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ANNUAL MEETING ABSTRACTS

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DAY 1: PLATFORMS, ABSTRACTS 001-004

001. Intoxication in Children of Family Members Prescribed Opioids: A Population-Based, Case-Control Study in Denmark

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Background: Worldwide 350,000 deaths are attributable to opioids each year. The association between prescription to family members and intoxication in children is unknown.
Research Question: What is the risk of serious overdose events (SOE) in children of family members who redeem prescription opioids?
Methods: We conducted a population-based, case-control study over 23 years (1995–2017). Using Denmark's national healthcare registries, we studied all residents < 20 years (cumulative: 3,270,980). Cases were individuals who experienced SOE. Each case was matched to 10 population-based controls with no SOE. Exposure was defined as an analgesic prescription redemption by a household family member of children within three months preceding the SOE. Households were grouped into three analgesic redemption categories: 1) prescription opioids; 2) non-steroidal anti-inflammatory drugs (NSAIDs); 3) none (i.e., unexposed). SOEs were defined as death, hospitalization, or emergency department visit due to opioid intoxication. We compared the odds of SOE across exposure categories using conditional logistic regression models, adjusted for sociodemographic and mental health covariates. Analyses stratifying by sex, age, and hospital disposition were performed.
Results: 1,752 children experienced an SOE and were matched to 17,401 controls. Among cases, 54.5% (955/1752) were males, 62.3% (1,091/1752) were hospitalized, and 2.6% (46/1752) died. Family member redemption of an opioid prescription within three months prior to SOE, compared with a child of an unexposed family, was associated with increased odds of a child's SOE (aOR 2.18; 95% CI 1.84 to 2.58), non-intensive care unit (non-ICU) hospitalization (aOR 2.76; 95% CI 2.24 to 3.39), ICU admission (aOR 2.87; 95% CI 1.62 to 5.09), and death (aOR 4.09; 95% CI 1.38 to 12.1). Increased SOE risk persisted compared to children of family members who redeemed NSAIDs and in the stratified and sensitivity analyses.
Conclusion: Children of family members prescribed opioids are at a markedly increased risk of experiencing an SOE and opioid-related death.

002. Engineering a Carbon Monoxide Poisoning Antidote From a Bacterial Hemoprotein Carbon Monoxide Sensor

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Background: Carbon monoxide (CO) poisoning causes 1,500 deaths in the U.S. annually. Up to 50% of moderately to severely poisoned patients suffer cardiovascular complications. No antidotal therapy for CO poisoning exists to date. We have developed a platform technology that utilizes heme-containing proteins as CO molecular sinks that may serve as intravenous antidotal therapies for CO poisoning.
Research Question: Can we engineer a high-affinity, CO-selective molecule based upon a CO sensor from the aerobic

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soil bacterium *P. xenovorans*, Regulator of CO metabolism (RcoM), as a potential CO antidotal therapy?
Methods: We designed, recombinantly expressed, and purified a truncated version of RcoM (RcoM-HBD-CCC) bearing the N-terminal heme-binding domain and three Cys substitution mutations (C94S, C127S, and C130S). We used absorbance spectroscopy to analyze the biochemical features of RcoM-HBD-CCC. We used a mouse model of severe CO poisoning where animals accumulate carboxyhemoglobin (HbCO) levels >85% and become hypotensive to test the agent.
Results: Spectroscopic analysis revealed that RcoM-HBD-CCC exhibits robust thermal stability (T_m = 71 °C), slow autooxidation rate (k_{ox} = 0.9 h^{-1}), high CO affinity ($K_{a,CO}$ = 5.4×10^{11} M^{-1}), and selectivity for CO over oxygen ($K_{a,O2}$ = 1.4×10^{5} M^{-1}; $K_{a,CO}/K_{a,O2} = 3.9\times10^{6}$). Compared to R-state hemoglobin, RcoM-HBD-CCC exhibits 1,000-fold higher CO affinity and 10,000-fold higher selectivity for CO over oxygen. Incubating RcoM-HBD-CCC with CO-saturated red blood cells results in transfer of CO from hemoglobin in < four minutes. In a murine model of severe CO poisoning, infusion of RcoM-CCC-HBD enhanced CO clearance from red blood cells, reversed CO-dependent hypotension, improved survival, and resulted in rapid renal clearance of CO-bound scavenger.
Conclusion: These data suggest that RcoM-CCC-HBD can act as a selective and efficacious CO scavenger that may serve as an improved therapeutic treatment for CO poisoning. Further development steps include optimizing manufacturing and performing dose-range finding safety studies.

003. A Ten-Year Clinical Experience Utilizing a Glycerol Dehydrogenase Serum Assay for Ethylene Glycol

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Background: Rapid detection of ethylene glycol, and exclusion of its presence, are essential in at-risk patients and ensure appropriate allocation of therapies such as fomepizole and hemodialysis. A glycerol dehydrogenase veterinary assay has been reported as an alternative to the gold standard of gas chromatography. Wider adoption of this assay could increase access to rapid ethylene glycol diagnostic testing; however, description of its use in real-world clinical settings is limited.
Hypothesis: Glycerol dehydrogenase-based enzymatic testing for ethylene glycol can be successfully used in clinical practice.
Methods: This is a retrospective review of all cases of suspected ethylene glycol exposure at an urban academic hospital which underwent testing with a glycerol dehydrogenase-based enzymatic serum assay, which had already been validated in-house as a laboratory developed test. Consecutive cases from date of assay implementation (January 14, 2013) to data retrieval date (September 18, 2023) were included. The number of samples tested, ethylene glycol detection, presence of atypical reaction kinetics, and unexpected test calibration were extracted from the dataset.
Results: Over a 10.7 year period, 372 serum samples from 296 patients were requested. Thirty-two samples from 14 patients had an ethylene glycol concentration of at least 10 mg/dL, the lower limit of quantitation, with some patients receiving serial testing to monitor concentration trends. Average time to assay result was less than two hours. Eleven samples displayed atypical reaction kinetics, necessitating confirmatory gas chromatography testing to assure accuracy. Average time to gas chromatography confirmation was approximately one day. Unexpected assay calibration occurred in one case, requiring recalibration with fresh calibrators and reagent.
Conclusion: Adoption of a glycerol dehydrogenase-based assay may facilitate rapid detection of ethylene glycol in hospitals that do not have ready access to gas chromatography. Test adoption requires in-house validation, as well as monitoring for unexpected calibrations and atypical reaction kinetics.

004. Complications Limiting Use of Hemodialysis in Salicylate Deaths

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Background: Salicylate poisonings continue to result in a substantial number of analgesic-related poisoning deaths annually. It is likely that not all nephrologists recognize the need for prompt hemodialysis in severe salicylate poisoning. The objective of this study was to assess the clinical and contextual characteristics associated with fatalities and utilization of hemodialysis.
Methods: The National Poison Data System (NPDS), comprising all poisoning cases reported to United States poison centers, was queried for all fatal salicylate poisonings between 2000-2021. Fatality abstracts were explored for fifteen specific patient care characteristics by two trained study investigators. A third investigator resolved disputes.
Results: There were 473 salicylate coded deaths reported from 2000-2021. Thirteen patients were excluded due to inadequate information or clearly not related. The median age of all patients was 52 years (IQR: 36, 67) and the median serum salicylate concentration at presentation was 79 mg/dL (IQR: 58, 100) (n = 436). The median concentration before

dialysis was 95 mg/dL (IRQ: 75, 115) (n = 33). Dialysis was performed in 103/460 (22.4%). There was no difference in the age between the groups. The initial salicylate concentration was higher in those who did not receive hemodialysis (85 mg/dL) versus those who received hemodialysis (71 mg/dL); $p < 0.0001$. The most common reasons for not performing dialysis were patients arresting shortly after intubation (82/357 and 6/103) and failure to recognize the need for or attempt to perform dialysis in a patient with clear indications (78/357 and 4/103). In 35 cases, aspirin poisoning was not diagnosed at the time of admission and in 13 cases, the patient died in a center unable to perform dialysis.
Conclusion: Hemodialysis was used in fewer than one-quarter of salicylate related deaths. Factors that may be associated with patient deaths include failure to perform hemodialysis, delay in initiation of hemodialysis, and intubation.

DAY 1: MODERATED POSTERS, ABSTRACTS 005-011

005. Delta-9 THC in the Young Pediatric Postmortem Population

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Background: While cannabis remains a Schedule I drug under U.S. federal law, many states have legalized medical and/or recreational cannabis. Lack of safety standards, accuracy in labeling, and quality control in terms of delta-9-THC content in edibles leads to concerns for unintended intoxication, particularly in children. Since legalization, there has been an increase in pediatric unintentional ingestions and hospital admissions due to acute cannabis toxicity; reported clinical effects include CNS depression, tachycardia, and vomiting. This raises the question about the frequency of cannabinoid findings in the pediatric postmortem population and its potential relevance.
Hypothesis: Postmortem cannabinoid results will mirror the increase in pediatric cannabis exposures as reported by the National Poison Data System.
Methods: Retrospective review of postmortem toxicology testing performed in children < 10 years of age at NMS labs from 2018 to 2022.
Results: NMS Labs tested 310 postmortem blood cases from children aged less than 10-years-old in five years. 89 cases reported positive results of either the parent compound (delta-9 THC) and/or one or both of its main metabolites (11-hydroxy-THC and carboxy-THC). In this timeframe, the number of positive cases jumped from 15 in 2018 to 31 in 2022. The average age was one year old with 63 of the cases being from those less than one year of age; 29 cases are from neonates (less than one month old) or victims of intrauterine demise, supporting exposure through maternal use. Reported delta-9 THC concentrations average 4.0 ± 13 ng/mL; median = 1.1 ng/mL; range, 0.52 – 100 ng/mL.
Conclusions: Pediatric exposures to cannabis are increasing as it becomes legalized in more states. Although no deaths directly from cannabis are reported in the literature, we found an increased detection of THC and metabolites in postmortem pediatric cases, which follows the pattern of increased exposure seen in clinical cases.

006. Whole-Blood Cannabinoid and Vitamin/Mineral Profiles in Adolescent Emergency Department Patients With Cyclic Vomiting Associated With Chronic Cannabis Use

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Background: Adolescent cannabis use has been associated with adverse health effects including cannabinoid hyperemesis syndrome (CHS). The pathophysiology of CHS in the adolescent population is poorly understood.
Hypothesis: Adolescents with CHS have differing blood cannabinoid profiles or measurable abnormalities in electrolytes or essential vitamins (outside of reference ranges) during symptomatic periods.
Methods: This was a prospective observational pilot study of adolescent emergency department (ED) patients with symptomatic cyclic vomiting onset after chronic cannabis use. Serial whole blood cannabinoids and serum magnesium, thiamine, pyridoxine, and cobalamin concentrations were performed at the index visit (while symptomatic) and at least one month afterward (while asymptomatic); potassium concentrations were available from the index visit. Index and follow-up visits were compared using Wilcoxon tests.
Results: We screened 869 adolescent ED patients and enrolled ten participants. All participants (n = 10) had cannabis use disorder (n = 9) or hazardous cannabis use (n = 1) by the Cannabis Use Disorders Identification Test-Revised. The median/interquartile range (IQR) ages were 18.0 (17.0,19.0); there were eight female and two male subjects. Median/IQR for index and follow-up evaluations were: time last cannabis use, two days (1,4) and one day (0,1); delta-9-THC, 2.4 ng/mL (2.0,10.8) and 7.9 ng/mL (3.7,32.5);

11-nor-9-carboxy-delta-9-THC, 82.0 ng/mL (37.5,145.0) and 119.0 ng/mL (39.5,267.5); 11-hydroxy-delta-9-THC, 0.6 ng/mL (0,2.6) and 4.2 ng/mL (1.2,10.1) (p = 0.0078); magnesium, 1.6 mg/dL (1.5,1.8) and 1.7 mg/dL (1.7, 1.8); thiamine, 132.5 nM (96.3,156.5) and 133 nM (94.5,174.5); pyridoxine, 30.3 nM (22.3,54.0) and 50.7 nM (36.7,75.8) (p = 0.0391); cobalamin, 455.5 pM (347.5,649.0) and 360.0 pM (329.0,597.5); index visit potassium, 3.6 mEq/L (3.3,3.7).
Conclusion: We report cannabinoid profiles in a pilot study of adolescent CHS patients and note significant differences in 11-hydroxy-delta-9-THC concentrations between index and asymptomatic follow-up visits. Median vitamin and mineral concentrations were within reference ranges at both index and asymptomatic follow-up visits.

007. Cannabis Use Disorder Diagnosis, but Not Urine Drug Screen Positivity, Correlates With Benzodiazepine Administration in Patients With Alcohol Withdrawal

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Background: Polysubstance withdrawal is less well-understood than alcohol withdrawal. We examined whether withdrawal from alcohol plus another co-used substance correlates with a higher maximum Clinical Institute Withdrawal Assessment-Alcohol Scale Revised (CIWA-Ar) score or increased benzodiazepine administration versus alcohol withdrawal alone.
Methods: This was a secondary analysis of a natural history protocol enrolling patients with alcohol use disorder (AUD) admitted to our inpatient clinical research unit between 2017-2022. Data were analyzed using general linear models (GLM) with total diazepam-equivalent benzodiazepine dose or maximum CIWA-Ar score as outcome variables for patient groups testing positive on urine drug screen (UDS) for 1) tetrahydrocannabinol (THC); 2) stimulants (cocaine, amphetamines, or both); or 3) pre-admission benzodiazepine use, versus a control group testing negative for all substances on UDS (amphetamines, benzodiazepines, cocaine, opiates, THC). Modeled variables included benzodiazepine administration, CIWA-Ar score, admission UDS results, seizure history, drinks per week, and demographics.
Results: Of 420 admitted patients, 348 met eligibility criteria: 216 had a negative UDS, 35 were pre-admission benzodiazepine-positive, 71 were THC-positive, and 26 were stimulant-positive. THC-positive patients received significantly fewer therapeutic benzodiazepines compared to controls (p = 0.012), despite no significant difference in maximum CIWA-Ar score. There was no significant difference in benzodiazepine administration for preadmission benzodiazepine-positive or stimulant-positive patients. A follow-up GLM including cannabis use disorder (CUD) diagnosis as an independent variable found significant effects of CUD (p = 0.03) and THC UDS positivity (p = 0.0003), but no significant interaction between them. However, in patients with CUD, THC-positive individuals received not significantly lower therapeutic benzodiazepine doses than THC-negative individuals (p = 0.07).
Conclusion: Positive UDS results do not reliably predict withdrawal severity in patients with AUD who co-use other substances based on total therapeutic benzodiazepine dose administered and may correlate with less severe early withdrawal courses. Study limitations include small sample size, potentially uncontrolled confounders, and possible misclassification of pre-admission benzodiazepine use.

008. The Impact of Cigarette Smoking on Serum α-Klotho Levels in Middle-Aged and Older Adults: Exploring Age- and Sex-Specific Associations

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Background: The α-Klotho protein has been identified as a key regulator of aging. Cigarette smoking could exacerbate the aging processes by affecting α-Klotho levels. The objective of this study was to explore the impact of active cigarette smoking on serum α-Klotho levels in middle-aged and older adults.
Methods: This is a cross-sectional study analyzing nationally representative data from the 2013-2016 National Health and Nutrition Examination Survey. A total of 4568 participants aged 40-79 years were included. Smoking status was determined using the questionnaire data and classified as nonsmokers, past smokers and current smokers. Serum α-Klotho levels were measured using an ELISA kit. Descriptive statistics and multiple general linear models were performed using SAS 9.4. Age- and sex-specific analyses were conducted.
Results: Significantly lower serum α-Klotho levels were found in both past and current smokers, with a weighted geometric mean of 772.04 pg/mL (p = 0.0068) in past smokers and 748.09 pg/mL (p = 0.0001) in current smokers, as compared with that in nonsmokers (805.88 pg/mL). A significantly inverse association between current smoking and serum α-Klotho levels was revealed. After adjusting for potential confounders, current smoking was associated with 7.36% (95% CI: -9.78, -4.87) decreased levels of serum α-Klotho,

compared to non-smoking, in the total study population. A stronger association was observed in older current smokers (60-79 year), with an 8.94% (-12.93, -4.76) reduction of serum α-Klotho levels, when compared to nonsmokers.
Conclusion: This study demonstrates a significant impact of cigarette smoking on lowering serum levels of α-Klotho, an anti-aging hormone, in middle-aged and older adults. A significant inverse relationship was revealed between current smoking and α-Klotho levels in both sexes and age groups. The study suggests that the observed decrease in Klotho levels due to smoking could contribute to the heightened risk of various age-related disorders observed in smokers.

009. Reevaluating Permissible Exposure Limits for Carbon Monoxide in Spaceflight

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Background: Managing carbon monoxide (CO) exposure in spaceflight presents a complex balance between mitigating the medical and operational risk of CO poisoning with potentially dangerous environmental control procedures, such as a complete atmosphere exchange. In collaboration with a private aerospace company, we aimed to reevaluate and derive CO exposure limits.
Research Question: How can CO exposure limits be safely optimized for spaceflight conditions?
Methods: Utilizing an algebraically rearranged Coburn-Forster-Kane (CFK) equation and R for graphical representation, we estimated carboxyhemoglobin (COHb) levels under spaceflight CO exposure scenarios and compared them with existing limits from several regulatory and research organizations.
Results: Notable variations were identified in recommended CO exposure limits across different organizations. Using the CFK equation, the National Aeronautics and Space Administration (NASA) spacecraft maximum allowable concentration (SMAC) of 100 ppm CO is projected to induce a COHb of 17.25% at 24 hours, while the National Research Council's (NRC) 150 ppm recommendation is expected to result in a COHb of 25.82%. Literature suggests a tolerable risk of 20% COHb may be endured without significant neurologic impairment. Consequently, a new SMAC of 116 ppm CO is proposed.
Conclusion: The significant variation in recommended CO exposure limits across organizations underscores the challenges in establishing a universally applicable threshold, especially in the unique environment of space. Utilizing the Coburn-Forster-Kane (CFK) equation, we suggest that a SMAC of 116 ppm CO over 24 hours might be a viable intervention threshold, assuming a tolerance up to 20% COHb. Regulatory organizations could consider raising the exposure limit to 116 ppm given risk of mitigation strategies, though a more robust protocol based on clinical findings may also be indicated. Further research should optimize the modeling of conditions in space, imperative for the development of robust protocols for managing CO exposure in space environments.

010. Rapid Point of Care Identification of Over-the-Counter Drugs via Skin Swabbing Using Portable High-Pressure Mass Spectrometry

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Background: Rapid noninvasive point of care identification of unknown drugs is potentially an important tool. There are currently no FDA-approved medical devices for this indication.
Hypothesis: Portable high pressure mass spectrometry will be able to accurately identify both tablet and powder residues of common over the counter drugs on participant hands.
Methods: We performed a pilot study using the MX908 portable, point-of-care high-pressure mass spectrometer (908 Devices, Boston, MA). A sample of the target substance is placed on a swab then inserted into the device, which performs collision-induced dissociation followed by ion detection. The resulting spectrum is identified using an on-board reference library. Two cohorts were evaluated: intact and crushed tablets. Over-the-counter acetaminophen, caffeine, and diphenhydramine were used. The intact tablet or powder was handled by ten participants. Each test involved rolling the intact or crushed tablet between both hands for 10 seconds followed by swabbing the hands according to the manufacturer's instructions. The subject would then perform a "transfer" by rubbing their hands on a clean object for two seconds; transfers were performed until a negative result, up to eight times. Intact and crushed tablet powder were tested directly as controls.
Results: All caffeine and diphenhydramine intact controls were negative. One acetaminophen intact control was positive. All crushed controls were positive. All handled intact caffeine and diphenhydramine hand swabs were negative

and one acetaminophen hand swab was positive on the first swab only. All crushed hand swabs were positive initially and remained so after five transfers. After eight transfers, 30% of caffeine, 80% of diphenhydramine, and 100% of acetaminophen remained positive.
Conclusion: The MX908 device consistently detected the powdered or crushed drug targets after multiple clean transfers. Simple handling of intact tablets did not produce detectable drug. Further study of this technology and its bedside application is warranted.

011. Analysis of Severe Phenazopyridine Poisonings: Insights From Case Narratives on Clinical Management and Outcomes

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Background: Phenazopyridine has the potential to cause severe poisoning. Severe cases may present with renal failure and methemoglobinemia, and therapies such as acetylcysteine and methylene blue have been advocated for treatment. This study focuses on delineating the management strategies and clinical outcomes of these severe cases, with focus on acute versus chronic phenazopyridine exposures among adult patients (> 18 years).
Methods: We requested 107 de-identified case-specific narratives from 2002 to 2022 from individual poison centers for single substance phenazopyridine exposures that resulted in renal failure, coded as major effect, or received acetylcysteine. We compared clinical effects, therapies, and reason for exposures by acuity.
Results: A total of 48 case narratives of adult phenazopyridine exposures were included in the current analysis. Most patients (n = 43, 89.5%) identified as female. Sixteen exposures were classified as acute and 32 as chronic. We identified a significant difference in the rate of methemoglobinemia (62.5% (n = 10) in acute vs. 87.5% (n = 28) in chronic, p = 0.044). There was a trend towards significance in rates of renal failure (56.3% (n = 9) in acute vs. 87.5% (n = 28) in chronic, p = 0.09). There was no significant difference in use of methylene blue between cases of acute and chronic exposures. Acetylcysteine was administered in only four cases.
Conclusion: This study provides an analysis of severe phenazopyridine poisonings, with a focus on contrasting clinical outcomes between acute and chronic exposures. We found a higher incidence of methemoglobinemia in cases of chronic poisoning as opposed to acute. There was a trend towards higher rates of renal failure in acute exposures. Acetylcysteine was used infrequently in phenazopyridine exposures, and its utility remains unclear. These results highlight the variability in clinical presentations depending on the acuity of the exposure.

