leading to significant toxicity in a child

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Background: Chronic pain syndromes are common problems that are often difficult to treat and may respond poorly to oral therapy alone. Alternative drug delivery routes, specifically transdermal, are often used to help alleviate patient symptoms. Compounding of several different classes of topical medications into a single, individualized preparation is increasingly utilized in an attempt to optimize therapy. The potential toxicity of compounded topical medications may be overlooked by physicians and patients alike, leading to unintentional exposures.
Case report: A 14-month-old (10 kg) previously healthy boy was found with his grandmother's diabetic foot ointment containing: gabapentin 5%; lidocaine 5%; clonidine 2%; ketamine (non-documented percentage); baclofen 0.4%. The ointment was not stored in a childproof container and the child had ointment on his hands and around his mouth. EMS noted the child had pinpoint pupils and was only responsive to painful stimulation. He had slow and inadequate respirations for which assisted ventilation by bag-mask was required. ED triage vital signs were: BP, 100/67 mm Hg; HR, 75/minute; RR, 12/min; O2 saturation, 100% on room air; T, 98 F. In the ED, following administration of naloxone 0.1 mg intravenous (IV), the child's respirations and level of consciousness only slightly improved. Due to continued lethargy and concern for airway protection, endotracheal intubation was performed. Several hours following intubation, bradycardia to 58/minute occurred and a dopamine infusion was initiated. He was admitted to the pediatric ICU where his ventilatory and vasoactive support was weaned over the following 2 days. He was subsequently discharged home without apparent sequelae.
Case discussion: This patient experienced significant toxicity requiring endotracheal intubation and hemodynamic support with vasopressors following ingestion of a compounded ointment. Ingestion of a topical compounded ointment resulting in toxicity has not been previously reported. Based on the clinical presentation, it is likely that clonidine played a large role in the patient's symptoms, coupled with the sedative effects from several of the other components.
Conclusion: Dermal absorption of medications leading to toxicity is a well-recognized problem. It may be overlooked that ingestion of compounded topical medications may also cause significant toxicity, specifically in pediatric patients. The potency and dangers of these products may not be well appreciated, as the preparations are often dispensed in non-childproof containers and patients receive minimal pharmacy counseling regarding potential toxicity and safe storage.
Keywords: Compounding pharmacy, Clonidine, Pediatric

264. Pyrimethamine-induced seizure caused by compounding error

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Background: Pyrimethamine (PYR), an anti-malarial compound, is also used in the treatment of toxoplasmosis. Typically PYR is combined with sulfadoxine or sulfadiazine for the synergistic inhibitory effect on the replication of the parasite. There is no commercially available pediatric preparation and individual prescriptions require compounding by a pharmacist. Overdose of PYR is rarely reported in the literature, and very few cases of seizures after exposure to PYR have been reported. We report a case of seizures in a 5 month-old infant after the administration of an improperly compounded PYR suspension.
Case Report: A 5-month-old male child, on therapy for congenital toxoplasmosis complicated by chorioretinitis, was given a new prescription for PYR. After receiving the first dose the child developed irritability and was seen in an ER and discharged. Shortly after a second dose, he developed irritability and suffered a tonic-clonic seizure. The seizure responded to lorazepam administration and he was admitted to the hospital. PYR was stopped for 24 hours and no seizures were noted. Upon re-introduction of the medication from the same dispensed bottle, the child suffered another seizure. The medication was incorrectly compounded by a retail pharmacy and contained 94 mg/ml rather than 2 mg/ml prescribed. A blood concentration drawn 18 hours after the last dose of PYR was 3.8 mcg/ml, therapeutic window tops at 0.4.
Discussion: PYR and sulfadiazine inhibit folic acid synthesis in the parasite by targeting two different enzymes, dihydrofolate reductase and dihydropteroate synthase respectively. This combined action causes blockage of synthesis of purines and pyrimidines and thus blocks DNA synthesis and parasitic replication. PYR toxicity characterized by neurological hyper excitability, seizure and GI symptoms has rarely been reported. Due to the lack of pediatric preparation of PYR, pharmacists are asked to compound it individually as needed. This patient's physician adjusted his dose 2 days prior to presentation to account for a weight gain and it was the compounding of prescription that lead to the incorrect concentration and toxicity.
Conclusion: We report an infant who was given an inadvertent overdose of PYR, developing seizures, which improved with cessation of the medication. This case highlights the rare occurrence of seizure following an acute overdose of PYR. Healthcare providers should be aware of the potential for iatrogenic dosing errors when dealing with uncommon illnesses and use of medications that are not readily available in pediatric dosage forms. Extra care should be taken when prescribing such unusual medications to children.
Keywords: Pyrimethamine, Pediatric, Adverse drug event

265. Toxicity from compounded analgesic creams

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Background: Pharmacy-compounded topical analgesic creams have become increasingly popular for the treatment of a variety of chronic pain syndromes. These have been associated with toxicity from both ingestion and dermal absorption.

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Case Reports: Case 1: A 26 mo old boy developed marked drowsiness and irritability. His mother was prescribed a compounded topical analgesic lotion for fibromyalgia, which contained the following ingredients: ketamine 10%, clonidine 0.2%, gabapentin 6%, diclofenac 5%, baclofen 2%, cyclobenzaprine 2%, menthol 1%, nifedipine 2%, and bupivicaine 1%. She noted that the bottle had been moved from its storage site and was colored with magic marker, as was the child's face, leading her to suspect he had found the bottle and ingested some of its contents. In a community hospital ED, he remained drowsy and had hypotension with BPs initially of 60s/30s mm Hg, followed by transient improvement with IV fluid therapy, but recurrence of hypotension with BPs of 70s/40s mm Hg enroute to a children's hospital. On arrival there, VS were: T 36o C, HR 104/min, RR 24/min, BP 98/56 mm Hg, and SpO2 100% on room air. The child was awake but appeared tired and slightly irritable. He was observed overnight and his symptoms completely resolved by the next morning. A rapid urine drug screen was negative. Case 2. A 34 y.o. woman on methadone intentionally ingested 3 "pumps" of a topical pain cream prescribed for her mother. She became obtunded and was brought to an ED, where she was intubated for airway protection. This product contained a number of agents; based on hospital pharmacist calculations the following doses of each were ingested: bupivicaine 90 mg, clonidine 0.9 mg, cyclobenzaprine 90 mg, flubiprofen 450 mg, and ketamine 450 mg. She awoke and was extubated the next day. Her UDS was positive for opiates and methadone.
Case Discussion: Touted benefits of compounded pain creams include fast transdermal absorption, bypass of first pass metabolism, decreased pill burden, multiple drugs in one combination and ability to customize the analgesic combination for each patient. However, risks include potential contamination, mislabeling or inadequate labeling, little to no counseling done for mailed prescriptions, non-child resistant closures, and usage over large body surface areas without adequate guidance re total dosing.
Conclusion: The growing prevalence of compounded topical analgesic creams poses significant toxicologic hazard risks.
Keywords: compounded, topical, analgesic

266. A descriptive review of tapentadol toxicity in children

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Background: Tapentadol (Nucynta®) is a schedule II controlled substance that is indicated for the treatment of moderate to severe pain in persons 18 years or older. Tapentadol's mechanism of action consists of acting as an agonist on the mu opiate receptor and inhibiting the reuptake of norepinephrine. There are no published reports on the toxicity of tapentadol in pediatric patients. The goal of this study is to describe the outcomes and clinical effects secondary to tapentadol exposure, and to determine whether poisoning secondary to tapentadol presents with both opiate and sympathomimetic effects.
Methods: This retrospective observational study utilized data from the National Poison Data System (NPDS) that had been compiled from calls to U.S. poison centers. Inclusion criteria: exposure to tapentadol, date: 11/1/08–12/31/13, age: 0–17 years, single ingestion only, and followed to a known outcome. The data requested and provided included the following: age, gender, date, outcome, route, clinical effects, reason, substance, and therapy. IRB approval of the study was obtained and all the data that was received was de-identified summary data from NPDS.
Results: 104 patients met the inclusion criteria. 80 patients (76.9%) were ages six and under with two year-olds the most common (60.6%) age group. There were 52 males and 52 females. Of the 104 patients in the study, 88 (84.6%) were unintentional exposures. No deaths were reported. 62 of the patients (59.6%) had no effect, 34 (32.7%) had minor effects, 8 (7.7%) had moderate or major effects. 30 patients (28.8%) reported drowsiness/lethargy. Other effects reported included nausea, vomiting, miosis, tachycardia, respiratory depression, and dizziness/vertigo. Clinical effects reported for the 8 patients with moderate or major outcomes included: respiratory depression, coma, dyspnea, pallor, vomiting, edema, hives/welts, drowsiness/Lethargy, slurred speech, pruritis and hallucinations/delusions. 53 patients (50.9%) were reported to have no intervention and only observation. Therapies provided included single-dose activated charcoal (17 patients), dilution (10), naloxone (7), and food (7).
Conclusions: This is the first study looking at the toxic effects of tapentadol in a pediatric population. A majority of the patients in this review developed no effect from exposure. The most common effect reported, drowsiness/lethargy, is opiate-like clinical effect. This study is limited by it retrospective nature, passive reporting and reliance on caller information. Additional study is needed to better define the clinical effects and the dose of tapentadol required to elicit those effects.
Keywords: Tapentadol, Pediatric, Overdose