DAY 1: POSTERS, ABSTRACTS 012-071

012. Adverse Drug Reactions to Crotalidae Immune $F(ab')_2$ (equine) in Alpha-Gal Syndrome Endemic Regions

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Background: Allergy to galactose-α-1,3-galactose (α-gal) may play a role in development of hypersensitivity reactions to antivenom. Recent data suggest that $F(ab')_2$ antivenom contains a significantly higher concentration of α-gal compared to Fab antivenom.
Research Question: Do adverse drug reaction (ADR) rates differ between $F(ab')_2$ and Fab antivenoms in a representative α-gal allergy endemic area?
Methods: This is a retrospective analysis of snakebite-related calls in Arkansas reported to the National Poison Data System between May 1, 2021 and July 25, 2023. Reviewers extracted the type of antivenom received and description of any ADRs from narrative data. Anaphylaxis was coded if the ADR involved two or more body systems. To determine agreement, the two reviewers first independently coded all data. Final coding was performed by consensus.
Results: One hundred eighty-four patients received Fab antivenom and 50 received $F(ab')_2$ antivenom, with 13 receiving both. Fifteen patients (30.0%) receiving $F(ab')_2$ antivenom experienced an ADR compared with 10 patients (5.4%) receiving Fab antivenom (chi-square test $p < 0.001$). Seven patients (14.0%) receiving $F(ab')_2$ antivenom developed anaphylaxis compared with three patients (1.6%) receiving Fab antivenom (Fisher's exact test $p < 0.001$). Despite perfect agreement (Cohen's kappa = 1.0) regarding the presence of an ADR, agreement on ADR severity (anaphylaxis vs. other ADR) was lower at $\kappa = 0.69$ (0.42 to 0.95). Four patients with ADR to antivenom had available α-gal IgE titers. All were positive, ranging from 0.56 to 9.3 kU/L (reference range < 0.10 kU/L).
Conclusion: Despite the limitations of lack of reviewer blinding, retrospective and secondarily reported data,

reviewers found starkly different antivenom ADR rates with excellent agreement. Clinicians may wish to elicit a history of α-gal allergy prior to administration of snakebite antivenom and use caution when administering $F(ab')_2$ in α-gal endemic regions.

013. Neurotoxic Neotropical Crotalid Envenomation Successfully Managed With Crotalidae Polyvalent Immune Fab Antivenom

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Background: Crotalus simus tzabcan (C. s. tzabcan, "Middle American rattlesnake" or "Central American rattlesnake") is a venomous snake of the Crotalus genus endemic to the Yucatan peninsula, northern Belize, and Guatemala that is known to possess a venom that is cytotoxic, hemotoxic, and neurotoxic. We report the first successful treatment of symptomatic C. simus tzabcan human envenomation with crotalidae polyvalent immune Fab antivenom.
Methods: This is a single patient chart review. A 31-year-old self-described "reptile handler" without significant comorbidities presented to outside hospital emergency department about one hour after sustaining a bite to his left middle finger by his pet snake, which he identified as a C. simus tzabcan. Our poison center was initially contacted for recommendations, and he was subsequently transferred to our institution and admitted for further management.
Results: On presentation he was tachycardic but otherwise vitally normal. His initial labs at OSH showed no thrombocytopenia, hypofibrinogenemia, or coagulopathy. Documentation from the patient's initial encounter noted erythema, ecchymosis, and edema on his left middle finger that progressed to involve the entirety of his left hand extending proximally to his wrist. He described perioral, gingival, and diffuse, whole-body paresthesias, though no bulbar or gross motor deficits were observed at OSH. He was treated with six vials of crotalidae polyvalent immune Fab antivenom (CroFab) and transferred to our facility. Repeat blood work several hours later showed elevated d-dimer but was otherwise unremarkable. He reported improvement in his paresthesias and by hospital day two had complete resolution of all subjective neurologic symptoms without re-dosing of antivenom. The extent of his soft tissue injury remained stable, and he was discharged home on hospital day two.
Conclusion: C. simus tzabcan species is capable of neurotoxicity that seemingly responded to ovine crotalinae polyvalent antivenom.

014. Comparing the Use of Antivenin Polyvalent Versus Observation in Management of Pediatric Snake Envenomation

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Background: Each year 1,300 United States children are bitten by venomous snakes of the pit-viper subfamily Crotalid. Although there is evidence that the antivenom Crotalid polyvalent immune fab (CroFab) mitigates the risk of skin necrosis, coagulopathy, and compartment syndrome, significant practice variation exists.
Hypothesis: We hypothesize that deferred CroFab administration in Crotalid envenomation increased length of hospital stay and morbidity in the pediatric population.
Methods: We conducted a multi-center, retrospective chart review comparing outcomes in snake envenomation following administration of CroFab versus supportive care alone at two pediatric tertiary medical centers (Sites A and B). Each site independently enrolled pediatric patients with ICD codes related to snake envenomation. Excluded patients included those discharged from the Emergency Department, non-crotalid bites, and injuries unrelated to a bite (i.e., cellulitis). Primary outcomes included length of hospital stay and need for surgical intervention.
Results: A total of 123 patients from Site A and 60 patients from site B met inclusion criteria. Demographics were compared between Site A (mean age 8.9 years; 50% copperhead bites; 81.7% given CroFab; mean 10 vials) and Site B (mean age 9.2 years; 45% copperhead bites; 26.0% given CroFab; mean 4.7 vials). Most patients were bitten on the foot. Patients at Site A had longer lengths of hospital stays (1.77 days compared to 1.53, $p = 0.136$) and were more likely to require intensive care (33.3% vs. 1.63%, $p < 0.01$). There were no differences in tissue injury, coagulopathy, or surgical intervention.
Conclusion: This study demonstrated no significant difference in length of stay, morbidity, or need for surgical intervention with a deferred approach to CroFab administration. This may be attributed to a greater proportion of lower extremity bites involving copperheads, as CroFab has consistently proven more efficacious in upper extremity and non-copperhead bites. Differences in higher acuity monitoring are likely due to local practice variation.

015. Diurnal Variation in Snakebites in Southeast Texas

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Background: Multiple reports in the medical literature describe the risk factors for and circumstances of snakebite in the United States. More recently, an association between ambient temperatures and snakebite incidence has been suggested. The purpose of this study was to assess the relationship between bite location and time of day, adjusted for month of year.
Methods: We retrospectively reviewed all snakebites on which our toxicology service was consulted between January 1, 2021 and November 1, 2023. Collected data included patient demographics, clinical features, and circumstances of envenoming.
Results: There were 226 total patients, including 24 cases that were excluded because they resulted from intentional interaction with the snake. Data were incomplete for 10 patients, leaving a total of 192 cases that were evaluated. Females accounted for 69 (35.9%) patients. The median age was 40 years old (range: 18 months-80 years). There were 69 (35.9%) upper extremity bites and 123 (64.1%) bites to the lower extremity. Bites occurred in daytime in 111 (57.8%) cases, while 81 (42.2%) bites occurred at nighttime. Upper extremity bites occurred disproportionately during daylight; there were 18 more bites than expected. Similarly, lower extremity bites disproportionately happened at nighttime. There was no diurnal variation associated with patient sex, but median patient age was slightly higher in the daytime bites, 45-years-old compared to 36-years-old. There were 34 (17.7%) bites in July. June and September each had 32 (16.7%) cases. There were only 22 (11.5%) patients in August, with a statistically significant paucity of nighttime bites to the upper extremity. Otherwise, there were no significant deviations from the expected diurnal variation.
Conclusion: Snake bites occur throughout the day and evening. Bites to the upper extremity are more likely to occur during daylight, and lower extremity bites are more common at night.

016. Snakes on the Plains

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Background: Antivenom is recommended immediately after severe Crotalid envenomation for maximum benefit. Delayed administration may result in lower efficacy. The therapeutic window for delayed antivenom administration is not known.
Hypothesis: Antivenom remains of therapeutic benefit when treatment is delayed up to 64 hours in severe Crotalid envenomation.
Methods: This case report describes a 65-year-old female who presented to our emergency department approximately 62 hours after crotalid envenomation while vacationing in Arizona. The patient was initially diagnosed with spider bite of the right dorsal foot and subsequently had two days of worsening pain, swelling, and ecchymosis up to the right groin, causing the patient to seek care now in her home state of Iowa. Diagnosis of severe crotalid envenomation was made based on the history, extent of RLE involvement, and severe coagulopathy. Antivenom treatment with four vials of CroFab was initiated over one hour, with fibrinogen, prothrombin time (PT), and platelet levels redrawn within one hour of each dose completion. Right thigh and calf circumferences were monitored. Two additional six-vial doses were needed with subsequent symptomatic control, followed by two maintenance vials, at which point treatment was completed given clinical improvement.
Results: Fibrinogen concentrations were undetectable (<50 mg/dL) and prothrombin time (PT) exceeded 100 seconds at baseline and after ten total vials of CroFab. After 16 total vials, fibrinogen improved to 56 mg/dL and PT 15 secs, then to 159 mg/dL and 11 secs respectively 24 hours after treatment, with normalization on post-hospital days three, seven, and ten. Platelet concentration was unaffected by envenomation. Right thigh circumference showed the greatest reduction (two cm) after 10 vials, as did the patient's subjective improvement in pain.
Conclusion: Antivenom remains efficacious and should be considered for treating severe envenomation in delayed presentations.

017. Successful Treatment of Paralysis and Necrotic Wound Infection After *Naja Kaouthia* Envenomation: A Case Report

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Background: Management of exotic snake envenomations, comprising approximately one percent of snake envenomations reported to US poison centers in 2021, is complicated by unfamiliarity with the clinical effects and difficulties obtaining antivenom. Concomitant respiratory paralysis and dermal infection after monocled cobra (*Naja kaouthia*) envenomation are infrequently reported in the US; the ToxIC North American Snakebite Registry described one in a decade. A patient who developed both respiratory failure and wound infection after monocled cobra envenomation requiring endotracheal intubation, antivenom, antibiotics and surgical intervention is discussed.
Methods: This is a single-patient chart review. A 37-year-old man with bipolar disorder presented to the ED after sustaining a forearm bite from his monocled cobra. He suffered rapid respiratory paralysis requiring endotracheal intubation and mechanical ventilation. Ten vials of Thai king cobra antivenom obtained from the regional zoo and transported by helicopter were administered intravenously six hours after presentation.
Results: The patient had spontaneous movement within six hours of antivenom administration and was extubated on HD two. He developed leukocytosis and troponinemia (high-sensitivity troponin 144 ng/L with a normal TTE) without hematotoxicity. The wound had no overt signs of infection at discharge on HD four; antibiotics were not prescribed. The patient returned to the ED two days later with erythema, purulence, and necrosis at the envenomation site. He underwent debridement, fasciotomy, and skin grafting. Wound culture grew *Morganella morganii* and *Enterococcus faecalis*. Vancomycin and cefepime were administered but narrowed to amoxicillin-clavulanate, ciprofloxacin and bacitracin. He was functionally normal 36 days post-envenomation.
Conclusion: Monocled cobra envenomations pose the risk of significant morbidity and mortality. Rapid onset respiratory paralysis after elapid envenomation must be addressed immediately, and secondary wound necrosis and infection may develop despite early antivenom administration. Emergent consultation with a regional poison center and medical toxicologist is critical to facilitate treatment, including antivenom procurement.

018. Snake Envenomation in New York State, 22 Years of Data

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Background: Snake envenomation is relatively uncommon in New York State (NYS) but remains clinically relevant. A previous study measured incidence and characteristics of snakebite and envenomation in NYS from 2000-2010.
Hypothesis: We suspect that climate change and human activity will increase the frequency of human snake envenomation in NYS. This study sought to evaluate the incidence of snake bites in NYS and compare this data to a previous study in the same region.
Methods: This is a retrospective observational study of snakebites reported to the poison centers in NYS between January 2011 and December 2022. Data were collected from the National Poison Data System (NPDS) and then analyzed for demographics, treatment, location, and clinical outcome. Stratified analyses were conducted to assess trends over time in venomous and non-venomous snake bites and heat maps were generated to assess frequency across NY state. This study was deemed exempt by the IRB.
Results: From 2011 to 2022 there were 564 snake bites reported to Poison Control Centers in NYS. Males made up 71% of the total number of snakebites. Venomous snakes accounted for 17.6% (99) of these cases and 7% (37) received antivenom. In comparison to the previous decade, the total number of snakebites represented a 19% increase, there was a 48% increase in venomous snake bites, and a 5% increase in patients receiving antivenom. Both venomous and non-venomous bites were more common in more populous counties. A generated location specific heat map correlates well with known populations of indigenous venomous snakes.
Conclusion: Venomous snakebites resulted in calls to the PCC in NYS with an average frequency of 10 bites per year during the period studied. This represents an increase of three venomous snake bites per year as compared with the previous decade.

019. Rattlesnake Envenomation During Pregnancy Complicated by Lethal Hydrops Fetalis

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Background: Rattlesnake envenomations during pregnancy are uncommon and frequently associated with severe complications with poor fetal outcomes, including placental abruption, intrauterine fetal demise, and spontaneous miscarriage. We present a case of a second-trimester fetus that developed lethal hydrops fetalis following rattlesnake envenomation of the mother.
Hypothesis: Pregnant individuals bitten by rattlesnakes face distinct obstetrical complications.

Methods: This is a single case report. A healthy 29-year-old, G2P1 woman at 24 weeks of gestation with routine prenatal care presented to the emergency department following a rattlesnake bite to her left ankle.
Results: Initially, she experienced hypotension requiring vasopressor therapy, had mild localized swelling around the wound, and received 6 vials of Crotaline Fab antivenom. Diagnostics revealed no hematological toxicity, and fetal ultrasound (US) was unremarkable. Five days post-discharge, she remained asymptomatic with no site progression but developed coagulopathy (D-dimer > 20 ng/mL; fibrinogen 60 mg/dL). A subsequent fetal US demonstrated new edematous skull tissue, pleural effusions, and abdominal ascites, consistent with fetal hydrops. Despite readmission and an additional 6 vials of Crotaline Fab antivenom administration, no significant hematological changes were observed. Comprehensive diagnostics were unrevealing to determine other immune and non-immune mediated etiologies of hydrops fetalis. A follow-up fetal US one week later showed near-complete resolution of fetal hydrops. However, at 32 weeks gestation, a repeat US revealed new significant polyhydramnios, the return of fetal hydrops with severe hydrocephalus, atrophic cerebellum, and diminished fetal heart tones. The patient underwent an emergent c-section due to premature rupture of membranes, but unfortunately, the infant expired at three weeks of life.
Conclusion: Rattlesnake envenomation complications in pregnant patients are poorly understood, with limited reported cases. We believe the lethal hydrops fetalis that developed was secondary to rattlesnake envenomation.

020. A Case of an Island Pit Viper Bite in Bali

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Background: The Island Pit Viper (Trimeresurus Insularis) is a venomous Indonesian crotalid that causes local tissue injury and hemotoxicity. Envenomation in Indonesia can pose clinical challenges when patients return to the United States (US) for treatment.
Methods: This is a case report.
Results: A 30-year-old healthy female, vacationing in Bali, presented to a hospital after a green snake envenomation of the left ankle. The snake was identified as an Island Pit Viper by description. The patient's vital signs were blood pressure 130/80, heart rate 78, respiratory rate 20, temperature 36°C. At presentation, the patient had no hemotoxicity (prothrombin time [PT] 9.6 seconds, activated partial thromboplastin time [aPTT] 19.2 seconds, international normalized ratio [INR] 0.89, platelets 165x103/μL, hemoglobin 13.0 g/dL) and a normal creatinine (0.68 mg/dL). She received supportive care and Biosave Polyvalent Anti-Snake Venom Serum antivenom (indicated for Naja sputatrix, Bungarus fasciatus, and Agkistrodon rhodostoma). The patient was observed for two days and discharged to fly back to the US. After discharge, an Indonesian snake expert informed the patient she received incorrect antivenom. She presented to a US emergency department for chest discomfort and leg pain. Her exam reflected bruising on the left ankle/leg. Her labs were unremarkable (troponin < 5.0 ng/L, fibrinogen 141 mg/dL, INR 1.0, PT 10.9 seconds, lactate dehydrogenase 165 U/L, aPTT 27.0 seconds, hemoglobin 13.6 g/dL, platelets 174x103/μL, and creatinine 0.83 mg/dL). The patient received pain control and was discharged.
Conclusion: This case necessitated knowledge of an exotic snake's expected toxicity, which ultimately presented similarly to other pit vipers. With international travel, this issue may arise, requiring international literature review and antivenom index reference. Biosave antivenom may be an effective treatment for Island Pit Viper envenomation, as the patient had no persistent toxicity after her initial envenomation and treatment.

021. Case of Unwelcome Airplane Travel Companion (Centruroides Sculpturatus) Leading to Envenomation in the Northeastern United States

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Background: Centruroides sculpturatus (Arizona bark scorpion) is native to the southwestern United States and northeastern Mexico. Arizona bark scorpions are the most venomous scorpions native to the United States (US), and can cause severe pain, paresthesia, weakness, and in severe cases can cause cranial nerve and autonomic dysfunction. Generally, envenomation of adults do not require intervention beyond analgesia, however children can develop severe toxicity requiring antivenom. There have been cases of scorpion envenomations outside of their native habitat, however these are usually due to pets. We report a case of envenomation by an unintended travel companion.
Methods: This is a single patient chart review of a 67-year-old male in the northeastern US whose daughter called our poison center after the individual developed numbness and tingling with minimal pain to his arm after a presumed envenomation by an Arizona bark scorpion. The patient had flown from Arizona and while unpacking their bag noted pain and numbness to his right arm, with an area of erythema.
Results: Initially the patient took cetirizine for a presumed allergic reaction and went to sleep. In the morning

the patient had worsening symptoms, now extending to his shoulder. On examining his luggage, the patient and his family discovered a scorpion, which they removed and killed. Over the day the patient had progressive improvement in his symptoms, and by the next morning the patient was back to baseline.

Conclusions: Understanding local endemic species can be extremely important to the toxicologist in determining the causative species, however, as in our case, not all exposures are due to local species. With increased globalization and air travel the probability of encountering non-native species as toxicologic exposures will also continue to increase. Toxicologists must always keep a broad differential regardless of the local prevalence of possible toxicologic exposures.

022. Disseminated Intravascular Coagulation and Renal Failure Secondary to African Bush Viper (Atheris Squamigera) Envenomation.

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Background: Envenomation by African Bush Vipers is rare in the United States with four published case studies. We report the case of a 32-year-old male who developed tissue necrosis, coagulopathy, and renal failure secondary to envenomation by Atheris squamigera.

Methods: This is a case report of a 32-year-old male with no medical history who presented to a local emergency department for evaluation of left thumb pain and swelling after being bitten by his pet African Bush Viper. Initial vitals were unremarkable, and the exam was notable for ecchymosis of the tip of the thumb. Laboratory studies showed elevated D-dimer at 0.65 [< 0.50 ug FEU/ml]. Within six hours, labs indicated developing coagulopathy with decreased fibrinogen from 414 to 121 [206-498 mg/dl], rising D-Dimer to > 20.0 and INR from 1.0 to 1.4. Within 32 hours, disseminated intravascular coagulation developed leading to microangiopathic hemolytic anemia with undetectable fibrinogen, rising INR to 1.9, platelets of 99 [134-365 103 /ul], LDH 2,266 [140-290 U/L], haptoglobin < 30 [44-215 mg/dL], schistocytes, and episodes of hematemesis. Hemoglobin nadir was 7.8 [12.1-17.4 g/dL] four days post envenomation. Renal failure occurred with creatinine rise from 0.88 to 6.93 [0.67-1.10 mg/dL]. Swelling of his thumb progressed with the development of hemorrhagic bulla and areas of necrosis.

Results: North Carolina Poison Control obtained 10 vials of Inoserp® Panafrican polyvalent antivenom from the Riverbanks Zoo in Columbia, South Carolina. The antivenom was administered on hospital day two. Patient's coagulation parameters normalized within 24 hours of antivenom administration. His renal function worsened necessitating hemodialysis. Progression of his ecchymosis halted after antivenom with necrosis persisting at the tip of his thumb. He was discharged on hospital day 13 with outpatient dialysis and orthopedic follow up.

Conclusion: Inoserp® Panafrican polyvalent antivenom is efficacious in correcting coagulopathy associated with Atheris squamigera envenomation.

023. Transient Hematotoxicity Following Emerald Horned Pitviper (*Ophyracus Smaragdinus*) Envenomation

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Background: A minority of snake envenomations in the U.S. occur in the occupational setting, and few involve non-native snakes. In this report we describe a commercial snake dealer who was bitten by an emerald horned pitviper, *Ophyracus smaragdinus*, she was treating in her facility.

Methods: This is a single patient chart review. A 36-year-old female was bitten on her left index finger by an emerald horned pitviper she was medicating for an intestinal parasite. Swelling to the finger and hand were present upon emergency department arrival. She had no systemic complaints, and her initial laboratory studies were unremarkable.

Results: The affected limb was elevated and five vials of Antivipmyn Tri® were administered. She developed a mild allergic reaction to the antivenom and was treated with diphenhydramine and famotidine. Her repeat laboratory studies were notable for thrombocytopenia and hypofibrinogenemia, but her swelling had improved. She declined additional antivenom. Subsequent laboratory tests were improved, but a small hemorrhagic bleb developed at the bite site. She followed up as an outpatient. Her swelling had resolved, her bleb had healed, and her laboratory studies continued to improve.

Conclusion: *Ophyracus smaragdinus* envenomation may cause hematologic toxicity and local tissue injury. Because these snakes are native to Mexico, either of the FDA-approved North American pitviper antivenoms could theoretically have been used. However, Antivipmyn Tri® might be more appropriate because it has been used successfully for other snakes from the genus *Ophyracus*. Physicians should know how to obtain this and other non-native antivenoms as well as how to access expert assistance in these uncommon cases.

024. Severe Pediatric *Crotalus horridus* Envenomation Requiring Mechanical Airway Support Treated with Crotalidae immune F(ab')2

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Background: *Crotalus horridus* envenomation results in cytotoxicity and hematotoxicity manifested by local tissue injury and DIC-like coagulopathy with severe thrombocytopenia, respectively. Neurotoxic effects are less common and cases in which severe systemic toxicity occurs are rare.
Hypothesis: *Crotalus horridus* envenomation in the pediatric population can result in severe systemic toxicity requiring invasive respiratory support and demonstrates response to treatment with Crotalidae immune F(ab')2.
Methods: This is a single case study. A 13-year-old female presented to an outside emergency department (ED) with concern for crotalid envenomation following a bite to her right index finger. She arrived encephalopathic with vomiting and drooling leading to swift intubation for airway protection. Her right hand and wrist were edematous and ecchymotic on exam. Labs showed severe thrombocytopenia with platelets $19x10^9$/L and D-dimer and fibrin split products above assay detection level. She was administered Crotalidae immune F(ab')2 and transferred to our center.
Results: On presentation to our hospital, she remained intubated with minimal extension of induration. Labs exhibited ongoing coagulopathy and mildly improved thrombocytopenia. She was administered additional Crotalidae immune F(ab')2 shortly after arrival. Successful extubation occurred on hospital day two and her coagulopathy subsequently improved with fluctuating thrombocytopenia. She reported improved pain with persistent paresthesia in the ulnar distribution. She was discharged on hospital day three with no focal neurologic deficits. Plastic surgery was consulted during her admission with documentation of a clinic visit two months later noting near resolution of paresthesia and otherwise normal function.
Conclusion: Life-threatening Crotalid envenomations are rare. They more commonly occur in the pediatric population as children receive a larger envenomation relative to body size. Here we report a case of pediatric *Crotalus horridus* envenomation resulting in severe systemic toxicity requiring mechanical airway support with good response to multidose Crotalidae immune F(ab')2.

025. Massive Honey Bee (Apis Sp) Envenomation: A Case Report.

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Background: Honey bees (Apis sp), have a venom composed of melittin, phospholipase A2, hyaluronidase and apamin, among other proteins. Severe poisoning is rare and occurs in the context of massive stings, which can occur when causing a disturbance in a hive or when confronted by Africanized bees. Envenomation can be lethal when it reaches between 100 and 1000 bites, or with an estimated 19 bites/kg.
Methods: A 65-year-old male, who was homeless, with a history of alcoholism, was taken to the emergency room 45 minutes after a beehive fell on him and suffered a massive attack. He had a total of 822 sting marks over his body, and 70 kg of weight (11.7 stings/kg). On arrival, he had an intense burning pain and his vital signs were: heart rate 123 bpm, blood pressure 177/105 mmHg and respiratory rate 26 rpm. Stingers were removed after arrival, using sterile gauzes and then tetanous toxoid was given. Hours later, he coursed with oliguria and hematuria. Laboratory analysis at 20 hours were CPK of 2660 U/L, serum creatinine 2.8 mg/dL and AST 126 UI/L. The patient was treated with IV saline solutions, opioid analgesia, acetaminophen, and hydrocortisone, showing clinical improvement, increasing in urine output and the absence of hematuria. Subsequently, the patient requested his early discharge on the second day of treatment.
Conclusion: Our patient exhibited elevated CK and signs of acute renal failure, however, the removal of the stingers and the implementation of supportive measures normalized his urinary volume, even though subsequent CK and other laboratory parameters quantifications were not possible. On the other hand, Bee stings are frequently associated with hypersensitivity reactions; However, emergency physicians should be familiar with massive bee envenomation because it is a life-threatening condition, and its therapeutic approach is different from that of anaphylaxis.

026. Black Widow Spider Bites Treated With Equine Inmune F(ab´)2 Specific Antivenom at Three Poison Control Centers in Mexico State.

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Background: Latrodectism is envenomation caused by Latrodectus spider bites. There are three grades of severity: Grade I causes localized pain, Grade II moderate muscle rigidity/spasms, Grade III severe delirium/arrhythmias. This retrospective study aimed to characterize latrodectism cases in three Poison Control Centers in Mexico state.
Methods: A retrospective, descriptive study analyzed 29 latrodectism cases treated at three Poison Control Centers in Mexico State. One center had cases from 2012-2023, while the other two centers were recently opened and had cases from 2022-2023. Information was examined on the number of patients, age, symptoms, bite site, severity, F(ab')2 antivenom treatment, and clinical behavior after treatment across severity grades.
Results: Twenty-nine cases of latrodectism were reported, predominantly in women (62.06%) and most frequently in individuals aged 21-30. The average patient age was 35.33, Incidents peaked in May, July and October. Patients typically reached the medical toxicology service within 2.95 hours, with bites most common on the right forearm and left hand. Symptoms were primarily paresthesias, pain, and hypertension. Severity varied, with 58.62% mild cases, and 13.79% severe, including three instances of fascie latrodectismica. All of them received and averaged 1.33 vials of F(ab')2 antivenom, and 48.27% received NSAIDs. Hospital stays averaged 12 hours, one patient, who received late treatment with F(ab')2 antivenom, experienced prolonged symptoms.
Conclusion: The use of antivenom F(ab')2 in our study, even in mild cases, reduced symptoms upon discharge, showing efficacy in all severity levels. Early administration was pivotal as patients treated promptly did not develop complications, including those with severe presentations, notably, no adverse reactions were reported, suggesting its security in management. However, further comparative studies are necessary to evaluate whether the treatment impacts other variables such decreasing hospital stays, envenomation severity, and the duration of symptoms.

027. Treatment of Black Widow Spider Envenomation With Antivenom (Antivenin: Latrodectus Mactans) Did Not Result in Adverse Events

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Background: Black widow spider (BWS) antivenom (Antivenin: Latrodetus mactans; Merck) is a horse serum-derived product available since 1954. After a single reported case of death following BWS antivenom administration, there continues to be controversy related to using spider antivenom. A lack of data about side effects and allergic reactions limits its use.
Methods: We present a retrospective, data-only cohort study of patients who received BWS antivenom after consultation from the Kaiser Permanente Northern California (KPNC) Medical Toxicology service between 9/1/2014 through 9/30/2023. The KPNC Medical Toxicology service provides consultation throughout 22 facilities in Northern California. All cases were extracted from existing Toxicology service patient logs.
Results: There were 57 cases of suspected BWS envenomation receiving antivenom including one pregnant patient and six patients under age 10 (range 1.2-82; mean 43.6, median 48.4). Sixteen patients (28%) received antivenom on return visits for ongoing symptomatic BWS bite. No patient in our cohort had an acute allergic reaction to antivenom. Ninety percent (49) of patients were treated in the ED and released. The mean LOS was 9.14 hours (median 4.98; range 2.55-57.27; 95% CI 6.06, 12.22). The mean time from antivenom to discharge was 5.11 hours (median 2.32; range 0.73-55.97, 95% CI 2.64, 7.58). Eight patients (14%) were admitted to the hospital. Of these, four were admitted prior to antivenom, three for reasons unrelated to BWS bite, and one for further observation due to anxiety and pain. Only one patient represented to the ED after receiving BWS antivenom for "red streaks". He was discharged with cephalexin.
Conclusion: We found no cases of adverse events or allergic reactions from antivenom. There were no return visits for serum sickness. Our results suggest that administration of BWS antivenom is safe.

028. Trends and Clinical Outcomes in Venomous Fish Exposures: 2000 - 2022

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Background: Venomous fish exposures pose unique clinical challenges, with a spectrum of outcomes ranging from mild irritation to severe systemic reactions.
Research Question: We aimed to characterize trends, clinical effects, and demographics of venomous fish exposures reported to the National Poison Data System (NPDS) over a 23-year period.
Methods: We conducted a retrospective analysis using the NPDS between January 1, 2000 and December 31,

2022. We queried the NPDS for cases coded as fish stings (generic code 0232000). We descriptively analyzed clinical effects, therapies and outcomes of fish sting exposures. We described trends in exposures over time.

Results: A total of 20,135 cases were identified over the study period. The analysis revealed a decline of 57.39% in venomous fish exposure cases from 2000 to 2022 (Mean 875 cases/year). Ninety percent of exposures occurred at the person's own residences or at a public area (n = 18,037); 77% (n = 15,747) were either not followed or determined to have a minor exposure. Approximately 74% of patients identified as male (n = 14,782). The most common clinical effects were dermal irritation/pain (n = 13,567; 67%) and puncture wounds/stings (n = 13,485 67%), followed by other local effects such as edema and erythema (n = 7987; 40%). Serious effects such as hypotension, paralysis, and muscle weakness were reported but infrequent (n = 110; 0.5%). Approximately 0.54% of all cases necessitated critical care admission (n = 109; 0.5%). Local wound care with washing/irrigating (n = 13754; 68%), antibiotics (n = 2,691; 13%), and antihistamines (n = 988; 5%) were among the most commonly provided therapeutics.

Conclusion: This analysis highlights a significant decrease in venomous fish exposure cases over two decades. While most exposures result in mild to moderate clinical effects, specifically requiring only local wound care, the occurrence of serious outcomes, albeit rare, necessitates knowledge of the range of possible outcomes.

029. Ciguatera Poisoning From the Ingestion of Imported Roi Fish (*Cephalopholis Argus*): A Case Series

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Background: The Roi fish (*Cephalopholis argus*) is a carnivorous reef fish invasive to Hawaii that causes ciguatera fish poisoning. The offending toxin, ciguatoxin, is tasteless, odorless, and heat stable. It causes gastrointestinal, neurologic, and cardiac toxicity via activation of voltage-gated sodium channels. Improper importation of the fish can pose a public health risk.

Methods: This is a case series of five patients reported to a single poison center who developed varying severity of ciguatera poisoning after the ingestion of imported Roi fish purchased from a local fish market.

Results: A 53-year-old female presented to the hospital eight hours post ingestion with vomiting and paresthesia to her face, hands, and feet. She had severe bradycardia (heart rate of 47 bpm) and hypotension (BP 73/44 mmHg) refractory to fluid resuscitation, three doses of atropine (total of 1.5 mg), and a norepinephrine infusion. Her hemodynamics improved on an epinephrine infusion. She was eventually weaned off of pressor support and discharged three days post-ingestion. Four other family members reported similar symptoms without cardiovascular involvement. One was evaluated and discharged from the Emergency Department. All five patients described paresthesia to hands and feet with cold allodynia. Three patients reported ongoing watery diarrhea and muscle weakness that lasted for two-three weeks, two patients had pruritus starting at three weeks, and one patient reported a sensation of "loose teeth." All symptoms resolved at four weeks post ingestion. The US Food and Drug Administration lab in Dauphin Island, Alabama identified ciguatoxin present in the leftover fried fish.

Conclusion: This case series included one life-threatening ciguatera poisoning after the consumption of Roi fish, with multisystem organ involvement and severe cardiac toxicity. Other family members had mild toxicity, and all had resolution of neurologic symptoms by four weeks.

030. Ciguatera-Induced Myocarditis

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Background: Ciguatera poisoning is caused by ingestion of reef fish that have bioaccumulated ciguatoxin produced by the dinoflagellate Gambierdiscus toxicus. Gastrointestinal and unique neurologic changes predominate, but cardiovascular effects including bradycardia and hypotension occur in 13% or fewer of cases. Myocarditis has not been previously reported.

Case Report: A previously healthy fifty-year-old female with GERD and obesity presented to the emergency department (ED) for generalized weakness, abdominal pain, vomiting and diarrhea. Her vital signs included HR 35 bpm, BP 95/65 mmHg, which responded immediately to atropine. Her ECG demonstrated sinus bradycardia with diffuse T-wave inversions. Her nurse recognized her husband at bedside who had presented with similar symptoms, bradycardia, and ECG changes the week previous. Ciguatera was suspected once recent barracuda consumption was discovered. The woman remained hemodynamically stable for a brief hospital stay and was discharged. She presented to the ED again three days later with new onset dyspnea on exertion, atypical chest pain, hot-cold reversal and altered taste. Pertinent labs

included a high-sensitivity troponin of 80 ng/L, peaking at 118 ng/L, as well as recurrent bradycardia to 45 bpm. She was given atropine in the ED with improvement in heart rate. During admission she had a coronary catheterization which showed no vessel disease and a normal echocardiogram. The regional public health agency obtained the residual fish and confirmed the presence of ciguatoxin.

Discussion: This case demonstrated several unique aspects of ciguatera poisoning, including delayed-onset neurologic symptoms and a predominance of cardiac symptoms. Ciguatoxin exerts its effects via opening of voltage gated sodium channels, and bradycardia is theorized to relate to cholinomimetic activity. Cardiac conduction delay such as junctional bradycardia and second-degree AV block are rare. Myocarditis has not been reported.

Conclusion: Myocarditis, though rare, may be a consequence of ciguatera poisoning.

031. Neurologically Intact Survival After Sodium Fluoride Ingestion Requiring Extracorporeal Circulatory Support

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Background: Soluble fluoride salts are toxic owing to systemic chelation of essential cations as well as direct cellular effects, leading to refractory arrhythmias and caustic injury. There are no reported cases of survival utilizing ECMO after fluoride salt ingestion.

Methods: Single-patient chart review of a 21-year-old male who intentionally ingested an unknown quantity of 99% sodium fluoride reagent, leading to electrolyte derangements and profound myocardial dysfunction requiring veno-arterial (VA) ECMO, anuric renal injury requiring renal replacement therapy, and caustic gastrointestinal injury. Timed serum and dialysate fluoride concentrations were obtained, as were serum electrolytes, esophagogastroduodenoscopy, echocardiographic, and electrocardiographic data.

Results: The patient presented with altered mentation and hematemesis requiring intubation. Initial laboratory workup demonstrated hyperkalemia (6.1 mEq/L, RR - 3.5 - 5.5 mEq/L), hypocalcemia (6.2 mEq/L, RR 8.6 - 10.3 mEq/L) and hypomagnesemia (0.58 mEq/L, RR 0.69 - 1.07 mmol/L) which persisted despite aggressive repletion. Serum fluoride concentration was 1.4 mg/L (NMS Labs, Horsham, PA, RR $\leq$ 0.13 mg/L). The patient developed bradycardia and QRS widening interval with increasing ectopy, progressing to polymorphic ventricular tachycardia and multiple cardiac arrests. Serum magnesium at that time was 0.25 mEq/L. He required cannulation for VA-ECMO and Impella placement, with a post-cannulation ejection fraction of 5%. Course complicated by disseminated intravascular coagulation, diffuse alveolar hemorrhage, and north-south syndrome requiring conversion to veno-arterio-venous-ECMO. Endoscopy demonstrated Zargar grade 3b injury. The patient was anuric, requiring renal replacement therapy (RRT). Dialysate fluoride concentration was 0.49 mg/L (hospital day two), and serum concentration decreased to 0.13 mg/L (hospital day four), correlating with hemodynamic recovery (EF 55-60%). The patient was decannulated and made a full neurologic recovery.

Conclusion: Mechanical circulatory support may benefit those with critical illness from fluoride salt ingestion. Fluoride was detectable in this patient's dialysate, suggesting utility of RRT for toxin removal.

032. Vasoplegic Shock Associated With Dihydropyridine Calcium Channel Blocker Poisoning.

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Background: An US Poison Center study noted amlodipine was the most common cause of death from calcium channel blocker (CCB) poisoning (61%; 37/61 cases), with treatment including vasopressors (97%) and high dose insulin (HDI: 81%). A median dose of 10 u/kg/h HDI is reported in managing amlodipine poisonings, this treatment is associated with the use of more vasopressors when compared with non-dihydropyridine poisonings.

Hypothesis: We postulate that HDI causes vasodilation and is rarely need in the management of dihydropyridine CCB poisoning. This study aims to determine treatments and outcomes from dihydropyridine CCB poisoning in Australia.

Methods: This is a retrospective study (Jan 2020 to July 2023) of patients with deliberate dihydropyridines poisoning that developed hypotension (MAP< 65 mmHg or SBP < 90 mmHg). Patients ingesting non-dihydropyridine, alpha- and beta-blockers were excluded.

Results: Fifty patients (32 amlodipine) were recruited, median age was 57 years (IQR: 42-67) with 62% females (n = 31). The ingestion has a defined daily dose of 34 (IQR 20-57), with 41 (82%) co-ingested angiotensin axis antagonist drugs and 28% (n = 14) patients receiving intubation. Median lowest SBP and MAP were 75 mmHg (IQR: 65-82) and 53 mmHg (IQR: 47-59) respectively. Noradrenaline (n = 34), metaraminol (n = 24), vasopressin (n = 17) or adrenaline (n = 15) were used in 39 (78%) patients; 28 (46%) patients received more than one vasopressors. Other treatments included intravenous fluid (median: 2.5L), calcium salt (n = 37), activated charcoal (n = 12) and methylene blue (n = 7). HDI was used in 10 patients (20%), median dose 1 u/kg/h (IQR: 0.5-3). Median length of stay was three days (IQR: 3-5). There was one fatality.
Conclusion: We observed favorable outcomes from dihydropyridine with or without angiotensin axis antagonist overdose with vasopressors, and relatively low dose HDI was used in a small proportion of patients.

033. Ziprasidone-Induced Torsades De Pointes

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Background: Ziprasidone is an atypical antipsychotic used commonly throughout healthcare settings with a demonstrable safety profile. Although correlated with QTc prolongation, there is little direct evidence that it contributes to development of polymorphic ventricular tachycardia or torsades de pointes (TdP), with only two cases ever reported.
Hypothesis: Ziprasidone administration at therapeutic doses can precipitate TdP.
Methods: This is a single patient chart review. A 46-year-old male was brought into the ED exhibiting signs of agitation following naloxone reversal of presumed opioid toxicity. Failed verbal de-escalation led to administration of Ziprasidone 20 mg intramuscularly for chemical restraint. Subsequently, the patient developed unresponsiveness and polymorphic ventricular tachycardia consistent with TdP. ACLS was performed and ROSC was achieved after 19 minutes of CPR. ED workup was significant for: post-ROSC EKG revealed sinus tachycardia at a rate of 108 with QTc interval of 482 ms, ethyl alcohol level 69 mg/dL, lactate 11.9 mmol/L, Cr 1.75 mg/dL, potassium 4.4 mEq/L, magnesium 2.5 mg/dL, and urine drug screen positive for cocaine, fentanyl, benzodiazepine and negative for methadone. One day later, the patient was extubated in the ICU and endorsed cocaine use in the hours preceding presentation. He underwent a largely unremarkable cardiac workup, including angiographically normal epicardial coronary arteries on catheterization and electrophysiology studies that were negative for inducible arrhythmia. He had AICD placed and was discharged from the hospital neurologically intact several days later with beta-blocker therapy after agreeing to abstain from illicit drug use.
Conclusion: Although rare, Ziprasidone can cause TdP, particularly in the presence of other circulating xenobiotics that may act synergistically to affect ventricular depolarization and repolarization. This is the first case ever reported of TdP after intramuscular administration at low-therapeutic dose.

034. Simultaneous Plasmapheresis and Lipid Bolus in Severe Amlodipine Poisoning

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Background: Amlodipine overdose can result in refractory vasoplegic shock. Hemodialysis is ineffective in removing amlodipine due to its high protein binding and large volume of distribution. Lipid infusion may decrease a drug's volume of distribution and increase plasma concentrations, potentially increasing the amount of drug which may be removed extracorporeally. We present a case of refractory vasoplegic shock treated with ECMO and simultaneous lipid infusion with plasmapheresis.
Case Report: A 14-year-old female with depression presented after ingesting 900 mg of amlodipine. Ingestion was not reported by the patient until 15 hours later. The initial ED transferred her to a children's hospital. Enroute she developed hypoxemia. Despite escalating respiratory support, she was intubated for hypoxia the morning of day three. After continued elevation of lactate, and oliguria in the setting of high doses of norepinephrine, vasopressin, dopamine, calcium infusion, high-dose insulin (6 U/kg/hr), methylene blue, and intravenous lipid boluses she was placed on VA ECMO. On ECMO her lactate increased, and anuria developed. A multidisciplinary care conference agreed to try plasmapheresis timed shortly after lipid bolus. In the hours after this session, lactate concentration and urine output improved, and vasopressin was weaned off within five hours. A second session of plasmapheresis occurred on day four. Perfusion continued to improve, dopamine weaned within five hours; norepinephrine and hyperinsulinemia euglycemic therapy were stopped within 12 hours. The patient remained on ECMO until day 10 due to pulmonary needs and recovered thereafter.
Results: Amlodipine serum concentrations were 890 ng/mL pre-plasmapheresis and 630 ng/mL blood post-plasmapheresis. Amlodipine serum concentration from the post-plasmapheresis circuit (blood leaving the plasmapheresis machine) was 180 ng/mL.

Conclusion: Plasmapheresis removed amlodipine from the patient's serum after lipid bolus administration. Clinical improvement and decreased hemodynamic support coincided with each run of plasmapheresis.

035. Supraventricular Tachycardia Secondary to Albuterol Toxicity in a Pediatric Patient With Concurrent Chronotropic Medication Use

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Background: The mechanism of beta-agonists suggests the possibility of supraventricular tachycardia (SVT) as a side-effect; however, the incidence is rare. This case of albuterol causing pediatric SVT was complicated by concurrent use of sympathomimetic, alpha-1 blockade, and antipsychotic medications.
Methods: An 11-year-old girl with a history of asthma, attention deficit hyperactivity disorder, oppositional defiant disorder, and depression presented to the emergency department (ED) with chest discomfort, shortness of breath, and palpitations. She reported a panic attack following an argument and felt dyspnea similar to an asthma exacerbation. Over one hour, she took 147 puffs of albuterol. She denied suicidal ideation. Her medication history included 30 mg dexmethylphenidate daily, clonidine 0.1 mg twice daily, and risperidone 1 mg twice daily. She denied illicit drug use. A urine toxicology screen, acetaminophen, and salicylate levels were all negative with serum potassium of 3.6 mEq/L, and magnesium 1.8 mg/dL.
Results: In the ED, she was alert, oriented, with no acute distress. Initial heart rate was 147 bpm, blood pressure 143/81 mmHg, SpO2 99% on room air, respirations 18 per minute, temperature 36.7 C, and weight 69.3 kg. The cardiac monitor showed a narrow complex with a rate of 266 bpm. EKG confirmed SVT responsive to vagal maneuvers, converting the rhythm to sinus tachycardia with rates from 140-160 bpm. Poison control initially recommended propranolol but changed course with findings of a borderline QTc on the repeat EKG. They recommended keeping the patient calm, continuing vagal maneuvers, 1 mg dose of lorazepam, and admission for observation.
Conclusion: Sympathomimetics, alpha1-blockers, and atypical antipsychotics may increase the risk of SVT with beta-agonists. The self-administered dose of albuterol was 13.5mg (0.19mg/kg), similar to continuous nebulizer therapy. This may represent a special population that should be closely monitored during treatment of asthma exacerbations, especially those requiring continuous albuterol.