267. Flecainide toxicity in a newborn

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Background: Flecainide is a class 1c antidysrhythmic used in the treatment of supraventricular arrhythmias. It blocks predominantly sodium channels, but also has activity at both calcium and potassium channels. Toxicity generally leads to QRS prolongation, and ventricular dysrhythmias.
Case report: A four week old female with a history of congenital atrial tachycardia was initially started on propranolol for episodes of supraventricular tachycardia. When this did not successfully halt her arrhthmias, the beta-blocker was stopped and she was changed over to flecainide 3 **mg** three times a day for a total dose of 2 mg/kg/day. Due to a pharmacy labeling error, instead she received flecainide 3 **ml** (5 mg/ml) three times a day, leading to a total dose of 10 mg/kg/day. The parents noted within a few days the child was more irritable and had difficulty sleeping and eating. Visits to the primary care physician lead to formula changes and supportive care without patient improvement. On day 14, a repeat cardiology visit noted the child to be in a wide complex tachycardia at a rate of 152 beats per minute with a measured QRS 236 ms and QTc 508 ms. At this time the dosing error was recognized, and she was admitted to the Pediatric ICU. Within the first twelve hours she had multiple brief runs of ventricular tachycardia, but was treated with

supportive care alone. Initial flecainide level was 910 ng/ml, and fell slowly while holding the medication. At 24 hours her QRS was 104 and QTc 623, and by 48 hours had returned to within normal limits. She was discharged at 72 hours on the previously planned dose of flecainide 2 mg/kg/day.
Case Discussion: Flecainide toxicity in newborns is a rare event. The patient had prolongation of both QRS and QTc intervals with episodes of ectopy, due to blocking of sodium and potassium channels. Treatment was supportive, but sodium bicarbonate could have been helpful if any prolonged arrhythmias had been encountered. Other treatments, such as lipid emulsion therapy are unproven, but could have been considered if the patient had deteriorated despite standard therapy.
Conclusions: Adverse drug events are an unfortunately common occurrence, responsible for significant morbidity and mortality. This case can be considered a near miss, with ultimately a benign outcome.
Keywords: Adverse drug event, flecainide, Cardiac toxicity

268. Crushing medication error: Calcium channel blocker toxicity following administration of a crushed extended-release tablet of nifedipine

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Background: National efforts to improve patient safety have increased the focus on medication errors. We present a rare case of severe calcium channel blocker (CCB) toxicity following enteral administration of a single crushed tablet of extended-release(ER) nifedipine.
Case Report: A 69-year-old man who had stabilized after treatment for gastrointestinal (GI) bleeding was transitioned to his home medication regimen on hospital day 5. The patient's nurse crushed his nifedipine ER 90mg pill and administered it through the patient's nasal duodenal tube. One hour after exposure his physical examination was significant for: blood pressure 65/44 mmHg, pulse 80 beats/minute in a ventricularly paced rhythm, and a decreased level of consciousness. His serum glucose was 300 mg/dL. Over the next 24 hours the patient was treated with 2 L of crystalloid fluid, 37 mg of glucagon, 2 g of calcium and titrated infusions of epinephrine, norepinephrine, phenylephrine, and dopamine. He did not have evidence of a recurrence of his GI bleed or other explanation for his hypotension. Twenty four hours after exposure, the patient's blood pressure returned back to the normal range without vasopressor support.
Discussion: Although calcium channel blocker toxicity is not unusual, severe poisoning following exposure to a single crushed tablet of ER formulation is rarely reported in the literature. The toxicokinetics of a crushed ER formulation of nifedipine are not well-described. In this case, the patient required hemodynamic support for 24 hours. CCB poisoning in any manner can be life threatening, but can be especially dangerous in cases of extended release mechanism-defeat. There is potential to absorb massive amounts of concentrated drug; additionally, if the error is not identified immediately, it may go unrecognized or inappropriately treated. If the medical record reflects the correct drug, dose, and route of administration, the subtle detection that an ER formulation was crushed before administration may not occur. Although efforts to reduce medication errors have resulted in "do not crush" lists and "do not crush" labels, this case illustrates that the potential still exists for this type of medication error to occur. Increased awareness and communication among physicians, nurses, and pharmacy staff is important to help mitigate the risks associated with ER formulations.
Conclusion: Medications with potential for severe toxicity can be distinctly dangerous in ER formulations. Increased awareness among healthcare workers, as well as institutional safety mechanisms to prevent this type of medication error are important in improving patient safety.
Keywords: Calcium channel blocker, Medication Error, tablet crushing

269. Massive levetiracetam overdose in a child resulting in: not much

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Background: Levetiracetam (LEV) is a relatively new anticonvulsant approved as adjunctive therapy in the treatment of partial onset, myoclonic, and primary generalized tonic-clonic seizures. LEV possesses no significant affinity for GABA or benzodiazepine receptors, and its exact mechanism of action is unclear, but it does have antiepileptic, anxiolytic, and cognitive enhancing properties. LEV use quickly escalated due to its minimal side effect profile and limited drug interactions, but despite its popularity little data is available regarding overdose, especially in children. We present a case of a massive LEV overdose in a child that resulted only in lethargy managed successfully with supportive cares.
Case Report: A 6 year-old, 18 kg child with cerebral palsy (CP) was inadvertently given 3.5 ounces of LEV 100mg/ml oral solution through his jejunostomy tube, a dose confirmed by the parent responsible. He presented to an emergency department one hour post-ingestion, awake and alert with the following vital signs: BP 101/57, HR 127 RR 20, 98% oxygen saturation. 2 hours later he developed extreme lethargy and a decreased gag reflex. Intubation was considered, but because he remained responsive and maintained oxygenation, this was deferred. The patient began to waken approximately 8 hours post-ingestion and his mental status continued to clear throughout the day. His lowest measured blood pressure was 80/38; this was managed with intravenous fluids. No additional intervention was required and the patient was discharged home within 24 hours of ingestion.
Discussion: 10.5g (583mg/kg) is almost 20 times the maximum recommended dose for a 6 year-old. In clinical trials adults given up to 6g/day experienced somnolence, agitation, respiratory depression and coma, and the few cases of large overdoses have reported consistent effects. This patient became lethargic and developed minor hypotension, but despite this massive overdose his airway remained protected and aggressive intervention was not required. Although LEV typically has a rapid onset, with peak plasma levels occurring in one hour, this patient did not develop symptoms until 3 hours post-ingestion. The cause for this is uncertain; decreased gut motility from CP may be a possibility; it is also possible absorption may be delayed in overdose. The T1/2 of LEV in children is 5–6 hours; resolution of symptoms within 24 hours of exposure suggests that the drug maintains first-order elimination even at 20 times a therapeutic dose.

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Conclusion: LEV overdose causes sedation that may lead to coma and/or respiratory depression; however, even massive overdoses may be managed with only supportive cares. Symptom onset may be delayed, yet recovery is expected to be rapid.
Keywords: Anticonvulsant, Overdose, Pediatric

270. Corneal abrasion from tide pod detergent

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Case: A 12-month-old girl presented to the pediatric emergency department 4 hours after she squirted the contents of a Tide detergent pod into her right eye. The poison control center was contacted; the poison specialist relayed that the detergent has a pH of 6.8–7.4, and recommended no further treatment. On fluorescein exam she was noted to have diffuse corneal abrasion, requiring eight days of medical therapy.
Discussion While ocular injury from detergent pod contents is an acknowledged danger in the pediatric population, the significance of this injury, as well as appropriate management, is not well documented. Alkaline injury is accepted as a severe form of ocular injury. Tide pod contents are listed as having a pH of 6.8–7.4; however, linear alkylbenzene sulfonate, the main surfactant in Tide detergent pods, is an alkali with a pH of about 10 in a 1% solution. The increased concentration of this surfactant in detergent pods versus liquid detergent is thought to play a major role in the mechanism of injury.

Contact with the detergent preservative is a theoretical yet plausible mechanism of injury. The most common preservative used in eye drops, benzalkonium chloride (BAC), has been shown to promote inflammation and alter precorneal mucins that may lead to epithelial cell death. BAC and benzisothiazolin, the preservative in Tide pods, are similar in that they share a quaternary ammonium structure. The ammonium group is lipophilic, and has been shown to penetrate and disrupt the outer layer of corneal epithelium.

Recent studies suggest avoiding irrigation with isotonic saline, instead favoring aggressive irrigation with a universal buffer solution. Irrigation should be continued until the pH reaches neutral. Ophthalmology should be consulted from the ED to help guide medical treatment. Ophthalmic corticosteroids, such as prednisone acetate, can decrease anterior chamber inflammation. Dosing intervals of 15 minutes to 1 hour have been shown to more effectively reduce inflammation than intervals of 4 hours. Ascorbic acid is another important factor in ocular wound healing. After an alkali injury, the concentration of ascorbic acid in the aqueous humor can fall to a third of its normal value. Both systemic and topical ascorbic acid are used in these injuries to restore normal levels. Lastly, topical antibiotic use is a universally accepted prophylaxis after corneal injury, and selection of any particular agent is at the provider's discretion.
Conclusion: Exposure to detergent pods is becoming an increasingly significant injury in the pediatric population. We report a case of diffuse corneal abrasion due to ocular contact with Tide detergent pod contents. This highlights the need for more widespread knowledge on management of these injuries.
Keywords: Caustic, Pediatric, Environmental

271. Facial burn due to unintentional use of phenol during cerumen removal in a child

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Background: Phenol has been used as an antiseptic and in dermatologic facial peels. Additionally, phenol finds use as topical anesthesia of the tympanic membrane. It is both caustic and anesthetic. The use of phenol on skin may cause partial-thickness burns and defatting, especially after prolonged contact.
Case Report: A healthy 4-year-old male was taken to an ear, nose, and throat specialist (ENT) for removal of impacted cerumen in the left ear. The ENT unintentionally instilled phenol into the child's ear instead of the normal irrigation solution, which typically contains hydrogen peroxide (3%). The phenol ran out of the child's ear and onto his face. Upon realizing the error, the child was sent to the emergency department (ED). On exam the child had a burn to more than thirty percent of the left side of his face with extension to the left earlobe and into the canal. On the face there was an irregular area of hyperpigmentation with surrounding erythema. There was no skin sloughing and the burn was non-tender to palpation. Irrigation of the skin was performed with water and normal saline. After evaluation in the ED, the child's skin was dressed with bacitracin and he was discharged to follow up with his ENT and a plastic surgeon.

Eight weeks after the incident, the child's mother reported that the child had passed a recent audiology evaluation. Follow up exams by a plastic surgeon showed that the child's left cheek, earlobe and auditory canal were no longer erythematous, however the hyperpigmented area had become hypopigmented. At last follow up, they were evaluating whether or not laser treatment would be necessary to even out the child's skin tone.
Discussion: This case illustrates the potential for long-term dermatologic effects that can occur with phenol exposure to skin. Although phenol is a caustic, it is only minimally irritating to skin because it functions as an anesthetic due to its sodium channel blocking effects. It is recommended that topical phenol exposures be irrigated with polyethylene glycol (PEG) or water, although some believe that water may increase dermal absorption of phenol. If PEG is used, PEG-300 or PEG-400 is best, not the PEG-3350 used in preparation for a colonoscopy. After removal of the phenol by irrigation, general burn care is appropriate.
Conclusions: Practitioners should be aware of the acute and delayed skin damage that can develop after topical exposure to phenol. Long-term follow up may be necessary for these burns. Although not regularly used, exposure to phenol is possible during ENT procedures.
Keywords: Dermal toxicity, Pediatric, Caustic

272. Pediatric marijuana exposures at a regional poison center serving a decriminalized state

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Background: Currently 18 states and Washington DC have decriminalized marijuana for use for medical purposes.

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Washington and Colorado have recently passed legislation allowing recreational use of marijuana. Previous studies have shown an increase in emergency department visits to tertiary care hospital in Colorado, in addition to an increase in calls to regional poison centers in states that have decriminalized marijuana. Our primary objective was to evaluate the number of unintentional marijuana exposures in children $<=5$ years of age from a regional poison center (RPC) serving a decriminalized marijuana state for as compared to the other US regional poison centers.

Methods: Retrospective review from the American Association of Poison Control Centers' National Poison Data System (NPDS) from January 1, 2000 to December 31, 2013 for US and RPC serving a decriminalized state for unintentional exposures to marijuana in children $<=5$.

Results: From 2000–2013, there were 2328 total exposure calls to all US poison centers. The RPC received 119. For all centers except the RPC, 83% of exposures occurred in the child's own residence, 70% were seen or referred to a health care facility, and 21% were admitted. There were 14% major or moderate effects and no deaths. For the RPC, 79% of exposures were in the child's house. 76% were seen or referred to a health care facility, and 23% were admitted. There were 16% major or moderate effects and no deaths. Nationally, calls increased from 130 in 2001 (1 per 10,000 annual NPDS calls) to 270 in 2013 (2.6 per 10,000 annual NPDS calls). RPC calls increased from 7 calls in 2001 (3 per 10,000 annual NPDS calls), to 26 in 2013 (13 per 10,000 NPDS yearly calls).

Conclusion: The overall rate of RPC calls serving a decriminalized state and all other NPDS regional poison centers remains low. However, the number of RPC increased between 2000–2013 and at a greater rate than the rest of the United States.

Keywords: Pediatric, Marijuana, Epidemiology

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273. Description of edible marijuana products, potency ranges, and similarities to mainstream foods

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Background: Medical use of marijuana is decriminalized in 18 states and Washington DC. Colorado and Washington State recently passed legislation allowing recreational marijuana use. In 2011, USA Today reported the marijuana industry had $1.5 billion in sales, and this is expected to increase to $3.3 billion by 2015. Though marijuana brownies have been around for some time, the economic explosion in the marijuana industry has fueled much more sophisticated THC-containing 'edibles', including candies, baked goods, butter, and beverages. Rather than using raw plant material, many of these products are prepared using concentrated THC extracts. Cases of unintentional pediatric exposure leading to severe symptoms have been reported with greater frequency in recent years following decriminalization. Few medications, drugs or controlled substances are available as foods or beverages, with examples of exceptions being nicotine and aspirin gum, chocolate laxatives, and fentanyl lollipops, making regulation of drug-containing foodstuffs relatively uncommon. Our primary objective was to describe some common edible THC products, highlighting their similarities to mainstream foods, and the ranges of THC concentrations in these products.

Methods: An internet search using "marijuana edibles" and onsite survey of random Colorado medical and recreational marijuana dispensaries was performed. Foods were classified as baked goods, candies, beverages, and other. THC concentrations &/or dose was provided by product manufacturers.

Results: A wide variety of THC-containing edibles are available. In Colorado, individual recreational purchases of THC are limited to a total of 100 mg, while prescription purchases may be as much as 500–1000 mg. Many edible products mimic mainstream foods such as gummy bears, chocolates, candy bars, pastries, and soft drinks. The reported concentration of THC in these products range from 10–100 mg.