036. A Clinical Study of the Cardiac and Hepatic Toxic Effects of Paraphenylenediamine in Poisoned Cases Admitted to Sohag University Hospitals With a Supportive Experimental Study in Rats

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Background: Paraphenylenediamine (PPD) is the main component of most commercial hair dyes and can result in serious local and systemic toxicity reactions.
Hypothesis: To evaluate the predictors of morbidity and mortality in acute PPD toxicity cases, with special consideration for the assessment of PPD-induced hepatic and cardiac toxicity.
Methods: This was an observational study conducted on acute PPD poisoning cases, including a retrospective part from Feb 2021 to Jan 2022 and a prospective part from Feb 2022 to July 2022 in Sohag University Hospitals. History and clinical and laboratory data were collected in an anonymous manner, with written informed consent from the patients.
Results: Seventy eight percent of patients had complete recovery after full hospital care, while 22% died or had permanent complications after recovery. Significant angioedema and anuria were observed in complicated and fatal cases. Increased AST > 644, ALT > 798.5, increased delay time per hour > 4.5 and decreased PH < 7.3 were significantly associated with mortality and morbidity with accuracy rate 80%, 73%, 79% and 18.5%. Sensitivity was 90.9%, 72.7%, 63.6% and 81.8%. The specificity was 61.5%, 71.8%, 82.1%, and 76.9%, respectively. Cardiac enzymes, blood urea, and creatinine levels were increased in almost all cases without a significant association with mortality. Cardiotoxicity and hepatotoxicity were confirmed by the supportive experimental part of the study with laboratory and histopathological assessment of the animal treated PPD group compared to the control animal group.
Conclusion: Elevated liver enzymes, increased delay time, decreased PH, and the presence of angioedema and/or anuria can be used as predictors of morbidity and mortality in acute PPD toxicity. The effects of blood urea, serum creatinine, and cardiac enzymes were observed in most acute PPD toxicity cases, even in those who had recovered completely, indicating the occurrence of cardiotoxicity and nephrotoxicity that require good supportive care and long hospitalization in the ICU.

037. Cardiac Conduction Abnormality After Acute Overdose of Mirabegron

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Background: Mirabegron is a selective beta-3 adrenergic (B3) agonist used as an alternative to antimuscarinic overactive bladder medications. Cardiac myocytes also express B3 receptors; adverse effects in clinical trials include tachycardia, palpitations, hypertension, and CYP2D6 inhibition.
Hypothesis: Mirabegron overdose causes QRS and QTc prolongation.
Methods: This is a single-patient chart review. An 80-year-old man with Alzheimer's disease presented to the emergency department after his wife witnessed him ingest 7.1 mg/kg of his mirabegron. He was prescribed metformin, nateglinide, donepezil, hydrochlorothiazide, potassium chloride, rosuvastatin, niacinamide, calcium carbonate, omeprazole, and escitalopram; no other ingestions were reported.
Results: Electrocardiogram revealed a regular wide-complex tachycardia at 111 beats per minute, QRS 180 ms, and QTc 636 ms. Baseline electrocardiogram showed sinus rhythm, first degree AV block, QRS 150 ms, and QTc 454 ms. Other vital signs and examinations were unremarkable. Laboratory testing revealed minimal hyponatremia and hypochloremia; other values were normal. Two mEq/kg of intravenous sodium bicarbonate were administered without effect. Heart rate and intervals returned to baseline sixteen hours later. He was subsequently discharged. Temporal association between supratherapeutic ingestion of mirabegron and electrocardiographic abnormalities suggests that the observed changes are related to mirabegron overdose. The mechanism underlying these changes is not well-understood, though QTc prolongation has occurred in female patients; QRS prolongation and ventricular tachycardia were observed in animals receiving supratherapeutic mirabegron doses. This patient's minimal response to sodium bicarbonate suggests QRS prolongation is not mediated by sodium channel blockade. Alternatively, mirabegron-induced CYP2D6 inhibition may have impaired escitalopram metabolism, potentiating QRS and QTc prolongation. While mirabegron overdose was witnessed, limitations include that exposure was not confirmed. CYP2D6 activity and escitalopram concentrations were not obtained, limiting evaluation of drug-drug interaction.
Conclusion: Mirabegron overdose may be associated with cardiac conduction disturbances.

038. Critical Care Management and Outcomes of Dihydropyridine Calcium Channel Blocker Exposures at a Single Tertiary Referral Center

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Background: Although dihydropyridine calcium channel blockers (DHP) are considered less severe in overdose than non-dihydropyridines, DHPs are more frequently prescribed and responsible for more deaths. Existing literature regarding clinical severity, management, and outcomes of DHP-specific exposures is limited.
Hypothesis: DHP exposures can result in severe toxicity primarily managed with high-dose vasopressors.
Methods: This is a single center retrospective chart review of DHP exposures between 2010-2022. Inclusion criteria included age >18 years and DHP ingestion noted on departmental patient log. Patients were excluded if DHP exposure was not documented in the medical record. Ambiguous cases were resolved by consensus review. Data on clinical presentation, management, and outcomes were reported. Analysis was descriptive.
Results: Sixty-eight cases of DHP exposure were analyzed; 86.8% were intentional ingestions. Amlodipine represented 88.2% of cases; 85.3% had co-ingestions. Median nadir systolic blood pressure (SBP) was 77.5 mmHg (IQR 66.8-90.5); median nadir heart rate was 61 beats per minute. Vasopressors were administered in 42 cases (62.0%), with a median of three agents (IQR 1.3-4). Norepinephrine was most common (n = 41; 97.6%), followed by epinephrine (n = 23; 54.8%); Median maximal rates were 45.0 (IQR 13.5-70.0) and 25.0 (IQR 12.0-30.0) mcg/min, respectively. Median nadir SBP for single-agent exposures (n = 10) was 83 (IQR 66-92.8) mmHg; 50% received vasopressors with median maximal norepinephrine rate 60 (IQR 34-60) mcg/min. 14.7% (n = 10) received high dose insulin euglycemic therapy (HIE), all had > 2 vasopressors administered before HIE. Peak norepinephrine rate was higher in the HIE vs no HIE group (72.5 vs. 37.1 mcg/min; p = 0.003). Twelve (17.6%) patients had ischemic complications; five (7.4%) experienced ischemic complications not evident before vasopressor administration. There were five deaths (7.4%).
Conclusion: This review reports critical illness in DHP exposures similar in severity to existing literature on non-dihydropyridines. High dose vasopressors were frequently administered.

039. Severe Refractory Flecainide-Induced Dysrhythmia With Therapeutic Dosing Treated With Extracorporeal Membrane Oxygenation (ECMO)

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Background: Flecainide is a class Ic antiarrhythmic useful in converting atrial fibrillation (AF) to sinus rhythm in patients without structural heart disease. Flecainide has rare life-threatening adverse effects in a narrow therapeutic window (0.20-1.00 mcg/mL).
Hypothesis: Severe adverse effects from flecainide at therapeutic dosing that are refractory to standard measures may benefit from early aggressive cardiovascular support.
Methods: This is a single patient chart review. We report a patient taking flecainide at therapeutic dosing suffering severe adverse effects treated with ECMO. Flecainide concentrations were sent on hospital days two and three.
Results: A 68-year-old female with a history of persistent AF was initiated on oral flecainide 100 mg twice daily for refractory AF. She underwent elective cardioversion the following day, restoring sinus rhythm. Eleven days later, she presented to the emergency department (ED) with syncope. EMS observed two episodes of ventricular tachycardia (VT) for which she was defibrillated and received intravenous (IV) amiodarone. Upon arrival to the ED, she experienced ventricular fibrillation (VF). She was cardioverted with return of spontaneous circulation and consciousness. She received infusions of lidocaine and sodium bicarbonate. Ten hours after presentation, the patient sustained multiple episodes of polymorphic VT and VF requiring defibrillations and endotracheal intubation. Temporary transvenous pacing was initiated for overdrive pacing. She received IV lipid emulsion. Fourteen hours after the presentation, she experienced a VF arrest. She underwent veno-arterial (VA) ECMO cannulation and temporary ventricular support device (TVSD) placement. Flecainide concentrations sent on hospital days two and three returned elevated at 1.59 mcg/mL and 1.25 mcg/mL, respectively. She underwent ECMO decannulation and TVSD removal by hospital day six. She was discharged to inpatient rehabilitation on hospital day 27 and was ultimately discharged home.
Conclusion: Early aggressive intervention may be considered even with therapeutic flecainide dosing causing adverse effects. Further research is necessary.

040. Serotonin Toxicity Secondary to Fentanyl and Cyclobenzaprine: A Case Report

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Background: Serotonin toxicity can be precipitated by exposure to multiple serotonergic agents. Fentanyl has been posited to have serotonergic properties. Cyclobenzaprine has also been implicated in serotonin toxicity, but there are limited reports of associated measured cyclobenzaprine levels. We report a case of fentanyl and cyclobenzaprine exposure associated with serotonin toxicity and include a cyclobenzaprine serum level obtained during the period of toxicity.
Methods: This is a single patient retrospective chart review.
Results: A 57-year-old female with a history of chronic kidney disease stage III and opioid use disorder presented after being found down. Per family, she ingested five cyclobenzaprine tablets prior to presentation. She received naloxone in the field, and subsequently developed agitation. Vitals were: blood pressure 210/144 mmHg, heart rate 110 beats/minute, and respirations 7 breaths/minute. Physical exam was notable for mydriasis, inducible bilateral ankle clonus, agitation, and urinary retention. She received haloperidol and lorazepam for agitation, and hydralazine and nifedipine for hypertension. Ethanol, salicylate and acetaminophen levels were undetectable. Urine drug screen (UDS) was positive for fentanyl only. Review of the state prescription drug monitoring database revealed prescriptions for alprazolam, zolpidem, and oxycodone last filled several months prior. A cyclobenzaprine level drawn approximately 17.5 hours after initial presentation, while still symptomatic, resulted at 54 ng/mL (therapeutic 4-40 ng/mL). Benzodiazepines were administered for agitation. When her mental status improved, the patient denied any use of stimulants, antidepressants, or other common serotonergic agents. The patient was discharged on hospital day eight.
Conclusion: The patient met Hunter Criteria for serotonin toxicity. She also demonstrated signs of opioid-related and anticholinergic toxidromes, consistent with detected fentanyl and supra-therapeutic cyclobenzaprine level. We did not perform comprehensive confirmatory testing to exclude other serotonergic agents. The only identified exposures that can account for the patient's serotonin toxicity are cyclobenzaprine and fentanyl.

041. Acute Lacosamide Overdose With Subsequent Status Epilepticus and Cardiovascular Collapse Treated With Intravenous Lipid Emulsion.

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Background: Lacosamide is a third-generation antiepileptic that selectively binds slow inactivated voltage-gated sodium channels. Effects on cardiac conduction have been described in overdose including QRS prolongation. Ventricular dysrhythmia and cardiac arrest are described with particularly large overdoses. Literature for intravenous lipid emulsion (ILE) therapy in this overdose setting is scant and data regarding serum lacosamide levels after its administration is lacking. We present a single case report with serial lacosamide levels after ILE therapy.
Methods: A 58-year-old male with a history of focal epilepsy presented to the emergency department with undifferentiated status epilepticus; his home medications included lacosamide, lamotrigine, and valproic acid. He required intubation and was given multiple antiepileptics. He was also found to have a wide complex tachycardia. Later, it was discovered he intentionally ingested approximately 18,000 mg of lacosamide prior to presentation. He was treated with sedatives to suppress electroencephalographic seizures, vasopressors, and repeated boluses of sodium bicarbonate for wide-complex tachycardia. On hospital day one he developed ventricular tachycardia and suffered a cardiac arrest; ROSC was achieved with standard therapy and the team gave 100mL 20% ILE immediately after achieving ROSC. He subsequently had progressive improvement with supportive measures, was extubated on hospital day 6, and discharged on hospital day 10.
Results: Serial lacosamide levels were obtained throughout hospitalization at hours 0, 12, 15, 41, and 83 and were 110.4 mcg/mL, 117 mcg/mL (peri-arrest), 116.4 mcg/mL (3 hours post-arrest), 86.5 mcg/mL, and 56.7 mcg/mL, respectively. The lamotrigine level was subtherapeutic and valproate level was undetectable. Qualitative urine drug screening using gas chromatography/mass spectrometry showed lamotrigine, lacosamide, tetrahydrocannabinol metabolites, and hospital-administered medications.
Conclusion: Serum lacosamide levels were relatively unchanged after treatment with ILE. Further research should be performed to determine its utility in the setting of severe lacosamide overdose.

042. Initial Serum Lactate Predicts Adverse Cardiovascular Events in Emergency Department Patients With Bupropion Overdose*

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Background: Bupropion can induce adverse cardiovascular events (ACVE) in overdose. Risk stratification is difficult due to delayed toxicity. Initial serum lactate has previously been associated with mortality in emergency department (ED) patients with heterogeneous drug overdoses and may be useful in predicting ACVE.
Hypothesis: Initial serum lactate value independently predicts ACVE in adult ED patients with suspected bupropion overdose.
Methods: This is a secondary analysis of prospectively collected data via the Toxicology Investigators Consortium from April 15, 2015 through July 30, 2018. Patients > 18 years old with acute or acute-on-chronic bupropion exposure were included; patients with signs/symptoms unrelated to the exposure, and those with missing data, were excluded. The primary outcome was ACVE (myocardial injury, shock, ventricular dysrhythmia, or cardiac arrest). Secondary outcomes included ACVE components, death, intensive care unit admission, seizures, altered mental status, and QRS widening. A multivariable logistic regression model was created with lactate value and potential confounders as independent variables and ACVE as the dependent variable. The optimal lactate cutpoint was derived using ROC curves maximizing sensitivity and specificity. A new model was created using this value, and diagnostic test characteristics were calculated.
Results: Among seventy-three patients included, ACVE occurred in 19 (35.2%). The median initial serum lactate value was 1.8 (IQR: 0.9-3.4) mmol/L. Initial serum lactate value demonstrated an increased odds of ACVE in the logistic regression model (aOR 1.15, 95% CI 1.00-1.32). The optimal cutpoint of 5.2 mmol/L was independently predictive of ACVE (aOR 12.2, 95% CI 2.50-75.2). The specificity

and negative predictive value of initial serum lactate > 5.2 mmol/L were 90.7% and 80.3%, respectively. Elevated initial lactate value was also associated with shock ($P = 0.005$) and ventricular dysrhythmias ($P = 0.03$).
Conclusion: Initial serum lactate value is useful in predicting which ED patients with bupropion overdose will develop ACVE.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

043. A Rare Case of Kratom-Induced Brugada Pattern

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Background: Kratom (*Mitragyna speciosa*) is an alkaloid that is easily available around the world. Kratom users primarily utilize the substance for its effects on kappa opioid receptors, although it does have some stimulant effects as well. Kratom use has previously been associated with a prolongation of the QT interval, however, has rarely been associated with a Brugada-pattern on electrocardiogram (ECG).
Methods: This is a single patient case report. A 21-year-old male without past medical history presented to the emergency department for a syncopal episode resulting in significant facial trauma. The patient had no history of prior syncope or seizures. However, he did admit to regular use of dextroamphetamine, nicotine, and most notably, kratom use just prior to the syncopal episode. There was no family history of sudden death or cardiac disease. Initial ECG showed coved type ST elevations in V1 and V2 consistent with type one Brugada pattern. Initial labs showed a potassium of 3.3 mmol/L but were otherwise unremarkable. The patient was admitted and placed on cardiac monitoring and serial ECGs were obtained to evaluate for any further arrhythmias. The Brugada pattern was consistent throughout the admission.
Results: No arrhythmias were noted during inpatient cardiac monitoring. He was discharged with an event recorder and sent for additional testing which did not reveal a genetic cause for the Brugada pattern. A repeat ECG was performed by cardiology after one month of Kratom abstinence which no longer demonstrated the Brugada pattern.
Conclusion: This case demonstrates a unique but dangerous association between kratom use and Brugada pattern on ECG resulting in syncope. There is one other report of similar ECG findings but no evidence of syncope. Providers should be aware of the possibility of such cardiotoxic effects and obtain an ECG when evaluating patients reporting kratom use.

044. Utilization of Digoxin Immune Fab for Serious and Life-Threatening Digoxin Toxicity

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Background: Characterize demographics, clinical factors, outcomes, and digoxin immune fab (DIF) utilization in a digoxin toxic (DT) population.
Methods: This was an IRB approved retrospective chart review of DT patients from 2011-2020. Patients were stratified by DIF vs non-DIF treatment. Groups were compared on: DT-related symptoms (renal injury/failure, mental status disturbances, cardiac arrhythmias, hyperkalemia); DIF utilization patterns (pre-defined criteria-- appropriate, inappropriate, or underutilized); and severe DT designation (> 1 of the following: mental status disturbances, antiarrhythmic therapy, acute renal injury/failure, serum digoxin concentration (SDC) > 4 ng/mL, or K+ > 5 mEq/mL). Logistic multivariable regression analysis was performed using Rv4.1.
Results: Data from 96 patients (non-DIF treated group = 49; DIF treated group = 47) were analyzed. The mean age was 71, 66% female, 70% white, 67% with severe DT, and 12% died. Several clinical parameters differentiated ($p < 0.05$) DIF vs non-DIF, respectively: higher SDC (3.41 ± 1.63 vs. 2.87 ± 1.17), higher initial K+ (5.33 ± 1.48 vs. 4.55 ± 0.87) and severe DT diagnosis (85% vs. 49%). The DIF group was more likely to be appropriately treated (85% vs 61%, $p < 0.001$). The DIF group (n = 17), compared to non-DIF (n = 25), had shorter ICU stays (12.4 ± 20.3 vs. 24.4 ± 28.7 days, $p = 0.018$). DIF was inappropriately utilized in 15% (7) of the DIF group. DIF was underutilized in 39% (19) of the non-DIF group. DIF was used appropriately in only 78% (25) of severely toxic patients. Cardiac arrhythmias (55, 75%) and hyperkalemia (14, 70%) were more common in patients with appropriate DIF utilization. The mortality rate in patients with appropriate versus underutilization of DIF was 8.6% and 21%, respectively.
Conclusion: The DIF group exhibited greater DT (higher SDC/ K+) but shorter ICU stays. DIF use was appropriately utilized in most. However, there was a high proportion of DIF underutilization, and these patients experienced higher all-cause hospital mortality.

045. The Predictive Value of Heart Rate in Determining Clinical Course After a Bupropion Overdose

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Background: Due to the possibility of delayed onset seizure after bupropion overdose, patients are often observed for periods of 12-24 hours. Tachycardia is a clinical predictor that holds promise in identifying low-risk cases that do not require prolonged observation. This study assessed whether heart rate (HR) within the first eight hours of presentation can identify cases that do not require extended observation.
Methods: This is a retrospective cohort study of all supratherapeutic bupropion cases from two hospital systems between 2010 and 2022. Data was extracted by two reviewers via manual chart review. We excluded cases with co-ingested medications which could suppress tachycardia. Primary outcome was the occurrence of delayed (> 12 hours after arrival) seizures, dysrhythmias, shock, or death. Logistic regression was performed to ascertain the relationship between the maximum HR in the first eight hours of observation and clinical outcomes. The optimal HR threshold for excluding delayed adverse outcomes was determined by ROC curve analysis.
Results: Data from 216 charts were included. Ingestions involving extended-release formulations made up 61% of all cases (n = 132). Seizures, hypotension, and dysrhythmias occurred in 19% (n = 41), 1.4% (n = 3), 0.9% (n = 2) respectively. One patient died. Delayed adverse effects were rare (n = 4); they occurred from 14 hours to 28 hours post-ingestion. Maximum HR in eight hours was associated with risk of adverse outcomes. (OR, 1.07 CI: 1.05 to 1.09; $p < 0.001$). An eight-hour maximum HR threshold of 104 bpm had a negative predictive value of 100% (CI: 96.7% to 100%) for occurrence of delayed adverse effects. All patients with delayed effects had tachycardia within five hours of emergency department arrival.
Conclusion: In this cohort of patients with bupropion overdose, absence of tachycardia within eight hours of presentation predicted a benign clinical course. This study supports the use of an 8-hour observation period.

046. A Case of Acute Myocardial Toxicity Secondary to 1,1-Difluoroethane Inhalation

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Background: 1,1-Difluoroethane (DFE) inhalation has been associated with myocardial sensitization and ventricular dysrhythmias. Cardiomyopathy is infrequently reported in survivors of dysrhythmia-induced cardiac arrest due to DFE toxicity but has not been reported as a direct xenobiotic effect.
Hypothesis: Acute DFE toxicity can manifest as direct myocardial injury and ischemia without dysrhythmia.
Methods: This is a single-patient case report. A 27-year-old male with a history of daily ethanol and remote cocaine use (three lifetime exposures) reported inhalation of 20 to 25 cans of DFE-containing dust cleaner daily. He experienced dyspnea 20 minutes after use and activated EMS, who on arrival noted sinus tachycardia. In the emergency department, electrocardiogram, cardiac biomarkers, serum/urine toxicology testing, and echocardiogram were obtained.
Results: Initial electrocardiogram revealed acute anterior ST-elevation myocardial infarction. Initial troponin-I was 82.2 ng/mL (normal < 0.03 ng/mL) and increased to 156.25 ng/mL post-procedure. Coronary angiography revealed mild coronary artery disease without culprit lesion and no vasospasm. Serum and urine toxicology testing was negative for all tested substances including cocaine metabolites. DFE testing was unavailable. A formal transthoracic echocardiogram showed severe left ventricular hypokinesis with an ejection fraction < 20% and moderately reduced right ventricular ejection fraction and mild dilation. Cardiac MRI revealed a mixed ischemic and nonischemic pattern consistent with dilated cardiomyopathy vs. atypical myocarditis pattern. A septal myocardial biopsy revealed prominently vacuolated cardiomyocytes with mild hypertrophic nuclei and minimal interstitial fibrosis consistent with significant cardiomyopathy but without myocarditis. No dysrhythmia was identified at any point during medical care.
Conclusion: DFE inhalation may result in direct myocardial ischemia and cardiomyopathy without dysrhythmia. This conclusion is limited by the descriptive nature of this case report and lack of confirmatory DFE testing.