Conclusions: A large variety of marijuana edible products mimicking mainstream foods is available containing a broad range of reported THC concentrations. While purchase size is legally limited, one typical food serving may contain the equivalent of multiple THC doses for an experienced user. The high THC concentration in these products, combined with the food appeal to children, creates a circumstance in which pediatric patients may be exposed to much higher THC doses than were previously likely from marijuana plant material.

Keywords: Marijuana, Pediatric, Drug of abuse

Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
Johnson & Johnson	Consulting Fees	Consulting Fees

274. The vaping phenomenon: a smoldering problem?

L Cantrell

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Background: Our poison system's published experience with electronic cigarette (e-cig) exposures from 2010–2012 demonstrated an increase in cases each consecutive year. The sources of nicotine exposure were liquid from cartridges or inhalation from an e-cig. Symptoms were minor and self-limiting. Given the continued rise in popularity and diversity of e-cig products, our goal was to detect increasing exposure rates as well as characterizing changes in the manner and severity of exposure cases.

Methods: The database of a statewide poison system was queried for human e-cig exposures from January 2013 through February 2014. Month, age, manner and route of exposure, estimate exposure amount, if evaluated in an emergency department (ED) and symptoms were recorded.

Results: A total of 129 cases were identified; 60 involved females. Ages: 6 years and under- 59 cases, 18 years and older 69 (range 1–64 years). Routes: ingestion- 72, inhalation- 37, ocular- 13, dermal- 7. Manner: children- ranged from smoking an e-cig to taste ingestions from refill containers; adults- e-cig device malfunction resulting in liquid ingestion, instillation of refill solution into eye instead of eye drops, intentionally nicotine dose escalation resulting in ED visits, use of e-cig by tobacco-naïve adult resulting in

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an ED visit. Most symptoms were consistent with mild nicotine poisoning (GI symptoms, dizziness, diaphoresis, headache, local irritation) and were self-limiting, although a 22 year-old male developed hypertension and tachycardia. Patients were either in or referred to an ED in 31 cases, with no admissions.
Discussion: Our data revealed a marked increase in both adult and pediatric exposures (69 and 59 compared to 12 and 7 in 2012, respectively) to e-cig products. Exposures to nicotine solutions from refill containers was novel, accounting for 23% all exposures compared to zero from the previous years and resulting in symptoms via all routes of exposure. There was an overall increase in ED visits/referrals from 14% to 24%.
Conclusions: While exposures to e-cig merchandise have yet to result in serious poisonings, the increasing popularity and diversification of these products has resulted in increased utilization of healthcare resources.
Keywords: E-cigarette, Nicotine, Ingestion

275. Aspirin and Fanconi syndrome: are there risk factors for its development?

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Background: Fanconi syndrome is a generalized transport defect within the proximal renal tubules which leads to inappropriate urinary losses of glucose, amino acids, bicarbonate, uric acid, phosphate, potassium and other organic compounds. It may be inherited or acquired following exposure to certain xenobiotics. The medical literature has a few case reports of aspirin (ASA) intoxication leading its development.
Research Question: In cases of ASA toxicity, are there differences between patients that develop Fanconi Syndrome and those that do not?
Methods: This is a retrospective review at a tertiary care hospital in an urban setting. All cases from 2001–2011 with aspirin concentrations >30 mg/dL were evaluated for the development of proximal tubule renal dysfunction (either elevation of creatinine on presentation that resolved prior to discharge, or development of an elevation during hospital stay), an associated glucosuria (within the renal threshold level of 160–180mg/dL or greater than expected based on serum glucose levels), and proteinuria. Cases that developed Fanconi Syndrome were compared to cases that did not develop the syndrome in regards to: sex, age, aspirin concentration, race and ethnicity.
Results: One hundred and three patients in 107 independent encounters had ASA levels >30mg/dL. Nine cases were identified to have developed Fanconi Syndrome.

For cases of Fanconi syndrome, the average age was 30.4 years (CI 95% 21.7–39.2). Mean ASA concentration was 59.8 mg/dL (CI 95% 44.1–75.5). Women accounted for 6 cases (67%). White race accounted for 8 cases (88%) and there were no cases that were classified as Hispanic.

ASA cases not meeting criteria for Fanconi Syndrome had an average age of 29.0 years (CI 95% 25.2–32.8). The mean ASA concentration was 46.8 mg/dL (CI 95% 43.9–49.8). Men accounted for 35 cases (36%). Black race accounted for 3 cases (3.1%), and there were 4 (4.1%) Hispanic cases.
Discussion: The literature has no information in regards to risk factors in the development of Fanconi Syndrome after ASA overdoses. In this single center study, females, white race and non-hispanic ethnicity account for higher numbers of cases. In regards to age and peak ASA concentration, there is no statistical difference between the two groups. This study was limited by its retrospective nature, single center and limited diversity.
Conclusion: Fanconi syndrome was found in 8.7% (9/103) of patients, but further studies in a larger scale may provide better understanding regarding the risk factors for the development of this syndrome following ASA overdose.
Keywords: Aspirin, Renal toxicity, Fanconi

276. Pattern of antivenin use in copperhead (Agkistrodon contortrix) bites reported to poison centers

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Background: Copperhead (Agkistrodon contortrix) bite is the most common venomous snake bite reported to US poison centers. Guidelines may recommend administration of antivenin for patients demonstrating serious symptoms. This study examines the association of various factors with the administration of antivenin.
Methods: Cases were all copperhead bites reported to a state-wide poison center system during 2000–2013. Cases were divided into those with antivenin and those without antivenin. The antivenin rate was determined for selected variables. When medical outcome was examined, the rate was determined for all classifications and for not serious (no effect, minor effect, not followed-judged nontoxic, not followed-minimal effects) and serious (moderate effect, major effect, death, unable to follow-potentially toxic) groups.
Results: Of 3,171 total copperhead bites, the antivenin rate was 41% and the serious outcome rate was 67%. Of 1,267 cases during 2000–2006, the antivenin rate was 31% and the serious outcome rate was 63%. Of 1,904 cases during 2007–2013, the antivenin rate was 47% and the serious outcome rate was 70%. The antivenin rate by medical outcome was no effect - 7%, minor effect - 27%, moderate effect - 53%, major effect - 70%, not followed-judged nontoxic - 0%, not followed-minimal effects - 12%, unable to follow-potentially toxic - 19%, not serious - 24%, and serious - 49%. For patients already at/en route to a healthcare facility, the antivenin rate was 45% and serious outcome rate was 68%; for patients referred to a healthcare facility by the poison center, the antivenin rate was 16% and the serious outcome rate was 72%. The antivenin rate by patient age was 0–5 years - 57%, 6–12 years - 43%, 13–19 years - 40%, 20 + years - 40%; the antivenin rate was 40% for males and 42% for females. The antivenin rate for the most common clinical effects was puncture/wound - 43%, dermal edema - 48%, dermal pain - 48%, ecchymosis - 54%, erythema - 49%, hypertension - 60%, nausea - 58%, and vomiting - 56%.
Conclusion: Antivenin was reported in only 41% of the copperhead bites. Although the antivenin rate increased with the severity of the outcome, antivenin was reported in only 70% of the cases with major outcomes. The number of reported bites increased 50% from the first half of the study period to the second; although the serious outcome rate increased by only 12% between the 2 periods, the antivenin rate increased by 49%. Although patients referred to a healthcare facility by a poison center had slightly

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higher serious outcome rates than patients already at/en route to a healthcare facility, the former had a much lower antivenin rate.

Keywords: Snake bite, Copperhead snake, Antivenom

277. Human exposures to veterinary vaccines reported to poison centers

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Background: Many veterinary vaccines are available without prescription and may be used by the public, potentially leading to adverse exposures. A previous study used US poison center data to examine human exposures to veterinary vaccines. That study may have had several limitations. This study describes human exposures to veterinary vaccines reported to poison centers without these limitations.

Methods: Cases were human exposures to veterinary vaccines reported to a statewide poison center system during 2000–2013. A search was performed for all of the specific product (PoisIndex) codes for veterinary vaccines that were in the system's database. Exposures involving other substances in addition to the vaccine and those not followed to a final medical outcome were included in the study. The distribution of exposures was determined for various demographic and clinical factors.

Results: Of 509 total cases, 497 involved 1 vaccine and 12 involved 2 vaccines. Of these 521 total vaccines, 73% were assigned the "Serums, Toxoids, Vaccines" Generic code and 27% the "Veterinary Drugs" Generic code. The most frequently reported vaccines were parvovirus vaccine (17%); adenovirus-canine distemper-hepatitis-Leptospira species-parainfluenza-parvovirus vaccine combination (11%), adenovirus-canine distemper-parainfluenza-parvovirus vaccine combination (10%), and West Nile virus vaccine (5%). 81% of the patients were age 20 years or older; 54% were male. 45% of the exposures occurred in April-July. The exposure was unintentional in 97% of the cases. The exposure site was the patient's own residence (84%), workplace (9%), other residence (3%), public area (2%), and other/unknown (3%). The exposure route involved injection (60%), dermal (19%), ingestion (13%), ocular (7%), inhalation (1%), and other/unknown (4%). 72% were managed on site (non-healthcare facility). The medical outcome was no effect (12%), minor effect (20%), moderate effect (3%), death (0.2%), not followed-judged nontoxic (8%), not followed-minimal effects (49%), unable to follow-potentially toxic (6%), and unrelated effect (2%). The most frequently reported adverse clinical effects were puncture/wound (39%), dermal irritation/pain (24%), edema (12%), erythema (5%), and ocular irritation/pain (4%).

Conclusion: Human exposures to veterinary vaccines reported to the poison center system often involved adults and males, occurred during the Spring, resulted from injection, and occurred at the patient's residence. These exposures tended not to be serious and could be managed outside of a healthcare facility. The most frequently reported adverse effects were usually dermal in nature.

Keywords: Poison center, veterinary drug, veterinary vaccine

278. Pattern of asenapine ingestions reported to poison centers

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Background: Asenapine, an atypical antipsychotic for the treatment of schizophrenia and bipolar I disorder, was approved by the Food and Drug Administration on August 14, 2009. Asenapine exhibits high affinity for serotonin 5-HT:1A/B, 2A/B/C, 5–7, dopamine D1–4, alpha1/2-adrenergic, and histamine H1; and moderate affinity for H2 receptors. There is limited data on adverse events associated with asenapine. This study describes potentially adverse ingestions of asenapine.

Methods: Cases were all asenapine ingestions reported to a state poison center system during 2009–2013. Exposures involving coingestants and those not followed to a final outcome were included. The distribution and mean dose (MD) was determined for selected factors. For management and outcome factors, analysis was limited to those cases not involving coingestants.

Results: There were 105 cases. Of the 56 cases with a reported dose, the MD was 54 mg (range 5–600 mg). The patient age was 10% 5 years or less (MD 9 mg), 21% 6–19 years (MD 37 mg), and 70% 20 years or more (MD 69 mg). Thirty-seven percent of the patients were male (MD 34 mg), 61% female (MD 64 mg). The most commonly reported reasons for the exposure were 47% suspected attempted suicide (MD 126 mg), 13% unintentional-general (MD 9 mg), 13% therapeutic error (MD 25 mg), 9% adverse reaction (MD 6 mg), and 9% intentional misuse (MD 21 mg). 54% involved no coingestants (MD 48 mg) and 46% coingestants (MD 73 mg). For cases without coingestants, the management site was 46% already at/en route to healthcare facility (MD 85 mg), 37% managed on site (MD 14 mg), and 12% referred to a healthcare facility (MD 19 mg). The medical outcome was 21% no effect (MD 24 mg), 21% minor effect (MD 40 mg), 14% moderate effect (MD 141 mg), 11% not followed-nontoxic (MD 12 mg), 26% not followed-minimal effects (MD 15 mg), and 5% unable to follow-potentially toxic (MD 85 mg). The most commonly reported clinical effects were 28% drowsiness (MD 71 mg) and 5% agitation (MD 25 mg). The most commonly reported treatments were 16% activated charcoal (MD 24 mg), 16% IV fluids (MD 197 mg), and 9% cathartic (MD 31 mg).

Conclusion: The majority of asenapine ingestions reported to the poison center system involved adults and females. Almost half were suspected attempted suicides. The majority of ingestions without coingestants had no serious outcomes. The most reported clinical effect, drowsiness, was consistent with asenapine's mechanism of action, and the most common side effect in premarketing clinical data. A limitation of this study is the small number of cases, particularly where the dose was reported and those without coingestants.

Keywords: Ingestion, Poison center, Asenapine

279. Poisonings in the Federal Republic of Germany – situation as 2012

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Objectives: Cases of poisoning account for an important share of accidents in Germany, which is particularly high for accidents

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involving children. Compared to other cases of disease and accidents, the numerical documentation of cases of poisoning is inadequate in Germany. Presently, there is no institution that could make available representative and meaningful data on the poisoning situation even the German Federal Statistical Office (DISTATIS).
Method: Owing to intensive scientific cooperation between the German Poison Information Centres (PIC) and the Poison and Product Documentation Centre at the Federal Institute for Risk Assessment (BfR DocCentre) as well as to international cooperation, harmonized and standardized elements for documentation and reporting procedures appropriate to account for poisoning accidents have been developed in different research projects.
Results: The evaluation for the 2005–2012 period that was based on published and processed figures for the Federal Republic of Germany has shown the following results:

Of about 230 000 telephone inquiries received in 2012, about 207 000 referred to exposure of humans due to relevant contacts with different noxae. An annual increase by 3–5% was recorded. Analyses for 2011 referring to subsets processed by means of standardized methods have shown the following results: Remedies were involved in about 39% of the cases recorded (of these, medicinal products for humans in 99%); chemical/physicochemical agents in about 26% (of these, cleaning and maintenance products in 46%); products of daily use in about 14% (of these, cosmetics in 40%); and plants in about 10%. More than 90% referred to acute and less than 5%, to chronic poisoning. Regarding the degree of severity of poisoning, an asymptomatic course was reported for 44% of cases; minor manifestations were experienced in 30%, moderate ones, in 6%, and severe manifestations, in 2% of the cases recorded. Fatal cases were rare ($< 0.1\%$). The majority of cases (67%) were caused by poisoning accidents, followed by suicidal action (20%) in second position, abuse and industrial poisoning (4%) in third position. 1% of the cases of poisoning were attributed to adverse drug reactions (ADR) and mistaking a medicinal product for another one. Infants aged 1–2 years have the highest risk of poisoning.
Conclusion: Proposals for a national monitoring scheme of poisoning incidents have already been developed by a panel of the BfR Committee for the Assessment of Poisonings. It is an ambitious aim to be able to prepare annual reports in a way similar to what has been achieved in the USA by means of the report of the National Poison Data System (NPDS) maintained by the American Association of Poison Control Centers (AAPCC).
Keywords: Epidemiology, Poison center, Intoxication

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280. Characteristics of salicylate ingestions reported to the toxic registry

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Background: Acetylsalicylic acid (ASA) overdose may result in morbidity and mortality and is an important public health issue. The Toxicology Investigators Consortium (ToxIC) Registry was analyzed to determine the demographic characteristics, dosage, and outcome of all salicylate ingestions reported to the registry since its inception.
Methods: We queried the ToxIC Registry database for all cases from January 1, 2010 to April 1, 2014. Inclusion criteria included aspirin exposure. Data collected included age, gender, nature of exposure (e.g. intentional), presence of co-ingestants, dose, serum salicylate concentration (SSC), use of activated charcoal (AC), gastric lavage (GL), whole bowel irrigation (WBI), sodium bicarbonate administration (SB), endotracheal intubation (ET), multiple-dose activated charcoal (MDAC), urinary alkalization (UA), hemodialysis (HD) and patient outcome. Regression analysis was used to determine if significant associations existed between SSC and AC, SB, UA, HD, and ET. Chi square analysis was performed to determine if significant associations existed between nature of exposure or presence of co-ingestants and AC, GL, WBI, SB, UA, MDAC, and HD.
Results: Over the 51-month study period, 775 cases met the inclusion criteria. Most cases were reported in females (64%), of whom 7 were pregnant (1%). The most common age range was 19–65 (54%). The majority of salicylate ingestions were intentional (84%) and were single agent exposures (57%). AC was administered in 17% of cases, GL was done in 1% of cases, and WBI in 0.4% of cases. MDAC was administered in 4% of cases, UA was performed in 17% of cases, and HD was initiated in 5% of cases. Dose was reported in 5% of cases and ranged from 0.325g to 325g with a median of 16.1g and a mean of 30.3g. SSC was reported in 16% of cases and ranged from 6mg/dL to 131mg/dL with a median of 45.5mg/dL and mean of 47.1mg/dL. Logistic regression demonstrated no statistically significant relationship between SSC and administration of AC or WBI. Logistic regression demonstrated a significant positive association between SSC and SB, UA, HD, and ET (all $p < 0.05$).