047. Trends in Chlorine and Chloramine Gas Exposures Reported to US Poison Control Centers From 2015 to 2022

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Background: In the United States, chlorine and chloramine gas inhalation can occur when household cleaners are mixed. There was an emphasis on disinfecting practices during the SARS-CoV-2 pandemic, possibly facilitating increased chlorine and chloramine gas exposures, which has not been studied.

Research Question: How has the epidemiology of chlorine and chloramine gas exposures changed from 2015 to 2022?
Methods: This was a retrospective review. Data on reported chlorine and chloramine gas exposures was collected from the National Poison Data System (NPDS), from 01/01/2015 to 12/31/2022. Data captured in the NPDS includes demographics and exposure details including location, dose, product, toxin formulation, symptoms, treatment, and outcome. Descriptive statistics and demographic analyses were conducted using RStudio.
Results: During the study period, there were 75,186 total exposures to chlorine or chloramine gas. There were 70,081 cases of isolated chlorine or chloramine gas exposures and 5,105 cases of co-ingestions. Of isolated chlorine gas exposures, 48.9% (n = 24,827) were confirmed to be from household acid mixing with hypochlorite. From 2015 to 2022, total exposures increased by 68.0% with the largest increase of 39.8% occurring from 2019 to 2020 with sustained elevations relative to total human exposure cases through 2022. The majority of cases occurred in "own residence" (n = 64301, 85.5%). N = 8,169 cases (10.8%) were classified as being associated with "moderate effects," "major effects," or "death."
Conclusions: The coincidence of the Covid-19 pandemic onset and increased emphasis on cleaning were likely driving factors in the marked increase of exposure calls noted in 2020, which persisted into 2022. The vast majority of reported cases were unintentional, resulting in relatively minor symptoms and use of non-invasive therapies. Our evidence suggests efforts directed towards public education on safe use of cleaning products could mitigate rises in chlorine gas exposures in future public health crises.

048. Analysis of Risk Factors for Inpatient Admission for Carbon Monoxide Poisoning

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Background: Complications from carbon monoxide (CO) poisoning continue to result in hospital admissions and mortality. We sought to analyze risk factors associated with hospital admission for CO poisoning.
Methods: Retrospective study of the US National Inpatient Sample (NIS) database, the largest publicly available all-payer inpatient healthcare database from AHRQ. All adults with ICD-10 code for CO poisoning from 01/01/2016 and 12/31/2020 were eligible. Demographics, comorbid conditions, insurance type, household income, length of stay (LOS), total charges, and mortality were abstracted. Univariable logistic regression was used to calculate unadjusted odds ratios (ORs) for CO poisoning inpatient admissions. Variables with P value ≤ 0.2 were included in a multivariable logistic regression model.
Results: Of 148,767,786 total adult hospitalizations, 14,625 had a principal diagnosis of CO poisoning. Compared to non-CO hospitalizations, the CO group was younger (median age 54 vs. 61 years; $p < 0.001$), included more males (61.1% vs. 42.7%; $p < 0.001$), and higher in-hospital mortality (4.0% vs. 2.4%; $p < 0.001$). Although LOS was similar (3 vs. 3; p = NS), the CO-group had lower median hospital charges ($24,368 vs. $ 32,667; $p < 0.001$). In multivariable analysis, male sex (OR 2.00; 95% CI 1.84-2.17), alcohol use disorder (OR 1.92; 95% CI 1.73-2.13), mood disorders (OR 2.68; 95% CI 2.47-2.91), and suicide ideation (OR 1.79; 95% CI 1.55-2.07) were independently associated with hospital admission. Race, income, and insurance status were not associated with hospitalization. Deaths in CO-poisoned patients were attributed most commonly to the toxic effects of CO, with fewer deaths attributed to smoke inhalational respiratory failure, burns, and sepsis.
Conclusion: Prior interventions have successfully reduced morbidity from unintentional CO exposure in vulnerable socioeconomic populations. Our data show more work is needed to address intentional CO exposures in those with substance use and psychiatric illness. Targeting these risk factors will likely require resource-intensive strategies to reduce CO poisoning hospitalization.

049. Mass Carbon Monoxide Poisoning in a Daycare: A Public Health Lesson

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Background: Thirty-two individuals were exposed to carbon monoxide (CO) due to a malfunctioning furnace at a Pennsylvania daycare, a state which did not mandate CO detectors in daycares. Emergency medical services (EMS) was called initially for a single pediatric syncope patient. However, on arrival, additional symptomatic victims were identified. EMS CO detectors alarmed, and subsequent fire department testing identified CO concentrations of 700-900 parts per million.

Hypothesis: Implementation of on-site CO detectors in facilities with vulnerable populations may prevent large-scale CO exposures.
Methods: An IRB-approved retrospective analysis was performed, and de-identified patient records were examined. Collected data included age, sex, race, ethnicity, CO concentrations, arrival time, time to hyperbaric oxygen (HBO) center contact, and time to transfer/discharge.
Results: EMS transported 16 patients to a tertiary care emergency department (ED) with both adult and pediatric departments. Fourteen patients were 10 years of age or younger. Fifteen patients arrived within one hour. Sixty-two percent were male (N = 10), and 94% (N = 15) identified as Hispanic. A hyperbaric center was contacted for five patients, all of whom were transferred for HBO. Mean transfer time was 1.9 hours after acceptance. Transfer criteria for HBO included a single CO level > 25%, or signs and symptoms consistent with significant CO toxicity (loss of consciousness, syncope or chest pain). One patient was transferred due to a level > 10% and history of a congenital heart lesion. Mean carboxyhemoglobin was 15.9%, with those transferred having a mean of 22.0%. All patients not transferred were discharged the day of ED presentation.
Conclusion: This large-scale daycare CO poisoning represents an avoidable mass casualty that unnecessarily harmed children and staff and necessitated significant coordination of care. Mandatory CO detectors in Pennsylvania daycares would provide early warning for staff, prevent or minimize toxicity, inform first responders and better prepare EDs to handle similar situations.

050. Counting Clouds: An Audit to Improve Documentation of Vaping Status

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Background: Four and a half percent of US adults and 9.1% of British adults are current vapers. Whilst doctors routinely document smoking status, the 2021 British Thoracic Society smoking cessation audit showed only six percent of notes contained information on vaping status. Cardiorespiratory and gastrointestinal symptoms have frequently been reported in previous EVALI cases.
Hypothesis: To compare the quality of documentation of vaping status in the Emergency Department (ED) and Acute Internal Medicine (AIM) notes in a large inner-city hospital.
Methods: Retrospective audit of consecutive presentations over two separate weeks to ED and AIM. Data was collected from ED paper notes and AIM electronic notes on the documentation of vaping status in patients aged 16-70 years and subcategorized into presentations with cardiorespiratory and gastrointestinal complaints.
Results: A sample of 1050 out of 3300 ED presentations was reviewed: 21 (2.0%, 95% CI [0-4.5]) patients had vaping status documented; the device used, or frequency of use was not documented in any records. Data were collected on the 283 patients admitted to AIM: seven (2.5%) patients had vaping status documented; device used was documented in two (28.6%) of these patients, frequency of use not documented in any records. There was no significant difference in vaping documentation for presentations with a cardiorespiratory complaint (1.6% [0-4.1] emergency (p = 0.77), 3.2% medicine (p = 0.68)) or for presentations with a gastrointestinal complaint (0% [0-2.5] emergency (p = 0.33), 2.9% medicine (p = 0.85)).
Conclusion: Documentation of vaping use in both the ED paper and AIM electronic notes in large inner-city hospitals was poor, including in those presenting with symptoms that could be related to vaping. This poor documentation was despite the high prevalence of vaping in the general population. Improved recording of vaping status may improve over understanding of the chronic health impacts of vaping.

051. Epidemiological Study of Acute Carbon Monoxide Poisoning in Tunisian Emergency Department

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Background: Carbon monoxide (CO) is a common cause of poisoning by inhalation, which can be life-threatening and have potential cardiovascular events and long-term neurological sequelae justifying early intervention.
Research Question: The aim of our study was to determine the epidemiological and clinical profile, and management of acute CO poisoning in our emergency department (ED).
Methods: We included all patients presenting with acute CO poisoning over a 24-month period. Acute CO poisoning was defined by a suggestive exposure context with corresponding symptoms and/or an elevated carboxyhemoglobin (COHb) level.
Results: A total of 681 patients were included, all of them due to accidental exposure. The gender ratio was 0.4 with a median age of 34 years. Twelve percent arrived at the emergency department having already received oxygen therapy during their transportation. The main sources of intoxication were water heaters (77.5%), braziers (14.7%), gas heaters (4.4%). Exposure to multiple sources simultaneously was present in 1.8% of the cases. Intoxication was reported as collective in 404 cases (59.3%). The main symptoms were headache (84.6%), dizziness (55.9%), vomiting

(19.4%), transit loss of consciousness (17.9%) and Chest pain (6.5%). Seven patients had an initial Glasgow Coma Scale < 9. Eleven cases were complicated with acute coronary syndrome. The average COHb level was 21.28%. An COHb level ≥ 25% was observed in 36.2% of the patients. All patients received normobaric oxygen therapy. In addition, 10.3% patients received Hyperbaric oxygen therapy (HBOT) and 20.7% were transferred to the intensive care unit. The average length of stay at the ED was 6 hours. We noted a favorable outcome for the majority of patients, and we reported 2 deaths.
Conclusion: In our study of acute CO poisoning the main source was water heaters, the majority presented minor symptoms and only 10 percent received HBOT.

052. Severe Carbon Monoxide Poisoning in a Hookah Lounge Employee

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Background: Hookah or water pipe smoking is a less-commonly recognized risk factor for carbon monoxide (CO) poisoning. In a 2011 study, patrons exiting hookah bars were found to have a mean CO level of 30.8 ppm, compared to 8.9 ppm in patrons exiting traditional bars. Between 2001-2017 there were 276 cases of hookah-related CO poisoning reported to US Poison Centers.
Hypothesis: Employment in a hookah lounge carries a risk for significant CO exposure.
Methods: This is a single patient chart review. A 23-year-old healthy woman presented to an emergency department (ED) after a syncopal event at a hookah lounge where she was employed. She had both prepared hookah for customers and smoked hookah for five hours. She fainted and demonstrated approximately five seconds of shaking activity after which she quickly returned to her baseline. She arrived in the ED roughly 15 minutes after the episode. Her vital signs were within normal limits, and she had a normal neurologic exam. She had no complaints. A venous blood gas (VBG) was sent with the initial set of labs ordered by the provider.
Results: The VBG demonstrated a pH of 7.29 and carboxyhemoglobin level of 36.1%. Her high-sensitivity troponin was undetectable, her electrocardiogram showed no ischemic changes, and a non-contrast CT of her head was without notable pathology. The patient was transferred to an area hospital where she underwent a single hyperbaric treatment, which she tolerated without complication.
Conclusion: Smoking hookah carries a significant risk for toxic CO exposure. The highest reported CO level in a patient working at a hookah bar was previously reported at 33.8%. Employees of facilities with water pipe smoking services may have increased risk for CO exposure especially if starting pipes or demonstrating use on a repeated basis.

053. Spare the Rod: Case Report of Elemental Thallium Rod Ingestion With Analytical Results

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Background: Thallium is a highly toxic metal, with most published experience demonstrating thallium poisoning from thallium salts. We report on a patient with elevated blood and urine thallium concentrations from elemental thallium that was purchased from the internet and ingested in a suicide attempt.
Hypothesis: Ingested elemental thallium can result in elevated blood thallium concentrations. The course of elemental thallium ingestion may differ from exposure to thallium salts.
Methods: The NJ Poison Center was contacted about an 18-year-old man who ingested, in a suicide attempt, a fragment from a 100-gram bar reported to be elemental thallium. The ingested metal fragment and a fragment of the metal bar found at the scene of the ingestion were analyzed via inductively coupled plasma mass spectrometry (ICP-MS). Serial serum and urine thallium concentrations were obtained.
Results: Prussian blue was started on hospital day (HD) two. A metal fragment was seen on abdominal x-ray and removed via colonoscopy on HD three. The ingested metal fragment was found to be 87.0% thallium. The initial serum thallium concentration was 423.5 mcg/L (Reference Range < 5.1 mcg/L), which subsequently decreased to 4.5 mcg/L, 29 days after the ingestion. An initial random urine thallium concentration was 1850.5 mcg/g creatinine (Reference Range < 0.4 mcg/g creatinine). The patient was hospitalized for 23 days and when followed up as an outpatient did not develop symptoms of thallium toxicity.
Conclusion: Elemental thallium ingestion is a rare toxicologic exposure, with very limited published clinical and analytical experience to guide management. This case report described a patient with ingestion of elemental thallium who developed elevated serum and urine thallium concentrations and was treated with prussian blue. Despite having elevated serum and urine thallium concentrations, the patient remained asymptomatic.

054. Prolonged Abstinence From Seafood May Not Be Necessary for Reliable Urine Arsenic Screens for Random Spot Arsenuria

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Background: Inorganic arsenic is associated with clinically significant toxicity; whereas, organic arsenic is less toxic by three orders of magnitude. Seafood is a common source of organic arsenic exposure. When performing heavy metal screening, it is classically recommended to abstain from seafood for multiple days to avoid false positive results. We report a case of a negative 24-hour urine arsenic screen in a patient abstaining from seafood consumption for 16 hours.
Methods: A case of a 44-year-old female with a history of psoriatic arthritis was admitted to our hospital with pancreatitis. The pancreatitis resolved with supportive care; however, the patient began to develop diffuse paresthesia and weakness to extremities. MRI and lumbar puncture were non-diagnostic. Nerve conduction studies showed abnormalities in motor and sensory nerves. Toxicology was consulted for an abnormal heavy metal screen, at the request of neurology.
Results: A heavy metal screen showed an arsenic creatinine ratio of 2284 mcg/g cr [normal < 24 mcg/g cr] and a random urine arsenic of 2466 mcg/L, which fractionated to mostly organic arsenic. Other heavy metal levels were normal. The toxicology service noted that during her seven-week hospitalization, the patient consumed fish twice a day. Despite recommendations that the patient abstain from seafood consumption 48-hours prior to sample collection, the urine sample collected by clinical staff started 16-hours after abstinence of seafood consumption. The resulting 24-hour urine arsenic level was 76 mcg/L [normal < 80 mcg/L] and was specified as purely the organic form.
Conclusion: We report a case of organic arsenuria which resolved with a brief duration of abstinence from a suspected seafood source. This may be beneficial when speciation of arsenic is not readily available, and a rapid answer is needed.

055. Severe Lead Toxicity Attributed to Extra-articular Retained Bullet Fragments in Thigh

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Background: Significant systemic lead toxicity is not commonly attributed to retained soft tissue bullet fragments outside of joint spaces. No consensus exists regarding optimal retrieval and chelation strategy in these cases.
Methods: This is a single patient chart review. A 33-year-old male with no medical history presented to the emergency room seven times over two months for worsening abdominal pain, nausea and confusion, with a workup eventually revealing anemia with basophilic stippling and a venous blood lead concentration of 158.9 mcg/dL. Patient disclosed he sustained a birdshot wound to his left thigh eight months prior. Imaging confirmed retained bullet fragments. Due to the shortage of dimercaprol, chelation with oral succimer 500 mg every eight hours for five days was initiated, followed by 500 mg twice a day for 14 days. Calcium disodium ethylenediaminetetraacetic acid (EDTA) was initiated four hours after succimer and continued until surgical intervention. The birdshot agglomeration was removed on day six of chelation. Timed serum lead concentrations and serial Montreal Cognitive Assessments (MoCA) were obtained.
Results: CT-angiography demonstrated metallic fragments within the intramuscular region of the anterior thigh, with no disruption to bone or major arteries. Trended serum lead concentration was found to be 132.2 mcg/dL on day one, 45.8 mcg/dL on day four, 42.1 mcg/dL on day 10 and 40.1 mcg/dL 17 days after completing chelation. Serial MoCA revealed interval improvement in mental status. A 7.4 x 4.7 x 4.5 cm mass was removed from the thigh, with pathology findings of fibrous tissue and calcification consistent with heterotopic ossification. During the surgery, the mass was punctured, and a clear/yellow fluid thought to be synovial fluid was expressed.
Conclusion: Significant systemic lead toxicity from leaching caused by heterotopic ossification should be considered in bullet fragments retained in extra-articular tissue.

056. Clinical Correlates of Confirmed Benzodiazepine and Opioid Co-Exposures Among Patients Presenting to the Emergency Department*

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Background: While novel psychoactive substances (NPS) benzodiazepines are structurally similar to prescription benzodiazepines, clinical effects and toxicity are not well studied, especially when combined with opioids in the setting of overdose.
Research Question: In a population of ED patients with confirmed opioid overdose, what are the clinical correlates of confirmed NPS benzodiazepine exposure compared to prescription benzodiazepines?
Methods: The Toxicology Investigators Consortium Fentalog study is an ongoing prospective multicenter cohort of 10 US medical centers. Adults with suspected opioid overdose who present to the ED with available waste clinical serum specimens, were eligible. For this analysis, we included the entire cohort including deidentified demographic data from chart review from 09/2020-09/2023. Qualitative toxicological analyses were performed on blood samples using liquid chromatography quadrupole time-of-flight mass spectrometry for the presence of over 1100 psychoactive substances. Analyses consisted of bivariate statistical tests and multivariable logistic regression to examine the association between confirmed NPS benzodiazepines vs. prescription benzodiazepine exposures.
Results: Out of 1624 patients eligible, we analyzed 1289 patients with complete toxicology results. Among patients with confirmed opioid overdose (n = 1170), 34.4% had benzodiazepine co-exposures. While the majority of benzodiazepine exposures consisted of prescription benzodiazepines (n = 327), 114 patients were positive for NPS benzodiazepines. Patients with NPS benzodiazepines were more likely to have concomitant illicit opioid exposures ($p = 0.004$) and have a higher number of concomitant opioids present in their blood ($p = 0.04$). NPS benzodiazepines were associated with higher odds of neurological events (aOR: 1.12; 95% CI: 1.01, 1.25), even after adjusting for age, sex, and race. There were no clinical differences with regards to CPR, intubation, and non-responsiveness to the first dose of naloxone.
Conclusion: Benzodiazepine co-exposures in ED patients with confirmed opioid OD was extremely common. NPS benzodiazepines, compared to prescription benzodiazepines, were independently associated with higher odds of neurological sequelae, suggesting greater severity of overdose.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

057. Jazzed or Junk? Do Energy Drink Contents Trigger Positive Immunoassay for Drugs of Abuse?

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Background: A recent social media trend demonstrated direct application of various energy drinks resulted in positive immunoassay (IA) results. Immunoassay interpretation is fraught with false positive results due to the non-specific nature of IA testing.
Methods: Commercially available IA testing kits (Prime Screen® 12 panel) were obtained. The top five energy drinks in the United States based on sales reports from 2022 were selected for testing. Samples of Red Bull®, Monster Energy®, VPX Bang®, Rockstar®, and Reign® were added to the designated "fill line" within each cup. Results for IA testing of amphetamines, barbiturates, buprenorphine, cocaine, methamphetamine, MDMA, morphine/opiates, methadone, oxycodone, phencyclidine, and cannabinoids were visually determined based on colorimetric results per the immunoassay packaging label. Outcomes included negative, positive, and invalid test. Three cans of each energy drink brand were analyzed in individual test cups. Samples from the first cans of each drink were analyzed by LC-MS/MS for confirmatory testing. Drug concentration cutoffs were provided by Prime Screen® packaging and institutional lab catalog respectively.
Results: Benzodiazepine immunoassays were positive in 9/15 samples including 3/3 Red Bull samples, 2/3 Monster Energy samples, 2/3 Bang samples, 2/3 Rockstar samples (and "invalid" one Rockstar sample). MDMA immunoassays were positive in 5/15 samples including 2/3 Bang samples, 2/3 Rock Star samples, and 1/3 Monster Energy samples. Amphetamine immunoassays were positive in 3/15 samples including 2/3 Rockstar samples and 1/3 Bang samples. Methamphetamine and oxycodone immunoassays were each positive in 1/3 Rockstar samples. Reign was negative on all immunoassays. LC-MS/MS failed to confirm the presence of any substance indicated by immunoassay.
Conclusion: Immunoassay testing of five energy drink brands demonstrated 9/15 samples positive for benzodiazepines and 5/15 samples positive for MDMA; however, LC-MS/MS testing failed to confirm.

058. Quantitative Analysis of Cadmium in Urine by Voltammetry Method Using Hanging Mercury Drop Electrode (HMDE)

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Background: Cadmium (Cd) is a metallic element present everywhere in our environment and is considered as a pollutant as it is derived from anthropogenic sources. Cadmium poisoning isn't very common today, but its carcinogenic nature can cause serious health ailments. Long

term exposure to Cd can cause Itai -Itai (ouch-ouch) disease. Humans can be exposed to Cd through soil, air, water, and food. One of the major routes of cadmium poisoning is through smoking. Various sophisticated analytical techniques like ICP-MS, AAS etc. are usually used to assess levels of cadmium in urine. An attempt has been made to develop the method for determination of cadmium in urine with a voltammetric technique using Hanging Mercury Drop Electrode (HMDE).

Hypothesis: Voltammetry Method using Hanging Mercury Drop Electrode (HMDE) can be used for analysis of cadmium in urine.

Methods: Spiked urine samples were digested in Microwave Digestor (MDS-10). The electrode was washed well with ultrapure water. Ten ml ultrapure water, one ml Ammonium Acetate buffer was taken in a voltammetric vessel and voltammograms of blank was recorded under the voltammetric conditions, with peak potential of cadmium as -560 mV. After completion of blank voltammograms, 0.1 ml of digested urine sample was added in a voltammetric vessel and voltammograms were recorded. After completion of sample voltammograms, 0.1 ml of standard solution of cadmium was added and voltammogram was recorded. Extrapolation graph gives the amount of cadmium in the urine sample.