Chi square analysis demonstrated that intentional ingestions were more likely to be treated with AC, and single ingestions were less likely to be treated with AC, GL, SB, UA, and MDAC (all $p < 0.05$).
Conclusions: Most salicylate ingestions reported to the ToxIC Registry occurred in females, were intentional in nature, and were single agent exposures. Serum salicylate concentration was predictive of UA, HD, SB, and ET but not AC. Intentional overdose was predictive of AC. Limitations of our study include incomplete reporting of dose and SSC.
Keywords: Aspirin, Salicylate, Overdose

281. e-Cigarette exposures: regional poison center exposures trends

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Background: Electronic cigarettes (e-Cigarettes) are battery powered devices containing nicotine fluid in varying concentrations. They are designed to mimic smoking by inhaling the vaporized nicotine fluid instead of smoke. These fluids are marketed in a variety of container sizes, concentrations, and flavors, from apple to menthol. The containers may or may not be in child resistant packaging. e-Cigarettes may also be used for smoking cessation. Fluid concentrations range from 0–36 mg/mL. Currently, these devices and fluids are not FDA regulated. While some nicotine fluid is made in the United States, other fluids are imported from

all over the world, including China. Due to the lack of child resistant packaging and enticing flavors and scents, e-Cigarette appeal is particularly worrisome in the pediatric population. We analyzed our adult and pediatric exposures to this emerging phenomena.
Methods: A retrospective review of our poison center's cases was performed from the American Association of Poison Control Centers' National Poison Data System from January 1, 2010 to March 31, 2014 using generic codes 0200620 and 0200622.
Results: Nicotine fluid from e-Cigarettes has steadily increased since 2010. This regional poison center (reported 155 total exposures. 2013 exposures increased 3.8 times over 2012. First quarter 2014 pediatric exposures are already 1/3 of 2013. During the study period, 43.2% experienced a minor effect, while 3% were documented as having a moderate or major effect. Of the total exposures, 70% had unintentional contact with e-Cigarette nicotine fluid (many as a direct result of refilling their e-Cigarette device) and 14% unintentionally misused the product.
Conclusion: RPC data indicated e-cigarette exposures are continuing to rise. A majority of these exposures are unintentional. Packaging and education regarding proper use of e-Cigarette nicotine fluid is important. Refillable cartridges can be used for other fluids like marijuana liquids. These cartridges filled with unknown or unlabeled product could be problematic to users and poison centers. Unit dose, non-refillable nicotine cartridges are a lower risk alternative and should be encouraged.
Keywords: Electronic cigarette, Nicotine, Legislation
Disclosure: Do you have relevant financial or other relationship(s) with the commercial supporters of NACCT?

Commercial Interest	What Was Received	For What Role?
BTG International, Inc.	Contract	Contract
Cumberland Pharmaceuticals	Contract	Contract
McNeil Specialty Consumer Pharmaceuticals	Contract	Contract

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282. Medication errors reported to the Italian poison control centers: a pilot study

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Background: Understanding the circumstances that contribute to medication errors can support the development of strategies to improve patient safety and medication practices. Poison Control Centre (PCCs) are a particularly valuable source of information on medication in Italy, the National PCC in Milan, in collaboration with the Italian National Institute of Health and the Italian Medicines Agency, has recently implemented a national surveillance system of medication errors based on cases managed by PCCs.
Objective: to provide a preliminary characterization of MEs handled by the Italian PCCs over a 1 year time period and support evidence-based preventive strategies.
Methods: A prospective study of cases notified to the national surveillance system of medication errors was conducted from 4/16/2012 to 4/15/2013. The collaborating PCCs used a standardized report form. For each case the following information were reported: patient data (age, weigh, gender), the location of exposure, the pharmaceutical agent (s), type of medication error, management site, the presence or absence of clinical effects, and the treatment recommended by the PCC. Drugs were grouped according to the WHO's Anatomical Therapeutic Chemical (ATC) classification system and the active pharmacological substance. Severity of poisoning was graded according to the Poisoning Severity Score.
Results: A total of 3.430 medication errors were notified to the Italian surveillance system during the first year of activity. About 40% of cases were aged < 5 years, 18% 5–19 years, 26% 20–69 years, and 17% 70 years or more. The most frequently reported types of medication errors were wrong dosage (54%) and wrong drug (25%). About 40% of patients were victim of their own mistake and 55% of their caregivers' mistake. Some 1% of medication errors involved hospitalised patients. Most of cases (84%) were asymptomatic. However, at least one treatment was prescribed for 40% of all cases. Among patients suffering signs or symptoms possibly related to the drug, 34% reported neurological, 29% gastrointestinal, 10% neuromuscular, and 9% cardiovascular effects. Severity of poisoning was low in 10% of cases, moderate in 6%, and severe in 2%. The most frequently reported agents were: acetaminophen (492 cases, 73% aged < 5 years), amoxicillin (193 cases, 71% aged < 5 years), azithromycin (No 85, 69% aged < 5 years), ibuprofen (84 cases, 58% aged < 5 years), salbutamol (No 68, 73% aged < 5 years), and tiotropium bromide (64 cases, 70% aged 70 years or more).
Conclusion: PCCs can provide a relevant contribution to pharmacovigilance providing timely, quality surveillance data on the circumstances and type of medication errors occurring in the community.
Keywords: Pharmacovigilance, Poison center, medication errors

283. The pyrethrins stewardship program – prospective study of exposures to pyrethrins focused on dermal and respiratory effects

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Background: Reports of dermatitis and respiratory reactions associated with use of pyrethrins- containing products have appeared in the medical literature over the last century. The Pyrethrins Joint Venture, in consultation with U.S. Environmental Protection Agency, established the Pyrethrins Stewardship Program (PSP) to investigate consumer exposures to pyrethrins-containing pesticides.
Objectives: The objectives of the PSP were to investigate consumer exposures to pyrethrins-containing products in order to evaluate the issue of possible correlation between use and respiratory or dermal adverse effects.

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Methods: Pyrethrin manufacturers FIFRA 6(a)2 data was queried for self-reports of exposure and included incidents managed by public or contract poison control centers. Identified incidents were evaluated on behalf of the PSP in the context of inclusion criteria requiring the subject to report at least one dermal or respiratory symptom with a case severity outcome coded with a minor or greater outcome consistent with Poison Center or FIFRA 6(a)2 severity coding criteria. Callers were then contacted by phone to obtain informed consent to participate in a structured interview regarding their exposure using a questionnaire. The likelihood of association between exposure and reported effects was evaluated by a team of medical and toxicology experts using an algorithm for evaluation of cases.
Results: Of 623 cases received during 2013, 247 cases involving 294 individuals qualified for inclusion in the PSP. Of the various product types represented exposure to the product type of Total Release Fogger was predominant. The majority of products contained pyrethroids as active ingredients in addition to pyrethrins. Approximately 82% of the exposed individuals were exposed as a result of unintentional exposures. Non-specific irritation to the respiratory tract (cough/choke, respiratory irritation) was the most commonly reported symptom. Almost 88% of exposed individuals claimed outcomes of minor severity; the remainders claimed moderate effects. No cases of major severity or deaths were reported. Of 294 eligible incidents, 26 individuals completed an Enhanced Questionnaire that probed circumstances of and results from exposure. Assistance with obtaining diagnostic patch and prick testing through their physician was offered, but no individual chose to participate.
Conclusion: None of the data collected to date suggest that pyrethrins-containing products pose a significant risk of serious dermal and/or respiratory reactions under conditions of routine use.
Keywords: Pyrethrins, consumer exposure, Surveillance

284. Contagious fear: mass psychogenic illness initially confused with carbon monoxide poisoning

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Background: Mass psychogenic illness (MPI) is a well-documented phenomenon that refers to the rapid spread of illness within a close social unit for which there is no plausible organic cause. Symptoms are most often subjective and benign. MPI often occurs among close-knit groups such as schools, factories, or health care facilities in the setting of an anxiety-producing event like a concert or performance. Symptoms typically spread via sight or sound, beginning in older individuals and disseminating down the age scale. Those affected are often disproportionately female. We present a case of multiple students afflicted with non-specific symptoms initially attributed to carbon monoxide (CO) poisoning that were ultimately found to be most consistent with MPI.
Case Reports: While rehearsing in an auditorium prior to a concert, multiple grade school students began complaining of headache, dizziness and nausea. School officials feared CO poisoning, thus the school was closed and 30 students were transported to a local hospital. The patients reported abdominal pain, headache, and dizziness. Physical exams revealed mottled skin and dilated pupils. Carboxyhemoglobin (COHb) levels, measured in all 30 students using multiwave pulse oximetry, ranged from 3 to 10%, resulting in the local media reporting a mass CO poisoning. COHb blood levels from the 13 "most critical" patients, however, were sent to a larger facility and all resulted $< 2\%$. Patients were treated with oxygen, symptoms resolved and all were discharged home within 8 hours. Testing of the school's air was completed by the local power company, the International Energy Agency and the local fire department. All testing was negative for CO or any other toxic agent. In consultation with the State Health Department the diagnosis of MPI was made.
Discussion: MPI often develops in high-stress group situations where an assumption of toxicity is introduced and perpetuated throughout the mass. The vague nature of typical MPI symptoms, including nausea, headache, dizziness, and general weakness, are similar to CO poisoning. Compounding the confusion in this case were the weakly positive multiwave pulse oximetry readings and the lack of immediate access to blood co-oximetry. Multiwave pulse oximetry has not proven to be sensitive or specific for CO poisoning, and in this case seems to have contributed to the reporting of this event as a mass CO poisoning.
Conclusion: False positive multiwave pulse co-oximetry contributed to a mass psychogenic illness being initially reported as CO poisoning. Caregivers should wait for confirmatory field or blood testing before giving patients the diagnosis of CO poisoning if multiwave pulse oximetry is equivocal.
Keywords: Carbon monoxide, Pediatric, Environmental

285. Pentobarbital toxicity after somnasol exposure

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Background: Somnasol is a pharmaceutical veterinary preparation of pentobarbital and phenytoin, used for animal euthanasia. This medication is intended for intravenous or intracardiac use only in animals and produces rapid loss of consciousness and cardiovascular collapse.
Case report: A 40 year-old woman, employed at a veterinary clinic, was found unresponsive for an unknown amount of time with an empty bottle of Somnasol 100 mL (390 mg/mL pentobarbital sodium, 50 mg/mL phenytoin sodium and 18% propylene glycol), a needle, and an empty bottle of wine. On arrival to the ED, her initial physical examination showed a Glasgow Coma Scale of 3, a blood pressure of 144/68 mmHg, a heart rate of 94 beats per minute, a respiratory rate of 12 breaths per minute, and pulse oximetry of 99% on nasal cannula. Her pupils were 4 mm and bilaterally reactive. She was intubated to protect her airway. No injection marks were found on her body, and the rest of her examination was unremarkable. Initial laboratory evaluation including blood glucose, blood count, renal function tests, liver function tests and arterial blood gases were all within normal limits; her ethanol level was 4 mg/dL. Approximately 4 hours after she was found unresponsive, her serum phenytoin level was 3.3 mcg/mL (normal range 10–20 mcg/mL). Simultaneously, the serum pentobarbital level was 15 mcg/mL (therapeutic range 1–5 mcg/mL) by gas chromatography and mass spectrometry. The patient was transferred to the intensive care unit and was extubated 3 days later with complete recovery.

Discussion: We present a severe case of pentobarbital toxicity after a novel exposure to Somnasol. We believe that the most plausible route of exposure is oral based on the history provided by a family member and absence of evidence of skin necrosis on her examination.
Conclusion: Although pentobarbital and phenytoin are not new drugs, this is the first report of exposure from this veterinary preparation.
Keywords: Overdose, Pentobarbital, veterinary preparation

286. Profound QT prolongation after attempted suicide with intravenous xylazine hydrochloride

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Background: Xylazine is an alpha 2 agonist that is widely used in veterinary medicine for sedation, anesthesia, muscle relaxation, and analgesia in animals such as horses, and cattle. The primary effects in toxicity are hypotension, bradycardia, and CNS/respiratory depression. Intravenous doses as low as 7 mg have been reported to cause symptoms. We present a case of apparent administration of 1000 mg intravenously resulting in severe toxicity including profound QT prolongation, a complication which is not previously reported to our knowledge.
Case report: 65 year old male presented to outside hospital after being found down unresponsive by his family. The patient was noted to have a syringe in his left arm and a bottle of xylazine hydrochloride 100 mg/ml near him. Approximately 10 ml of the 50 ml bottle (1000 mg) was unaccounted for. The patient's family did bring the "antidote" yohimbine to the emergency department. The medical providers were advised to intubate the patient and not administer yohimbine. The patient was intubated and admitted to the intensive care unit.

Vital signs on presentation included heart rate (HR) 45 beats per minute (bpm) and blood pressure 113/67. At presentation the patient's electrocardiogram (EKG) demonstrated sinus bradycardia at 54 bpm with a QT interval of 490 msec and QTc interval of 472 msec. He remained bradycardic with a HR in the 40s–50s for the first 2 days of admission. On hospital day (HD) #2, EKG revealed HR 49 with QT 614 msec and QTc 554 msec. Serum potassium was 5 mEq/L at this time. Patient did receive 4 grams of intravenous magnesium. Repeat EKG 12 hours later demonstrated QT 714 msec and QTc 664 msec. On HD #3 the EKG demonstrated heart rate 58 with QT 640 msec and QTc 628 msec. Patient remained intubated without sedation for approximately 48 hours. On HD #3 the patient was extubated and was awake and alert with some mild confusion. Upon discharge at HD #5, HR was 74 bpm and QT interval was 540 msec.
Discussion: Human xylazine poisoning is an uncommon exposure. However, it has been well described via various routes of exposure to cause hypotension, bradycardia, and CNS/respiratory depression. EKG changes previously reported have included bradycardia, tachycardia, diffuse T wave flattening or inversion, and frequent premature ventricular contractions. To our knowledge, QT/QTc prolongation has not been previously reported as a complication of xylazine overdose.
Conclusion: We report profound QT/QTc prolongation after intravenous administration of xylazine in a suicide attempt, a complication not previously reported to our knowledge.
Keywords: Cardiac toxicity, Overdose, Xylazine

287. Asymptomatic presentation of overdose of levetiracetam with highest reported serum level

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Background: Levetiracetam is a newer anticonvulsant and is gaining popularity with its relatively safe side effects profile and wide therapeutic margin. Little is known about its effects in overdose or at what serum level toxicity should be apparent.
Case report: 33 year old male with past medical history of seizures, pseudoseizures, depression, and noncompliance with medications presents with complaint of several seizures in last 24 hours and intentional ingestion of a 30 day supply of 750 mg BID of levetiracetam approximately four hour prior to arrival (total of 45 g). The patient was asymptomatic except for feeling tired. On exam, patient was sleepy but easily arousable, otherwise the exam was complete normal. A levetiracetam level drawn at 2 hours after admission was 596 mcg/mL; it resulted 2 days after it was drawn. For his dosing regimen, his peak levetiracetam level should be between 10–40 mcg/mL (Quest Diagnostics Nichols Institute, Chantilly, VA). The patient remained asymptomatic during his 4 day hospital stay, was evaluated by neurology and psychiatry, and ultimately was discharged to an inpatient psychiatric facility on phenytoin, instead of levetiracetam. The patient has since returned to our emergency department with complaints of seizures, on phenytoin or levetiracetam or both, as well as with overdoses of the same medications.
Case discussion: Levetiracetam is a newer anticonvulsant and is gaining popularity with its relatively safe side effects profile and wide therapeutic margin. One poison center based study demonstrated that most symptoms are neurologic (including central nervous system depression, lethargy, vertigo, ataxia, and agitation) or gastrointestinal (vomiting). In that study, major outcomes were rare and patients generally did well with monitoring alone. The study did not find a relationship between suspected ingested dose and outcome; no levels were reported. One study of post-mortem data revealed levetiracetam to be a contributor in two polysubstance overdose deaths with the highest blood level of 230 mcg/mL. The only case report that had reported blood levels on an acute overdose reported a peak level of 400 mcg/mL; the patient presented with vomiting and obtudation.
Conclusion: This is the highest reported level of levetiracetam in the medical literature in an otherwise asymptomatic patient.
Keywords: levetiracetam, Overdose, asymptomatic