Results: The concentration of cadmium was successfully detected in all the spiked urine samples. The developed method is suitable for the determination of cadmium in urine samples. The limit of detection of the method is 0.1 µg/L for cadmium.

Conclusion: The developed voltammetry method is simple, selective, sensitive and reproducible technique for quantitative determination of cadmium in urine using Hanging Mercury Drop Electrode (HMDE).

059. Tianeptine Troubles: Characteristics of a Cluster of Severe Illness Reported to the New Jersey Poison Information and Education System

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Background: Tianeptine is an atypical tricyclic antidepressant that is not approved for use in the United States but is readily purchased online or sold at gas stations, in an elixir formulation. This report describes a cluster of severe illness from tianeptine ingestion and the results of analytic testing of ingested products.

Hypothesis: We hypothesized that the severe effects observed in this cluster were due to xenobiotics other than tianeptine.

Methods: This is a retrospective case series of tianeptine ingestions reported to the New Jersey Poison Information Education System (NJPIES) from June 17th to November 6th, 2023. We reviewed the Toxicall database and summarized clinical presentations and outcomes. Six samples of ingested product from two cases were analyzed using gas chromatography mass spectrometry (GC-MS) and liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF-MS). Results were compared against a standard database and confirmed by comparison to reference materials.

Results: NJPIES received 20 exposure calls regarding tianeptine use in 17 patients aged 28 to 69 years. 70% (14) of patients ingested the tianeptine product "Neptune's Fix." Six reported other co-ingestions. All patients were reported as having altered mental status. Other clinical effects included tachycardia (11 patients), hypotension (ten), seizure (eight), QTc prolongation (seven), QRS prolongation (four), and cardiac arrest (one). Thirteen patients were admitted to an intensive care unit, and seven were intubated. Analytic testing of six bottles of Neptune's Fix identified variable product composition and the presence of tianeptine, kava, tetrahydrocannabinol, cannabidiol, and the synthetic cannabinoid receptor agonists (SCRAs) ADB-4en-PINACA and MDMB-4en-PINACA.

Conclusion: These cases represent a marked increase in reports of tianeptine exposure compared with the center's average of ≤ 2 cases per year. Analytic testing revealed variable product composition and the presence of two SCRAs. The severity of reported effects might reflect SCRA toxicity, the effects of polysubstance ingestion, or both.

060. Disguised by Design: A 2023 Review of NPS Trends and Challenges

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Background: Novel psychoactive substances (NPS) have infiltrated the illicit drug supply for over a decade, challenging toxicology stakeholders with rapid emergence, variable lifespans, limited testing availability and mimicking toxidromes of routinely encountered drugs. It is imperative that medical toxicologists are familiar with the current landscape of NPS that may cause or exacerbate opioid, sedative or sympathomimetic toxidromes.

Hypothesis: NPS are likely underreported in clinical casework due to rapid emergence and variable testing protocols.

Methods: This is a retrospective review of toxicology results collated from a large reference laboratory performing clinical and forensic testing, mined for reporting NPS of the opioid, benzodiazepine, and stimulant subclasses between January 2022 and October 2023. Emerging NPS were typically detected through a surveillance library employed alongside liquid chromatography/time-of-flight mass spectrometry (LC/TOF-MS) screening. NPS detected through the surveillance library required confirmatory analysis for reporting.
Results: In 2022, there were approximately 3000 surveillance library findings of NPS detected in 2413 biological samples (blood, serum/plasma, or urine) after LC/TOF-MS screening. In the first 10 months of 2023, one or more NPS have been detected in 4076 specimens. Novel synthetic opioids (NSOs) detected in casework are mostly of the 'nitazene' subclass; these include protonitazene, metonitazene, isotonitazene, N-pyrrolidino etonitazene, N-pyrrolidino protonitazene and N-desethyl isotonitazene. For the NPS benzodiazepine subclass, bromazolam was the most prevalent compound, but others include 8-aminoclonazolam and desalkylgidazepam. N,N-dimethylpentylone was the most frequently detected NPS stimulant, along with its metabolite pentylone.
Conclusion: Medical toxicologists are recommended to stay informed on NPS trends due to infiltration of the illicit drug supply. NPS have been confirmed as responsible agents in overdose populations, often alongside routinely encountered substances such as fentanyl. It is also important for all stakeholders to understand scopes of analytical toxicology testing, especially if a NPS is suspected in an overdose.

061. Sodium Nitrite Poisoning: A Case Report and Introduction of Postmortem Urine Dipstick Testing of Vitreous Humor

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Background: Sodium nitrite is an inorganic, white to yellow, sodium salt that has been increasingly used over the last several years as a pharmacologic suicide agent. We describe a case of sodium nitrite poisoning with classic postmortem findings and introduce spot urine dipstick testing of the vitreous humor as a rapid, inexpensive way to detect elevated nitrites while awaiting confirmatory testing.
Methods: This is a case report of a 20-year-old female who was brought by emergency medical services to the emergency department in cardiac arrest. A bottle of sodium nitrite was found in the patient's possession.
Results: The patient presented to the emergency department with cardiopulmonary resuscitation in progress. A methemoglobin level returned at > 30%. Despite excellent supportive care and methylene blue, the patient ultimately died. Autopsy examination showed an ashy, gray fixed livor mortis and brown discoloration of both internal organs and blood, with blue-tinged tissue noted in both the brain and aorta. While awaiting confirmatory testing for sodium nitrite, dipstick analysis for the presence of nitrates/nitrites was performed on both the urine and the vitreous humor of the eye—dipstick analysis demonstrated elevated concentrations. Testing of antemortem blood later resulted positive for sodium nitrite.
Conclusion: Urine dipstick analysis of the vitreous humor was a rapid, simple, and inexpensive method to detect elevation in nitrites in body fluids prior to completed confirmatory testing for sodium nitrite.

062. The Application of Smart Watches in Toxicology: A Case Report of Phenazopyridine-Induced Methemoglobinemia Detected by an Apple Watch

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Background: Methemoglobinemia can be induced by supratherapeutic doses of phenazopyridine. Patients typically present with signs and symptoms of hypoxemia, including low pulse oximetry readings refractory to supplemental oxygen. With the advent of smart watches with pulse oximetry capabilities, it is unclear whether they demonstrate the same interference in the case of methemoglobinemia as traditional dual wavelength pulse oximetry utilized in most hospitals.
Hypothesis: Smart watches with pulse oximetry can detect methemoglobinemia in a similar fashion as the pulse oximeters used in the hospital setting.
Methods: This is a single patient case report. A 71-year-old female presented with methemoglobinemia after unintentionally taking supratherapeutic doses of phenazopyridine for one week for symptomatic relief of dysuria. The first sign of toxicity was an alert from her Apple Watch indicating low blood oxygen. The patient had a Series 6 Apple Watch, version 9.6.3, which measures light absorbance at wavelengths of 660 nm and 850 nm. Apple Watch data correlated with medical-grade traditional dual wavelength pulse oximeters which measure absorbance at 660 nm and 940 nm. In the hospital, the patient's methemoglobin level was measured using the Masimo Rad-57 co-oximeter.
Results: Patient's Apple Watch revealed five days of hypoxia prior to presentation, with the lowest measured blood oxygen level being 73%. Upon presentation to the emergency department, blood oxygen level was 84% via traditional dual wavelength pulse oximetry. A Masimo Rad-57 device measured an initial methemoglobin level of 19.8%. The patient was given 1 mg/kg of methylene blue and seven hours later, methemoglobin level was 3.0%. She was discharged from

the hospital 24 hours after initial presentation with complete resolution of symptoms.
Conclusion: Dual wavelength pulse oximetry has been incorporated into smart watches. These watches can report hypoxia in the presence of methemoglobinemia by the same interference exhibited in traditional dual wavelength pulse oximeters.

063. Fatalities From Drug Overdoses and Predictors for the Withdrawal of Life Support and Brain Death Determination, 2017-2023*

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Background: Few studies have examined the characteristics of those who have life support withdrawn and brain death confirmed after a drug overdose. This study sought to determine predictors associated with life support withdrawal and brain death confirmation among fatalities in the ToxIC Core Registry.
Research Question: Are there differences in demographics, drug exposures, and overdose intent among those who have life support withdrawn and receive brain death confirmation compared to those who die naturally after an overdose?
Methods: The ToxIC Core Registry is a national, multicenter registry of patients seen at the bedside by medical toxicologists. The analytic sample consisted of drug overdose fatalities who received toxicological treatment and were intubated (n = 217). Analyses consisted of multivariable logistic regression models to determine significant predictors for: 1) patients who had life support withdrawn vs. those who died naturally and 2) patients who had brain death confirmation vs. those who did not have brain death confirmation among those who had life support withdrawn. Analyses were conducted in R v 4.2.1.
Results: Among those who were intubated and died from 2017-2023 (n = 217), 65.9% (n = 143) had life support withdrawn, and 27.2% did not have life support withdrawn (6.9% unknown). Of those with life support withdrawn, 53.1% had confirmed brain death prior to life support withdrawal. There were no statistically significant differences in the odds of life support withdrawal for demographic characteristics (e.g., age, sex, race/ethnicity). Cardiovascular drug overdoses were associated with a reduced odds of life support withdrawal (aOR: 0.77; 95% CI: 0.63, 0.95). There were no statistically significant differences in demographics, type of drug overdose, or type of intent with the odds of brain death determination.
Conclusion: Among cases seen by medical toxicologists at the bedside, there were no disparities in sex or race/ethnicity identified for life support withdrawal or brain death confirmation.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

064. Analyzing Poison-Related Deaths: Insights From a Half-Decade Toxicological Findings of Autopsies in Lahore, Pakistan (2018-2022)

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Background: Studying autopsies involving poisoning is essential, serving as a linchpin for ascertaining the causes of death, facilitating forensic investigations, and improving the knowledge base for targeted medical interventions. This research contributes to public health by unraveling trends and improving prevention strategies and promotes an understanding of the complex dynamics underlying the impact of poisons.
Methods: This record-based retrospective study, spanning over five years from 1st January 2018 to 31st December 2022, was conducted at the Department of Forensic Medicine & Toxicology of Lahore General Hospital, Lahore, focused on autopsies involving poisoning-related deaths. Data was sourced from autopsy registers, police, and Punjab Forensic Science Authority reports. Data analysis was performed using SPSS version 25.
Results: Of 495 autopsies, 58 (11.7%) of cases were attributed to poisoning. Noteworthy trends emerged, with 40 (69.0%) of poisoning cases affecting males, resulting in a male-to-female ratio of 2.2:1. Police records revealed accidental deaths in 19 (32.8%) of cases, with 33 (56.9%) involving multiple poisons, according to Punjab Forensic Science Authority reports. Thirty-eight (65.5%) cases remained undeclared. Only 15 (25.9%) of autopsies attributed poisoning as the cause of death, with five (8.6%) declared negative. Aluminum Phosphide was the primary single poison in seven (43.3%) of cases, according to PFSA. In instances of multiple poisons, pharmaceutical drugs of abuse took precedence, with morphine leading in 18 cases, followed by dextromethorphan in 15 cases, and diazepam in 11 cases.
Conclusion: This study highlights the diverse landscape of toxic substances necessitating strategic interventions by healthcare practitioners, law enforcement, and policymakers. Urgent research is essential, particularly for aluminum phosphide, given its availability and lack of a specific antidote. There is a need to devise and implement strategies to limit access to pharmaceutical drugs of abuse, with physicians and pharmacists exercising caution in prescribing and dispensing to lower poisoning incidents.

065. Hexavalent Havoc: A Modern Case of Occupational Chromium Toxicity

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Background: Chromium toxicity is a rare cause of skin and mucosal ulceration, commonly referred to as 'chrome holes,' or 'blackjack dermatitis,' that can present following exposure among workers in chrome plating or stainless steel welding industries. OSHA standards make toxicity rare.
Methods: This is a single patient chart review. A 21-year-old male presented with ulcerative lesions on his hands and nasal septum. He reported employment in the chrome industry, and frequent underuse and improper use of personal protective equipment. Physical examination revealed painful erosion of the nasal septum as well as painless lesions with shallow central ulcerations across his bilateral hands in various stages of healing. Serial chromium concentrations were obtained during active employment and several months after separation.
Results: Initial serum chromium concentration was 8.9 ng/mL, with subsequent decrease to 0.9 ng/mL following removal of the patient from his workplace one month following initial testing, with no other intervention.
Conclusion: Prolonged exposure to soluble hexavalent chromium (Cr (VI)) is known to result in dermal ulcerations. Similarly, inhalation of Cr (VI) can result in disruption of nasal mucosa, with prolonged exposure leading to septal perforation. Hexavalent chromium exerts its toxic effects through both immunologic mechanisms and oxidative DNA damage via generation of free radical species during reduction of Cr (VI) to trivalent chromium (Cr (III)), thereby disrupting cellular integrity and functions. This case correlates a serum chromium concentration with dermal manifestations of toxicity. Due to primary prevention through OSHA standards of air quality monitoring and personal protective equipment guidelines, chromium toxicity has become a rare, but not entirely extinct disease entity in modern society. Primary intervention for patients presenting with chromium toxicity remains removal from the source.

066. Evaluation of Emerging Inflammatory Markers for Predicting Noncommunicable Disease in Lead and Copper Co-Exposure

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Background: Exposure to both lead (Pb) and copper (Cu) evidence has shown the negative effects associated with disturbance of immune homeostasis and the promotion of inflammation within the body. However, minimal research has been conducted to investigate immune inflammatory disorders associated with heavy metal exposure. In this study, we assessed the ability of inflammatory markers to screen and predict noncommunicable diseases.
Hypothesis: Could these inflammatory markers be useful in predicting a high risk of developing noncommunicable diseases?
Methods: A total of 470 subjects (165 women and 305 men) had a routine laboratory examination, including a complete blood count, blood Pb and Cu, and immune inflammation biomarkers (such as systemic immune-inflammation index; SII, eosinophil-lymphocyte ratio; ELR, lymphocyte-monocyte ratio; LMR, platelet-lymphocyte ratio; PLR and neutrophil-lymphocyte ratio; NLR) were analyzed. Subjects with a medical history that altered their blood parameters such as active cancer, chemotherapy, corticosteroid therapy, infection or hematological malignancies were excluded.
Results: The median of blood Pb and blood Cu were 7.88 μg/dL and 109.52 μg/dL, respectively. The NLR, PLR, and SII of subjects were higher and the LMR was lower than the normal ratio. Furthermore, co-exposure subjects were divided into high- and low-risk of NCD. The subjects in the high-risk of NCD displayed higher levels of blood copper and lead, ELR, NLR, and SII compared with the low-risk group, and LMR levels displayed the opposite trend.
Conclusion: According to our research, co-exposure to Pb and Cu is linked to systemic immune inflammation and exacerbates the immune inflammatory response. These might be implicated in the NCD associated with increased levels of copper and lead exposure. The immune-inflammatory biomarkers SII, NLR and LMR can be used as potential markers for the evaluation of systemic immune inflammation caused by Cu and Pb co-exposure.

067. A Fatal Case of Occupational Metaphenylenediamine Exposure

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Background: Metaphenylenediamine (MPD), or 1,3-diaminobenzene, is an industrial chemical used in manufacturing epoxy resins, rubber, dyes and others. Human exposure may occur through ingestion, inhalation, or dermal absorption. As an aniline derivative, it may induce methemoglobinemia. We present a case of dermal exposure to MPD resulting in death.

Methods: A healthy 30-year-old was found unresponsive at home the day following occupational dermal exposure to MPD. No decontamination occurred at work, but the patient showered at home. Initial vital signs were HR 141 bpm, RR 40 bpm, BP 171/110 mmHg, unknown temperature, and O2 sat 67% on non-rebreather. Initial blood glucose was 27 mg/dL. ABG showed pH 7.07, pCO2 17, pO2 262, O2 sat 99.7% and HCO3 5. Chocolate-colored blood was noted, and they were empirically treated with methylene blue (MB) 1.5 mg/kg IV and transferred to tertiary care.
Results: The patient had a seizure during transfer and was intubated upon arrival. Initial methemoglobin was 77.9% and MB 0.5 mg/kg was given. A thick brown fluid discovered on their body was washed with soap and water. Two hours later, the patient had cardiac arrest. Post-ROSC methemoglobin was 76.7%; MB 1.5 mg/kg and ascorbic acid two g were administered. Repeat methemoglobin remained > 75% after another 0.5 mg/kg MB. Serum lactate was 19.6 and pH 7.2. Despite crystalloids, multiple vasopressors, sodium bicarbonate infusion, additional MB 0.9 mg/kg, ascorbic acid two g and exchange transfusion (with subsequent methemoglobin 22.8%), the patient developed refractory hypotension, ischemic bowel and died 26 hours after arrival.
Conclusion: Occupational dermal exposure to MPD with inadequate decontamination resulted in severe refractory methemoglobinemia and death. Methemoglobinemia did not respond to a total of five mg/kg of MB but did improve after exchange transfusion. Occupational exposure to MPD warrants targeted prevention, prompt decontamination and treatment.

068. Did Chloroquine and Hydroxychloroquine Exposures Increase With the COVID-19 Pandemic?

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Background: In March 2020 the US Food and Drug Administration issued an Emergency Use Authorization for the antimalarials chloroquine and hydroxychloroquine (CQ/HCQ) as treatments for COVID-19. This was rescinded in June 2020 because the risk of cardiac adverse events (e.g., conduction disturbances, dysrhythmias) was thought to outweigh any potential benefits.
Research Question: Did the incidence and severity of CQ/HCQ exposure cases reported to poison centers (PCs) increase with the onset of the COVID-19 pandemic?
Methods: The National Poison Data System, with data from all US PCs, was queried for human single-substance CQ/HCQ exposures from 2003-2022 including clinical effects, treatments provided, and medical outcomes. CQ/HCQ as a proportion of total human exposures was compared between pre-COVID-19 years (2003-2019) and pandemic years (2020-2022). Medical outcomes for cases followed to a known outcome were compared between the two periods. Medical outcomes are determined by PCs through global assessment of clinical features according to standardized criteria; they are categorized as no effect, minor, moderate, major effect, or death.
Results: During 2003-2019 and 2020-2022 there were 5034 and 1161 CQ/HCQ exposures, respectively. There was a 37% increase in the rate of CQ/HCQ inquiries to PCs during the pandemic period (relative risk: 1.37, 95% CI: 1.26, 1.49; $p < 0.0001$). Of CQ/HCQ-exposed patients followed to a known outcome, 412 out of 2576 (16.0%) had medical outcomes of moderate or major effect during 2003-2019 compared with 116 out of 575 (20.2%) for 2020-2022; there were 11 (0.4%) with medical outcomes of death during 2003-2019 and 2 (0.3%) in 2020-2022 ($p = 0.052$).
Conclusion: Chloroquine/hydroxychloroquine exposures rose significantly during the COVID-19 pandemic. The proportion with serious medical outcomes (moderate/major effect or death) increased though that increase was of marginal statistical significance.

069. Prolonged Epinephrine Induced Digital Ischemia Treated With Phentolamine

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Northwell Health, Queens, NY, USA

Background: Unintentional digital injection of epinephrine can cause prolonged symptomatic ischemia, necessitating pharmacologic intervention to alleviate symptoms.
Methods: This is a single patient chart review. A 51-year-old female presented to the emergency department with pain, decreased sensation, and cyanosis of the right thumb after unintentional digital injection of epinephrine (0.3 mg) via an auto-injector pen, approximately seven hours prior to arrival. Vital signs at presentation were: BP 110 mmHg/70 mmHg, HR 96 bpm, RR 18 bpm, T 36.7°C, SpO2 97% on room air. Physical examination revealed a cyanotic distal right thumb with good capillary refill, diminished sensation, and normal motor function.
Results: Initial management included warm water immersion of the digit. Given the lack of improvement with supportive care, topical nitroglycerin 2% was applied at 14 hours post-exposure for three to four hours, also without resolution of symptoms. Approximately 24 hours post-exposure, phentolamine five mg diluted in 10 mL of isotonic saline was injected subcutaneously around the site of initial epinephrine injection. The patient showed significant improvement in color and sensation 30 minutes post-injection, with complete resolution of pain and normalization of thumb color by the 2-hour post-injection assessment.

Conclusion: Phentolamine injection is an effective treatment for epinephrine-induced digital ischemia and should be considered when supportive measures fail.

070. A Case of Chronic, Massive Polyethylene Glycol Use Necessitating Continuous Renal Replacement Therapy

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Background: Polyethylene glycol (PEG) is a readily available, well-tolerated osmotic laxative. Excessive PEG may cause diarrhea resulting in dehydration and electrolyte disturbances; however, most cases are self-limited and life-threatening toxicity is rarely reported. We present a patient with anion gap metabolic acidosis (AGMA), acute renal failure (ARF), and rhabdomyolysis from massive PEG exposure requiring continuous renal replacement therapy (CRRT).
Methods: This is a single patient case report. A 60-year-old female with a history of chronic kidney disease (CKD) stage three, hypertension and depression presented to the hospital with altered mental status (AMS). Vital signs were normal, and no traumatic injuries were identified. Labs demonstrated ARF with creatinine 21.51 mg/dL and BUN 180 mg/dL; rhabdomyolysis with creatinine kinase (CK) 11,493 U/L; and AGMA with pH 7.07, bicarbonate 5 mEq/L and anion gap 37. The potassium was 4.9 mmol/L. A bicarbonate infusion was initiated, and she was admitted to the intensive care unit for emergent CRRT.
Results: The patient's AMS, renal function, and AGMA improved following hydration and three days of CRRT. Further history revealed she was ingesting one bottle (765 grams) of PEG daily for at least 30 days and was reportedly having 20 bowel movements daily. Medical toxicology, nephrology, neurology, and psychiatry consultants found no alternative cause for her AMS and metabolic anomalies. Renal function returned to baseline following CRRT. This patient's PEG exposure was 45x higher than the recommended dose (17 g per day, maximum seven days). Laxatives are associated with metabolic alkalosis, but this patient's protracted volume loss induced pre-renal and intrinsic renal failure. The resultant azotemia contributed to AGMA noted on arrival.
Conclusion: Appropriate PEG use can be effective in increasing stool output; however, extreme misuse can result in severe, life-threatening volume loss leading to electrolyte derangements and ARF.