288. Coma delivered in the mail: pediatric pentobarbital overdose

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Background: Pentobarbital is used in the hospital setting for sedation and for medical induction of coma, and in veterinary medicine as an euthanasia solution. This case reports an intentional out of hospital ingestion resulting in coma from pentobarbital acquired through a non-pharmaceutical source.
Case Report: A 16 year old woman was found by EMS unresponsive at home. Initially, her oxygen saturations were 40% with few spontaneous respirations. She was given naloxone with no clinical change, intubated, and transported. On initial Emergency Department (ED) evaluation: T 35.9, HR 117, BP 113/83, SaO2 100% on 50% FiO2. Physical exam was notable for equal, reactive, 2mm pupils, no spontaneous respirations, cool pale skin with red areas on the heels, and shivering. Neurologically she was unresponsive, flexed her arms with pain, had 1–2 + DTRs, 2 beat clonus at ankles, and no cogwheel rigidity. Labs/studies showed a blood gas with pH 7.28, pCO2 57, CO2 20, BE 1; CBC and CMP were unremarkable; Head CT was normal; CXR was normal; ECG Qtc 517 ms with no ectopy; urine drug screen positive for barbiturates, serum with mildly elevated TCA (157 ng/mL), blood alcohol level negative. She was given IV fluids for hypotension, confirmatory barbiturate serum testing was sent, and she was admitted to the Pediatric ICU (PICU). She became progressively more responsive in the PICU and was extubated on day 2. Serum confirmatory testing showed negative butalbital level, phenobarbital < 1.1ug/mL, pentobarbital 18 ug/mL (approx. 16 hrs post ingestion) and 4 ug/mL 9 hours later. She was evaluated for anoxic brain injury with some residual dizziness and disequilibrium, but did not develop any other evidence of end organ injury. Bullae developed on her heels and elbows. Patient disclosed that she had taken a "white powder" that she ordered online and received "through the mail" as well as a single dose of ondansetron and zolpidem, and a beer in a suicide attempt about 12 hours before her family found her.
Case Discussion: This case describes an intentional overdose with a substance that is not thought of as generally available. Pentobarbital is reportedly used in areas where assisted suicide is legal and is not commonly used as a drug of abuse. There have been few cases of overdose reported in the literature over the past 20 years. Her exact source has not been revealed, but internet searches do reveal multiple sources claiming to supply pentobarbital.
Conclusions: Patients presenting with severe coma and respiratory depression should include pentobarbital ingestion in the differential diagnosis. Pentobarbital can be acquired through commercial sources without a prescription.
Keywords: Overdose, Barbiturate, Pediatric

289. Conservative management of mediastinal hematoma following brodifacoum ingestion

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Background: Brodifacoum is a long acting anticoagulant and significant poisoning typically requires treatment for at least several months with oral vitamin K. Mediastinal hematoma is an uncommon complication of brodifacoum ingestion.
Hypothesis: Patients with mediastinal hematoma following ingestion of brodifacoum can be managed conservatively with correction of their coagulopathy.
Methods: This is a single patient case report. A 37 year old male with history of schizophrenia, bipolar disorder, and ethanol abuse living in sober halfway house presented to the emergency department with general malaise, weakness and flu-like symptoms for the past two to three weeks and worsening dyspnea and chest pain over the past 2–3 days. Chest radiograph demonstrated a widened mediastinum. Subsequent computed tomography (CT) demonstrated a $4.2\text{cm} \times 8.1$ cm hematoma in the anterior mediastinum extending into the anterior pericardium. Lab work also revealed an International Normalized Ratio (INR) > 14. He was given 2 units of fresh frozen plasma (FFP), 10 mg of Vitamin K intravenously, and 25 units/kg of Feiba NFã (Anti-Inhibitor Coagulant Complex). Patient denied use of anticoagulants or recent trauma. Toxicology was consulted on hospital day 3 due to persistent coagulopathy with INR > 5 despite daily vitamin K and FFP. Because this presentation was concerning for long acting anticoagulant ingestion, the patient was started on oral Vitamin K 40 mg twice a day and his INR began to stabilize. Brodifacoum level was subsequently positive. Repeat chest radiograph demonstrated improvement in mediastinal hematoma. At 4 week follow up patient was stable on vitamin K 35 mg BID. He was gradually tapered to vitamin K 20 mg BID and maintained a normal INR at 3 months. Just prior to the 4th month of vitamin K therapy he ran out secondary to financial barriers. His INR continued to be followed and it did not elevate during this time period. Vitamin K was discontinued and the patient continued to do well without further complications at 6 month follow up.
Discussion: Mediastinal hematoma is an uncommon presentation of brodifacoum poisoning and previously has been reported to have a poor outcome. This case demonstrates that brodifacoum ingestion complicated by mediastinal hematoma can be managed conservatively with oral vitamin K.
Conclusion: We report mediastinal hematoma, an uncommon complication following brodifacoum poisoning, which was successfully managed conservatively with oral vitamin K.
Keywords: Vitamin K, Brodifacoum, Antidote

290. Delayed seizure due to venlafaxine ER and lamotrigine overdose

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Background: Seizures have frequently been described following venlafaxine overdose. However, they have usually occurred within 6 hours of ingestion. We describe a patient who developed seizures approximately 12 hours post ingestion even with therapeutic levels of the antiepileptic drug lamotrigine.
Case Report: The patient is an 18 year old female with a history of anxiety and depression, who ingested twenty-two 150 mg capsules of venlafaxine ER, 600 mg of lamotrigine and 25 mg of melatonin, in a suicide attempt three hours prior to Emergency Department admission. She was complaining of "jitteriness" and feeling hot as well as dizziness and nausea, with no change in mental status. Her initial vitals were only remarkable for a heart rate of 136 beats per minute. Her pupils were dilated and sluggishly reactive with horizontal nystagmus. Tremors were noted without any clonus. The laboratory exam was remarkable for only a positive urine

drug screen for cannabinoids (with a THC-carboxylic acid result of 26 ng/ml). The EKG revealed sinus tachycardia with normal intervals.

The patient was observed for eleven hours post ingestion whereupon she was admitted to psychiatry with a pulse rate of 119 beats per minute. Shortly after the psychiatry admission (and at 12 hours post ingestion), the patient had a brief, generalized seizure. She regained normal consciousness within twenty minutes. No benzodiazepines were administered and the patient was transferred to the intensive care unit and the tachycardia resolved within six hours. Intensive care unit course, neurological work-up and electroencephalogram were all unremarkable and the patient was transferred to psychiatry the next day.

At the time of the time of the seizure, the patient's serum lamotrigine level was 3.8 mcg/ml (reference anti-seizure range of 2.5 to 15 mcg/ml) while her serum venlafaxine, O-desmethyl venlafaxine (ODV) and venlafaxine plus ODV were 4610 mg/ml, 3230 ng/ml and 7840 ng/ml, respectively. The therapeutic reference range for serum venlafaxine plus ODV level is 195 to 400 ng/ml.

Discussion: Previous case series have estimated that seizures occur in approximately 5 to 14% of venlafaxine overdoses, with one case series noting an average onset time to seizure of 6.2 hours (range 3 to 12) in a dose-dependent manner. Even though our patient also co-ingested an anti-seizure drug, a brief generalized seizure occurred 12 hours post ingestion. Thus it appears that lamotrigine is not protective for venlafaxine-associated seizures.

Conclusion: Clinicians should be aware that a delayed onset of seizures can occur 12 hours post venlafaxine overdose, despite therapeutic levels of lamotrigine.

Keywords: Seizure, Overdose, venlafaxine

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