071. Sanitizer Tablets, Beware!

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Background: Steramine is the trade name of a multi-purpose sanitizing agent containing 50% Dimethyl-Benzyl-Ammonium-Chloride which is a quaternary ammonium compound that can lead to caustic injury with ingestion. We describe a novel case with acute ingestion of multiple concentrated tablets.
Methods: This is a single patient case study via chart review. A 16-year-old male with no past medical history presented with acute Steramine ingestion; he reported taking nine tablets of concentrated Steramine prior to arrival in the ED. Our service was consulted via telemedicine for further management.
Results: On presentation the vital signs were all within normal limits. Labs including CBC, CMP, troponin, ethanol, salicylate, and acetaminophen levels were within normal limits. Documentation from the encounter reported no physical exam abnormalities including normal oropharyngeal exam. Patient described immediate vomiting after ingestion with residual burning sensation to his throat although there was no reported difficulty with tolerating secretions. He was admitted to the pediatric service and kept NPO overnight due to concern for caustic injury of the upper airway tract. On hospital day one, the patient reported decreased pain and was able to tolerate clear liquids. On hospital day three, the patient was tolerating a regular diet and discharged home without any further intervention.
Conclusion: Our case demonstrated concentrated ingestion of Dimethyl-Benzyl-Ammonium-Chloride can cause mild mucosal irritation without significant caustic injury. However, symptomatic patients may benefit from continued observation due to the potential of caustic injury and possible need for endoscopy.

DAY 2: PLATFORMS, ABSTRACTS 072-076

072. Will Artificial Intelligence Replace the Medical Toxicologist? Pediatric Referral Guidelines Generated by GPT-4.

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Background: Generative Pre-trained Transformer 4 (GPT-4) is an advanced artificial intelligence learning model with potential applications in medicine.

Research Question: How do GPT-4 generated guidelines for pediatric referral to health care facilities (HCF), sometimes known as send-in guidelines, compare with those developed by medical toxicologists for selected drug exposures?
Methods: We compared pediatric send-in guidelines developed by GPT-4 with those from the California Poison Control System (CPCS). CPCS send-in guidelines are developed by the expert consensus of medical and managing directors from all four divisions of CPCS. We accessed the latest version of GPT-4 (OpenAI) in August of 2023. We selected 34 exposures encompassing varying degrees of severity and recorded whether GPT-4 gave a specific mg/kg threshold or tablet number for hospital referral.
Results: GPT-4 gave a response for all 34 exposures queried. GPT-4 gave a specific mg/kg, or tablet threshold for referral in 24/34 exposures (71%) compared with 28/34 (82%) of CPCS guidelines. In the 20 cases in which both GPT-4 and CPCS both gave specific threshold referral amounts, 4/20 (20%) were identical and in 15/20 (75%) GPT-4 gave a lower threshold. In one case GPT-4 gave a higher threshold compared to CPCS (Ibuprofen: 400 mg/kg vs. 250 mg/kg). All GPT-4 responses were caveated with a recommendation to contact a poison control center.
Conclusion: GPT-4 generated guidelines gave specific threshold values for hospital referral in fewer exposures compared with CPCS guidelines. GPT-4 threshold values were almost always lower than CPCS guidelines, however in one case they were substantially higher. Such differences could result in a greater number of unnecessary healthcare facility (HCF) referrals or in some circumstances inappropriate under-referrals. More research is needed to understand how AI technology can best be used in the hands of health care providers including medical toxicologists.

073. Jarvis: A Software Tool for Automatically Identifying Substances and Doses From Online Commentary

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Background: Online commentary is an invaluable data source for understanding substance use in the general population. Current methods for extracting information from online commentary identify general themes but not medication information (e.g., substance, dose). Software developed to extract medication information from clinical notes performs poorly on online commentary. Manual review of online commentary can only analyze a small fraction of the available data. Here we introduce Jarvis, software that can identify drug names and dosages.
Methods: This study is a development of software to extract names and dosages from online commentary. We obtained publicly available comments from Reddit related to opioid use. We manually marked up each comment for mentions of substances or medication doses. We used those annotations to train a neural network to identify substances and doses. We randomly divided the comments into training and testing sets to develop and evaluate our model, respectively. We calculated sensitivity and specificity using manual annotations as our gold standard.
Results: We obtained 12,905 unique comments (6,470 training, 6,435 testing) from r/opiates, r/heroin, r/fentanyl, r/suboxone, r/OpiatesRecovery, and r/OurOverusedVeins. Of the comments, 47% in the training set mentioned at least one drug and 52% in the evaluation set. In each set, 7% mentioned at least one dose. The most mentioned substances were fentanyl (540 times in training set, 481 in evaluation set), suboxone (298 and 245, respectively), heroin (265, 234), methadone (216, 203), opiates (209, 182) and kratom (175, 184). Our model achieved a sensitivity of 87% and specificity of 91% for identifying drug names and a sensitivity of 58% and specificity of 86% for identifying drug dosages.
Conclusion: Jarvis identifies substances in online commentary with high sensitivity and specificity and dosages with moderate sensitivity and specificity. Future work can improve dose recognition and allow identifying other information.

074. Analysis of Acute Hypersensitivity Reactions by Antivenom Type by Geographic Location in the North American Snake Bite Registry*

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Background: No difference in incidence of acute hypersensitivity reactions (AHRs) between Fab and Fab2 antivenom after crotalid envenomation has been established. Galactose-alpha-1,3-galactose (alpha-gal) content in antivenom, four-fold higher in Fab2, may confer a risk of AHRs, particularly in geographic regions with increased alpha-gal syndrome (AGS).

Hypothesis: Fab2 is associated with increased AHRs in the ToxIC North American Snakebite Registry (NASBR); AHRs after antivenom are more common in high-AGS regions.
Methods: This is an analysis of prospectively collected data from the NASBR January 1, 2018 - December 31, 2022. Patients administered Fab or Fab2 on initial presentation after rattlesnake envenomation were included. High-AGS vs low-AGS regions were defined according to epidemiologic data. The primary outcome was incidence of AHRs after Fab vs Fab2 exposure. AHRs between high-AGS vs low-AGS regions were also examined. Bivariate differences in the number of exposures were analyzed.
Results: Eight-hundred-twelve unique cases were included. Five-hundred-nineteen received only Fab, 199 received only Fab2. Ninety-four cases received both antivenoms and were included in total Fab (n = 613; 67.6%) and Fab2 (n = 293; 23.3%) exposures. Fourteen-point-two percent of cases (n = 115) were in high-AGS regions. There was no difference in history of allergies or eczema, pretreatment for allergic reaction, or previous antivenom exposure between comparison groups. AHRs were reported in 4.1% (n = 33/812) of cases; 3.3% (n = 20/613) after Fab and 4.4% (n = 13/293) after Fab2 exposures (p = NS). 5.2% (n = 6) vs. 3.9% (n = 27) of AHRs occurred in high-AGS vs. low-AGS states (p = NS). Rash (70.0%) was the most common AHR reported. Epinephrine was given in 30.3% and antivenom was stopped in 42.4% of AHR cases. No cases reported AHRs to both antivenoms.
Conclusion: There was no statistical difference in AHRs between Fab and Fab2 antivenom exposures or high-AGS and low-AGS regions in the NASBR population. Low Fab2 utilization in high-AGS regions prior to 2021 limits conclusions.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

075. Comparison of the Incidences of Acute Adverse Reactions in Two Pitviper Antivenoms

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Background: There are two FDA-approved antivenoms for the treatment of North American pitviper envenomations: Crotalidae polyvalent immune fab (ovine) [FabAV, CroFab®] and Crotalidae immune F(ab')2 (equine) [Fab2AV, Anavip®]. Previous publications have estimated the risk of acute adverse reactions to FabAV to be 1.4%-8%. There are fewer studies assessing the adverse reaction rate in Fab2AV. This study compared the incidences of acute adverse reactions between the two products.
Methods: We retrospectively reviewed all snakebites on which our toxicology service consulted between January 1, 2021 and November 1, 2023. Collected data included patient demographics, clinical features, antivenom use, response to treatment, adverse reactions to antivenom, and medications prescribed for these reactions.
Results: There were 227 snakebite patients, including 78 (34.4%) females. Ages ranged from 18 months to 89 years old, with a median age of 38 years old. The majority (n = 134, 59%) of bites were attributed to the eastern copperhead, *Agkistrodon contortrix*. We administered antivenom to 154 patients with native pitviper envenomations; 102 received Fab2AV and 52 were treated with FabAV. Acute adverse reactions were observed in 14 (13.7%) of the Fab2AV patients and in two (3.8%) patients managed with FabAV. In the Fab2AV group, two (2%) patients developed anaphylaxis characterized by dyspnea, wheezing, and vomiting. Both were treated with epinephrine, diphenhydramine, and famotidine. The remaining 12 had pruritus and urticaria. Nine of these patients received diphenhydramine and famotidine. One was treated with diphenhydramine and methylprednisolone and another with just diphenhydramine. For one patient, the antivenom was discontinued but no additional medication was administered. Both FabAV patients developed pruritus. One was treated with diphenhydramine and famotidine. The other received diphenhydramine, famotidine, and methylprednisolone.
Conclusion: The incidence of acute adverse reactions to Fab2AV is higher than to FabAV. The reaction severity also appears to be greater in the Fab2AV group.

076. Efficacy and Safety of Two Antivenoms in the Treatment of Eastern Copperhead (*Agkistrodon Contortrix*) Envenomations in Southeast Texas

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Background: There are two FDA-approved antivenoms for the treatment of North American pitviper envenomations: Crotalidae polyvalent immune fab (ovine) [FabAV, CroFab®] and Crotalidae immune F(ab')2 (equine) [Fab2AV, Anavip®]. Most comparisons between the two products have focused on rattlesnake envenomations. This study compared the efficacy and safety of the two products in eastern copperhead envenomations.
Methods: We retrospectively reviewed copperhead bites on which our toxicology service consulted between January 1, 2021 and November 1, 2023. Collected data included patient demographics, bite location, clinical features, antivenom use, response to treatment, and adverse reactions to antivenom.

Results: There were 134 patients with confirmed copperhead envenomations. We administered antivenom to 89 patients, including 36 (40%) females. The median age was 42 years old (range: 2-89). Fifty-nine patients received Fab2AV and 30 were treated with FabAV. Initial control was achieved in 30 (100%) patients treated with CroFab. In the Anavip group, 53 (89.8%) achieved control; six patients with acute adverse reactions declined further treatment despite persistent symptoms. The median FabAV dose required for initial control was six vials (range: 4-6). A median dose of 10 vials (range: 10-30) was used in the Fab2AV group. No FabAV patients required additional doses for control, although a median of two vials (range: 2-6) were administered for maintenance in 16 subjects. Repeat doses of Fab2AV were required in 15 (25.4%) cases. There were no acute adverse reactions to FabAV. Acute adverse reactions were seen in seven (11.9%) of patients treated with Fab2AV. One patient developed anaphylaxis and required epinephrine, diphenhydramine, and famotidine. Five other patients were treated with diphenhydramine and famotidine. One patient required no intervention.
Conclusion: FabAV use in the management of eastern copperhead envenomations was associated with greater efficacy and fewer acute adverse reactions than treatment with Fab2AV.

DAY 2: MODERATED POSTERS, ABSTRACTS 077-083

077. Naloxone Infusions for Opioid Overdose: A 10-year Retrospective Analysis

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Background: Recurrent opioid toxicity following naloxone reversal can occur with longer acting opioids. Naloxone infusions are commonly used in this circumstance, though limited data are available on their clinical outcomes.
Research Question: To describe the clinical outcomes associated with naloxone infusions for opioid overdoses.
Methods: This is a 10-year (1/1/2013-1/1/2023) retrospective chart review of adults treated at two emergency departments with naloxone infusions after presumed or known opioid overdoses. Those treated for other reasons were excluded. Demographic, exposure, and infusion information were collected. Naloxone's current average wholesale drug prices were obtained from Medi-Span® (Wolters Kluwer, Philadelphia, PA, USA).
Results: Forty-four cases were identified. The mean age was 36 (20-62 years) and 82% were male. Half were from 2021 and 2022, with a rising number of cases annually. Nineteen self-reported their opioid exposure, with fentanyl being the most common. Oral ingestion was the main reported route, with 17 cases (39%). The median infusion time was 281 minutes (IQR: 124.25-524.75 minutes). The median starting dose was 0.76 mg/hr (IQR: 0.1-1.3 mg/hr). The mean number of infusions utilized was 1.1 (range 1-2). Thirty-four patients (77%) received one 10 mg infusion, four (9%) received one 5 mg, four (9%) received two 10 mg, and one (2%) received one 10 mg and one 5 mg infusions. The current average wholesale drug cost of total naloxone vials used for a 5 mg infusion ranges from $168.00 to $299.00 and $252.00 to $448.50 for a 10 mg infusion. In total, 20 patients (45%) were admitted, with four (22%) to ICU, nine (50%) to step-down, and five (27%) to floor levels of care; two were transferred.
Conclusion: Naloxone infusions are frequently used for short durations, potentially resulting in drug waste. With use rising, paralleling the worsening opioid epidemic, research into more cost-effective treatment strategies is warranted.

078. Precipitated Withdrawal in Emergency Department Patients Following a Presumed Opioid Overdose*

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Background: Larger amounts of naloxone are being used to treat patients following opioid overdoses. The incidence of precipitated withdrawal (PW) following naloxone dosing remains unknown.
Hypothesis: Naloxone dose is directly associated with the occurrence of PW.
Methods: This is a subgroup analysis from a prospective cohort of the Toxicology Investigators Consortium (ToxIC) Fentalog Study Group. Consecutive ED patients from November 2020 to September 2023 following a presumed opioid overdose receiving naloxone were screened. Exclusion criteria included pediatrics (age < 18), prisoners, burns/trauma, and non-toxicologic diagnosis. The subgroup of patients who received naloxone were included for analysis. Waste serum was tested via liquid chromatography quadrupole time-of-flight mass spectrometry, blinded to clinical outcome. PW was defined by the data abstractor. Association between naloxone dose (total mg and number of doses) and PW was determined using descriptive statistics, Mann-Whitney, and analysis of variance.

Results: A total of 1624 patients were screened, of which 1256 received naloxone (median total bolus dose 2.8 mg [IQR 2.72, range 0.04-59.2 mg]). A second dose was administered to 638 patients, a third to 326 patients, a fourth to 183 patients, and 5th to 111 patients. PW occurred in 65 patients (5.2%), including 2.9% after the first dose, 3% after the second, 2.5% after the third, and 0.5% after the fourth (H 6.6, $p = 0.04$). The median initial dose of naloxone in those with PW was 2 mg (IQR: 2, Range: 0.2, 12 mg) and those without was two mg (IQR: 3, Range; 0.04-56) (P = NS). PW was not reported in patients receiving five or more doses. Limitations: Naloxone dosing was observational and not randomized. Data was abstracted via chart review.
Conclusion: The incidence of PW was low. There was no association between initial naloxone dose and PW. Repeat dosing was inversely associated with PW.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

079. Trends in Naloxone Use in the Treatment of Opioid-Related Respiratory Depression in the Fentanyl Era

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Background: The emergence of synthetic opioids has significantly changed the US opioid epidemic. Recommendations for naloxone dosing and observation period following an opioid overdose were derived from the era when heroin was predominant. Few studies have examined naloxone dosing patterns after opioid overdose in the fentanyl era.
Hypothesis: With the emergence of synthetic opioids, naloxone administration patterns may change.
Methods: We retrospectively reviewed naloxone administrations in an urban quaternary care hospital emergency department (ED) for adult patients from 1/1/2016-6/30/2023. We identified and reviewed charts for dose, route, and timing of naloxone administration. We examined annual trends to uncover evolving practice patterns.
Results: We identified 1,191 patients who received naloxone, averaging 159 patients annually. Most patients received only one naloxone dose and nearly all were given via the intravenous, intramuscular, or intraosseous route (1162/1191). Preliminary data analysis shows a significant increase year over year in the amount of naloxone administered to each patient (0.12 mg increase per year, $p < 0.001$), and a nonsignificant increase in the number of dosing events for each patient (1.55 per patient in 2016 to 1.66 in 2023, $p = 0.08$). Further analysis will be performed to examine intervals between dosing events and the indication for each naloxone dose. We plan to perform chart reviews to elucidate the circumstances of each naloxone dosing event.
Conclusion: In the evolving fentanyl era of opioid overdoses patients did require a slight increase in the number of dosing events for naloxone and did experience an increase in the dose of naloxone administered for opioid overdose. This suggests that in the age of synthetic opioids naloxone dosing strategies may also be changing.

080. The Partial Agonist that Could: A Review of Patient Outcomes with Protocolized Buprenorphine Micro-inductions

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Background: Buprenorphine (BUP) is approved for treatment of opioid use disorder (OUD) and pain management. While various "micro" induction protocols exist, limited literature describes use of intravenous (IV) buprenorphine for micro-induction. This study expands our initial 19-patient report to a broader 108 patient analysis, reporting our inpatient Addiction Medicine service's experience with a semi-protocolized IV BUP micro-induction.
Methods: This is a single center, retrospective review (3/23/22 – 9/4/2023). IV BUP was used in patients with iatrogenic dependence or suspected OUD. BUP was administered every four to six hours and doses were increased after 16-24 hours. Dosing began at 150 or 300 mcg IV, was followed by 2 mg sublingual doses, then full therapeutic doses of 4-32 mg/day. Full μ-opioid agonists were continued until a therapeutic dose was established.
Results: IV BUP was ordered for 108 patients with 71 patients ultimately completing the protocol. Precipitated withdrawal (7.4%) and discharge (9.2%) accounted for most protocol terminations and 10 (8.3%) patients did not receive micro-induction dosing. Symptoms of precipitated withdrawal included nausea, diarrhea, palpitations, and anxiety. Management of iatrogenic withdrawal during mechanical ventilation constituted 15/108 patients. Protocol completion was 100% in a mean of 2.86 days with no cases of precipitated withdrawal. Overall, the average time to reach a therapeutic dose was 3.27 days which was most commonly 24 mg/day. Prescription fill rates for patients with OUD who completed the protocol was 77% (50/65).
Conclusion: The use of IV BUP facilitates efficient induction during full μ-opioid agonist therapy. We were ubiquitously successful in discontinuing opioid infusions in ventilated patients with no cases of precipitated withdrawal.

Cases of precipitated withdrawal were mild and did not require intervention. Prescription fill rates were encouraging. Further research should delineate optimal BUP dosing and incremental advancement during micro-induction.

081. Substance and Prior Treatment Experience and Motivation to Change Reported During Peer Recovery Intervention Following an Overdose

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Background: Emergency departments (EDs) manage patients with a variety of overdoses; however, treatment experience and motivation may vary depending on the substance involved.
Research Question: Is there a difference in substances used and treatment experience and motivation in patients that present to the ED with opioid overdose versus non-opioid overdose?
Methods: We performed a retrospective chart review of ED visits from nine hospitals in the DC/Baltimore area from April 2019-June 2021. The health system utilizes a validated Screening, Brief Intervention, and Referral to Treatment (SBIRT) system with peer recovery coaches (PRCs) for ED patients that are clinically stable and willing to participate. We compared responses of patients that presented with acute overdose from opioids vs. non-opioid agents based on the patient's self-report.
Results: Of 537,373 encounters, there were 3800 (0.71%) visits for overdose-2630 (69.2%) involving opioids and 30.3% involving non-opioids engaged by a PRC (0.4% missing). Both groups were motivated to change (86% vs. 74%, $p < 0.001$) and decrease substance use (82% vs. 70%, $p < 0.001$), but more so in the opioid group. More patients with opioid overdose had prior treatment (53% vs. 43%, $p < 0.001$), but there was no difference in current enrollment in a treatment program at the time of the encounter (20% vs. 16%, $p = 0.15$), or the median number of previous treatments (1 vs. 0 (0-6), $p = 0.27$). Opioid overdose patients more commonly used heroin vs. other opioids (63% vs. 16%), but of those who had a non-opioid overdose, 14% reported opioid use in the past 12 months. Those with opioid overdose were more likely to report polysubstance use (40 vs. 34%, $p = 0.002$).
Conclusion: Patients with self-reported opioid and nonopioid overdose were motivated to change and decrease use. Engaging all overdose patients regardless of substance used during the ED visit may provide a critical opportunity to promote recovery.

082. Clinical Effects of Psychedelic Substances Reported to United States Poison Centers Over a Ten-Year Period

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Background: Psychedelic drugs have a long history of use, though clinical effects of exposures in a large population have not been described. Description of baseline exposures is imperative given that availability will likely increase with approved or proposed legislation for psychedelic legalization in almost half of states in 2024.
Research Question: What are the clinical effects of psychedelic exposures reported to United States (US) Poison Centers (PCs)?
Methods: This was a retrospective study of psychedelic drug exposures reported to US PCs between January 1, 2012, and December 31, 2022. We examined all exposures with generic and product codes for ketamine/analogs, hallucinogenic amphetamines, LSD, tryptamines, phencyclidine (PCP), hallucinogenic mushrooms, and hallucinogenic plants. We assessed patient demographics, clinical effects, treatments, and medical outcomes using descriptive statistics. Pairwise adjusted odds ratios were calculated to predict NPDS moderate or worse outcomes by psychedelic drug categories.
Results: There were 54,605 psychedelic drug exposures reported to US PCs during the study period. Total yearly exposures increased 23.4% from 2012 to 2020, hallucinogenic mushroom exposures increased most [2012: n = 593, 2022: n = 1,440]. Using hallucinogenic plants as reference, tryptamine exposures had the highest odds of moderate or worse outcomes (OR: 2.4 [95% CI: 2.0-3.0]), while ketamine/analogs (1.5 [1.3-1.7]) and hallucinogenic mushroom exposures had the lowest (1.6 [1.5-1.8]). Hallucinogenic amphetamine use had the highest frequency of cardiovascular effects (n = 14,602, 31.1%), while hallucinogenic mushroom use had the fewest (n= 2,695, 20.4%). Hallucinogenic plants (n = 1,148, 18.0%) and hallucinogenic mushrooms (n = 1,587, 12.0%) had the most gastrointestinal adverse effects. Ketamine/analogs (n = 348, 8.4%) and PCP (n = 725, 8.1%) had more ventilation/intubation interventions than other exposures.
Conclusion: Psychedelic drug exposures reported to US PCs increased and led to a moderate or worse outcome in > 50% of cases. Tryptamines were most likely to lead to moderate or worse outcomes while hallucinogenic plant and mushroom exposures were least likely.

083. Medical Toxicology vs. Emergency Medicine and Internal Medicine -- Are We Really Full of Case Reports?

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Background: While case reports invaluably present information about new or rare clinical entities, they are perceived as having diminished value relative to other study designs. It has been said the practice of medical toxicology (MT) is based largely upon case report literature and thought to be unique among other specialties in this regard. A comparison of case report content in recently top periodicals from other specialties would be informative to see if case report frequencies differed.
Hypothesis: Medical toxicology periodicals have many more case reports compared with emergency medicine (EM) and internal medicine (IM) journals.
Methods: This retrospective review examined five years of articles in six top journals from MT (Journal of Medical Toxicology, Clinical Toxicology), EM (Annals of Emergency Medicine, Journal of Emergency Medicine) and IM (JAMA Internal Medicine, New England Journal of Medicine) was performed by one reviewer using publisher's website or medical library portals online. Every article in each issue was evaluated for inclusion (case report/series) vs. total articles. "Case reports/series" were presentations about individual patients, one patient's data (their image, testing, etc), or a case series (less than five patients). Total articles per issue were reported after removing exclusions (letters to the editor, editorials, perspectives, book reviews, etc).
Results: Between 2018-2022, these six periodicals published 522 issues (MT-80; EM-120; IM-322); 2644 case reports; and 8246 total articles (MT-283; EM-1294; IM-1067). Comparison of MT case reports, (283; 25.2%) vs. EM (1294; 37.6%) revealed a statistical difference ($X2(1) = 57.1$, $p < 001$); MT (283; 25.2%) compared with IM (1067; 28.3%) was also significantly different ($X2 = 4.1$, $p = 0.042$). The percent of case reports increased yearly in IM and EM and consistently more than MT.
Conclusion: This multi-journal literature review revealed that in the last five years core MT journals published significantly fewer case reports compared with top EM or IM journals.

DAY 2: POSTERS, ABSTRACTS 084-142

084. The Root of the Problem: A Case Series of Children With Methemoglobinemia Secondary to Consumption of Pureed Vegetables

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Background: Finding the source of oxidant stress in cases of methemoglobinemia is frequently challenging. One commonly overlooked dietary source of oxidant stress is root vegetables which are often rich in nitrates. We present a case series of three patients, ages 5-24 months, with acquired methemoglobinemia thought to be secondary to pureed root vegetable consumption.
Hypothesis: Root vegetable puree is a potential cause of acquired methemoglobinemia in children.
Methods: This case series utilized retrospective chart reviews to describe three children, ages 5-24 months, with acquired methemoglobinemia; cases were obtained from two academic medical centers and one community hospital in the northeast United States. Each child's diet was primarily composed of homemade pureed root vegetable baby food. Providers had clinical concern for methemoglobinemia in each case. Clinical data included pulse oximetry, hemoglobin level, methemoglobin percent, treatment, recurrence, and assessing exposure to common sources of acquired methemoglobinemia. Abstracted data was deidentified and met criteria for Institutional Review Board exemption.
Results: Three healthy children, ages five, seven, and 24 months, presented with acute onset cyanosis. Each had low pulse oximetry on presentation (87%, 88%, 87%, respectively) which did not improve with supplemental oxygen. Methemoglobin concentrations on presentation were 21%, 62.4%, and 'immeasurably high', respectively. Meticulous toxicologic history revealed no preceding illness, no well water exposure, no local anesthetic use, and no exposure to methemoglobin-inducing xenobiotics. Symptoms resolved in each case following administration of methylene blue. Further examination revealed each child's dietary history included homemade root vegetable purees with varied amounts of carrots, sweet potatoes, beets, and squash. No child had recurrence of clinical methemoglobinemia following cessation of root vegetable puree consumption at one month follow-up.
Conclusion: Providers should consider pureed root vegetable consumption as a potential cause of acquired methemoglobinemia in children. Counseling on limiting consumption should be considered to prevent future methemoglobinemia.

085. Fatal Pyrethroid Poisoning From Intentional Exposure in a Pediatric Patient

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Background: Cypermethrin, a widely-used type II synthetic pyrethroid insecticide, can induce poisoning upon inhalation, skin exposure, or ingestion, resulting in primarily neurological and gastrointestinal disturbances. At high concentration pyrethroids also act on GABA-gated chloride channels which may be responsible for seizures, induce free radical formation and display AChE inhibitory activity. While unintentional instances of pyrethroid exposure are frequently observed, severe poisonings are rare and can be associated with intentional and acute intoxication.
Methods: This is a single patient chart review. A 14-year-old female with no significant medical history was admitted to the emergency department due to neurological deterioration following sniffing an unknown amount of cypermethrin in powder form. She was last observed by family members 12 hours prior to her medical examination. Upon admission, she was unconscious and did not respond to naloxone treatment, subsequently necessitating advanced airway management and vasopressor support. Laboratory findings indicated rhabdomyolysis, acute kidney injury, and liver failure. The toxicological profile and blood test for acetaminophen came back negative. She was treated with hemofiltration on the second day and N-acetylcysteine which was later discontinued on the fourth day due to improvement in liver function.
Results: On day five, cerebral edema was identified and managed with hypertonic solution. Attempts to wean from mechanical ventilation were unsuccessful, leading to tracheostomy and gastrostomy placement. The patient's condition deteriorated, experiencing seizures unresponsive to levetiracetam and phenytoin treatment. This culminated in brain death, confirmed by cranial MRI and angiography 26 days post-admission.
Conclusion: While pyrethroid toxicity is uncommonly severe, it can be lethal. This case led to fatal complications as the patient remained in a coma for an undefined period, causing prolonged cerebral hypoxia, which was a critical factor in her mortality. Early identification and prompt supportive care are crucial, given the absence of a specific antidote.

086. Hypoglycemia and Multi-Organ Dysfunction in a Breastfeeding Infant Due to Hypoglycin a Toxicity From Maternal Ingestion of Unripe Ackee Fruit

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Background: No reported cases exist of hypoglycin A toxicity in infants. We present a case where hypoglycin A in breastmilk likely triggered systemic toxicity in an infant with multiple acyl-CoA dehydrogenation deficiency (MADD).
Hypothesis: Hypoglycin A causes severe toxicity in patients with MADD due to a shared underlying pathophysiology involving suicide inhibition of multiple mitochondrial flavoprotein acyl-CoA dehydrogenases (ADH) and carnitine-acyl coenzyme (CoA) transferase.
Methods: This case involves a single patient chart review. A five-month-old healthy male with no newborn screening presented with acute lethargy, severe hypoglycemia, and hypothermia. Vital signs showed BP 104/67 mmHg, HR 163 bpm, RR 36 bpm, T 97.5° F rectally, SpO2 87% on RA. The patient was intubated, developed hypotension requiring vasopressors, and became hypothermic requiring active warming. Workup was significant for serum glucose 6 mg/dL, WBC 36K/uL, AST 53U/L, ALT 50U/L, ALP 369U/L, total bilirubin 0.2 mg/dl, serum HCO3 16 mmol/L, AG 22 mmol/L, VBG pH 7.23, pCO2 38mmHg, lactate 3.2 mmol/L, and ammonia 202 umol/L. The mother reported consuming unripe ackee fruit 2-3 days prior while continuing to breastfeed. Treatment included fluid repletion, dextrose, vasopressors, antibiotics, and L-carnitine administration. The patient developed vasoplegic shock and ventricular dysrhythmias requiring VA-ECMO support, with persistent high anion gap metabolic acidosis and hyperammonemia. The patient never developed seizures or significant transaminitis until cardiopulmonary arrest. The mother never developed severe symptoms.
Results: Testing showed elevated octanoylcarnitine and hexanoylcarnitine, consistent with hypoglycin A toxicity and/or MADD. The genetics team reported that infantile-onset MADD usually presents with dysmorphic features which were absent in our patient. Our patient may have mild MADD, and after modest amounts of hypoglycin A, developed severe systemic toxicity. Genetics and breast milk analysis are pending.
Conclusion: Breastfeeding infants with mild MADD may be at risk of Hypoglycin A toxicity due to maternal consumption of unripe ackee fruit.

087. Pediatric Exposures, Referral Rates, and Medical Outcomes of Cigarettes and E-Cigarettes From 2000-2022

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Background: Over the past decade e-cigarette use has increased, especially among young populations, while traditional cigarette use has declined.
Research Question: We aimed to compare cigarette to e-cigarette exposures among children less than six years of age.

Methods: We conducted a retrospective analysis using the National Poison Data System (NPDS) between January 1, 2000 and December 31, 2022. We queried the NPDS for all single substance ingestions of cigarettes and e-cigarettes in children aged less than six years. We compared referrals to a healthcare facility and described cases by demographics, management site, clinical effects, and medical outcome.
Results: Between 2000 and 2022, 115,518 cigarette exposures among children aged < 6 years were reported to NPDS. The first cases of e-cigarettes were reported to NPDS in 2010. Between 2010 and 2022, 20,021 e-cigarette exposures were reported. Cigarette cases started declining in 2018 and crossed exposures with e-cigarettes in 2022 (2419 compared with 2452, respectively). The average total yearly cases reported was 5893, with a peak of total cases in 2015 (8961) and has trended down over the past seven years (4871 in 2022). Of these, 83.7% (n = 96,673) of cigarette exposures were kept at home compared to 62.6% (n = 12,021) of e-cigarette exposures ($p < 0.001$). Of 61252 cigarette and 12,733 e-cigarette cases followed to a known outcome, the medical outcome was similar except that two deaths were reported from e-cigarette exposure. Clinical effects were similar with the exception that vomiting (n = 3169; 15.8% vs. n = 12297; 10.6%; $p < 0.001$)) and cough (n = 1531, 7.6% vs. n = 1748, 1.5%; $p < 0.001$) were more frequent in e-cigarettes exposures.
Conclusion: There is a trend towards decreased total cigarette and e-cigarette exposures in the pediatric population over the last seven years. While these data suggest that medical outcomes are similar, continued study of trends is needed due to the increasing incidence of e-cigarette exposure.

088. Continued Increase in Unintentional Ingestions of Edible Cannabis Products Reported to a Single Poison Center Among Children ≤ 5 Years, 2020-2022

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Background: Edible cannabis products have become widespread in the United States. Currently, 38 states and Washington, DC, have legalized medical or recreational cannabis. Consequently, unintentional pediatric cannabis ingestions have increased with a commensurate increase in poison control center (PCC) calls. Our state legalized recreational cannabis in 2018 with a corresponding increase in pediatric exposures, warranting emphasis on risk-reduction.
Hypothesis: Are exploratory pediatric ingestions of edible cannabis products reported to our state PCC continuing to increase post-legalization?
Methods: A retrospective review of unintentional pediatric (5 years old and younger) single-substance cannabis ingestions reported to our PCC from January 1, 2020, to December 31, 2022.
Results: A total of 801 ingestions were reported with a progressive increase from 2020 (n = 187) to 2022 (n = 325), representing a 73.8% increase. The proportion of PCC cases related to pediatric cannabis ingestions increased from 0.35% (2020) to 0.62% (2022). The median age was two years old, with the majority involving males (n = 413; 51.7%). Central nervous system depression was the most common clinical effect (n = 431; 53.8%) followed by other neurological effects including confusion, dizziness, and ataxia (n = 113; 14.1%). A total of 238 patients (29.7%) were admitted for hospitalization. Of the hospitalized patients, 82 (34.5%) were admitted to critical care units. Moderate medical outcomes were most frequent among all cases (n = 259; 32.3%) with an annual increase in outcome severity.
Conclusion: Our state PCC reports a near 74% increase in exploratory pediatric ingestions of edible cannabis products from 2020 to 2022. Children are particularly at risk due to their smaller weight and lower threshold for toxicity. Acute toxic effects include sedation, ataxia, potential respiratory depression, and coma. Attractive flavors and packaging and resemblance to food products entice children. Our results reinforce the need for risk reduction measures, product packaging reform, education to mitigate household risk, and caution against usage with children present.

089. High-Risk Alcohol and Cannabis Use Commonly Reported Among Youth Presenting to the Pediatric Emergency Department

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Background: Despite its importance, there is limited understanding of the extent of substance use among youth presenting to US emergency departments (EDs), as well as which youth are more likely to engage in high-risk use. Understanding high-risk substance use can help develop ED-initiated youth substance use interventions.
Research Question: What is the frequency and type of high-risk substance use and which youth in Pediatric EDs (PEDs) are more likely to have high-risk substance use (monthly or more substance use)?
Methods: We conducted a tablet-based, anonymous, self-reported survey of patients 14-21 years (y) presenting to an urban, academic PED from 2/01/23-7/31/23. The survey was a modified version of the Screening to Brief Intervention (S2BI) screening tool, including questions regarding frequency of use for tobacco, alcohol, cannabis, and other substances (cocaine, methamphetamines, heroin,

K2, hallucinogens, inhalants), and prescription medication (stimulants, benzodiazepines, opioids) and over-the-counter medication misuse. Frequency and type of substance use was analyzed by age group (14-17y and 18-21y). Logistic regression was used to identify characteristics associated with high-risk use.
Results: Of 446 PED patients approached, 317 (71%) completed the survey and 122 (38.5%) reported high-risk substance use. Average age was 17.6y (SD = 2.2), 60% were female, 61% were Hispanic. Among 14-17y (n = 145), 26% had high-risk use, including 8% with daily use. Among 18–21y (n = 172), 49% had high-risk use, including 25% with daily use. For those with high-risk use, alcohol (14-17y: 35%; 18-21y: 73%) and cannabis (14-17y: 65%; 18-21y: 72%) were most commonly used; cannabis was most often used daily (14-17y: 22%; 18-21y: 35%). Older age (18-21y) was associated with high-risk use (aOR 3.02, 95% CI 1.84-4.96).
Conclusion: High-risk substance use was common in this urban, academic PED and most often involved cannabis and alcohol. These findings highlight the need for universal ED substance use screening and ED-based, targeted interventions for youth.

090. Impact of Recreational Cannabis Legalization in Illinois and Missouri on Pediatric Exposures to Cannabis at Saint Louis Children's Hospital

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Background: Cannabis legalization for recreational use has led to an increase in accessibility of edible cannabis products to children.
Research Question: Was there an increase in pediatric cannabis exposures in Illinois and Missouri after recreational cannabis, including edible products, was legalized?
Methods: We conducted a retrospective chart review of children aged one month - nine years with positive tetrahydrocannabinol (THC) exposures confirmed by urine drug screen (UDS) who presented to Saint Louis Children's Hospital between November 6th, 2018 and May 31st, 2023. Patients were categorized into three time period groups: before recreational cannabis legalization in Illinois, after recreational legalization in Illinois but before recreational legalization in Missouri, and after recreational legalization in both states. Demographic details including state of residence, and UDS results were retrieved from the electronic health record. The total number of positive UDS results was normalized to the number of total UDS tests ordered and the total number of emergency department (ED) visits during the time period.
Results: There were 115 cases meeting the inclusion criteria. Of these, 10 occurred in the 14-month period before recreational cannabis legalization in Illinois, 67 occurred in the 34-month period after recreational legalization in Illinois but before recreational legalization in Missouri, and 38 occurred in the seven-month period after recreational legalization in both states. THC-positives per 1000 UDS orders increased from 1.7 to 4.2 (95% CI for difference: -3.3 to 8.3) after recreational legalization in Illinois and to 13.7 (95% CI for difference: 3.1-20.6) after recreational legalization in both states. THC-positives per 10,000 ED visits increased from 1.8 to 13.1 (95% CI for difference: 2.8-19.8) pre vs. post legalization in both states.
Conclusion: THC UDS-positivity increased significantly among children aged one month to nine years after recreational legalization of cannabis in Illinois and Missouri.

091. Children With Cannabis Edible Exposure Reported to a Regional Poison Center and Seen at a Healthcare Facility

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Background: Cannabis edible products can resemble items appealing to children. Some jurisdictions don't regulate delta-8 tetrahydrocannabinol (THC), purportedly less psychoactive than its delta-9 isomer.
Research Question: Is pediatric ingestion of delta-8 THC edibles associated with milder clinical effects compared with delta-9 products?
Methods: This is a retrospective review of data collected at a regional poison center (RPC) on children age < 10 years with single-substance exposures seen at a health care facility (HCF) 1/1/2016-3/31/2023. Cases were reviewed for cannabinoid subtype, clinical effects, level of care, and medical outcome.
Results: The RPC was contacted about 208 children. Frequency of calls increased over the study period, with ≤ 5 annually in 2016-2018 and 23 in Q1 of 2023. After excluding those not seen at a HCF 145 were left for analysis. Of these, 56% had no effect/minor effect, 39.7% had moderate, 4.3% had major effect; there were no deaths. Nearly half (47.5%) were admitted to a non-critical unit, 44.7% were treated/released from an emergency department, and 7.8% were admitted to a pediatric intensive care unit (PICU). Cannabinoid content was described as delta-8 in 15.9%, delta-9 in 4.1%, other in 17.9%, and was not provided in 62.1% of cases. Of 11 children admitted to a PICU, two, three, and six had consumed products containing delta-8, delta-9, and undifferentiated THC, respectively. Of six children with major effects, four consumed products with undifferentiated THC, one consumed delta-8, and another consumed delta-9

THC. All six had CNS depression, two had seizures, and one was intubated.
Conclusion: THC subtype was specified for a minority of products. Though 43.4% of children had positive urine screens for THC, testing for subtypes was not performed. Pediatric exposure to cannabis edibles is increasing. Subtype identification in our sample was too infrequent to establish correlation with medical outcome.

092. Ocular Quinine Toxicity and Hyperbaric Oxygen Therapy: I Can See Clearly Now

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Background: Quinine is an antimalarial that can cause cardiotoxicity and vision loss in overdose. It is a Class 1A antidysrhythmic with sodium and potassium channel blockade. Postulated mechanisms for blindness include direct retinal toxicity and indirect ischemia, secondary to arterial vasoconstriction. Case reports suggest hyperbaric oxygen (HBO) therapy, vasodilators including calcium channel blockers, and steroids may improve retinal blood flow and restore vision.
Methods: This is a single patient chart review. A 17-year-old female, with a history of intentional overdose and malaria infections in Congo, presented with "black and blurry vision loss" and CNS depression. Bilateral vision loss occurred about six hours after ingestion of an unknown amount of quinine. Initial BP (70/40 mmHg) improved after 1.5 liters of intravenous fluids (IVF). Infectious workup was initiated and treated with cefepime. Dextrose infusion and octreotide treated refractory hypoglycemia. EKG revealed normal intervals. She was transferred to the PICU at a tertiary children's hospital. The next morning, she had persistent vision loss. Toxicology was then contacted and recommended HBO, steroids and nifedipine. She received 100% oxygen until starting HBO therapy for 90 minutes on hospital day three. The patient's vision returned after HBO; confirmed by ophthalmology with bilateral 20/25 visual acuity and "normal retinal vasculature." She did not follow up outpatient.
Results: Laboratories demonstrated a lactate of 12 mmol/L, pH of 7.33, and serum bicarbonate of 15. Infectious workup, including CSF and urine studies, and blood cultures, was negative. Acetaminophen, ethanol, and salicylate concentrations were negative. Her head CT was negative. A quinine concentration did not result though she confirmed her intentional quinine ingestion to psychiatry. CNS depression, recurrent hypoglycemia, and vision loss were consistent with quinine overdose.
Conclusion: HBO therapy may be of benefit in quinine-induced vision loss.

093. Mind the Decimal Point: A Diazoxide Overdose-Induced Ileus

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Background: Diazoxide blocks the sulfonylurea receptor one subunit of K-ATP channel on pancreatic beta cells, suppressing insulin secretion, and it is the only FDA approved medication for treatment of hyperinsulinism-induced hypoglycemia. Potential adverse effects include edema, heart failure, pulmonary hypertension, ileus, necrotizing enterocolitis, vomiting, diabetic ketoacidosis, thrombocytopenia, and neutropenia. Overdose is infrequently reported.
Methods: This is a single patient case report. A four-week-old male, born at 32-weeks due to placental insufficiency and growth restriction, was prescribed diazoxide and chlorothiazide for perinatal stress-induced hyperinsulinism. The day after discharge from the neonatal intensive care unit (NICU), the patient presented to the emergency department (ED) with feeding intolerance and abdominal distension after an accidental 10-fold diazoxide overdose.
Results: On presentation, vital signs were remarkable for tachycardia and intermittent tachypnea. Physical exam revealed a grossly distended abdomen. Abnormal labs included a glucose of 216 mg/dL, sodium of 132 mmol/L, and chloride of 98 mmol/L. Bedside point of care echocardiogram was normal. The abdominal X-ray was interpreted as moderate gaseous distension suggestive of generalized ileus. The patient was admitted to the NICU, and a nasogastric tube was placed. He received dextrose fluids, and feeds were resumed as serial X-rays showed resolution of bowel gas. Ileus is a possible adverse effect of diazoxide, likely secondary to retained fluid and gastrointestinal smooth muscle relaxation. The patient remained in the NICU for several days to monitor bowel movements and resolution of ileus, and he was discharged after improvement.

Conclusion: While diazoxide overdose is rarely reported, and ileus due to such is documented even less frequently, 10-fold medication dose errors are common among infants. The source of the 10-fold mistake is often decimal points, leading zeros, or trailing zeros. Utilizing the smallest possible syringe for the prescribed dose may reduce the incidence of medication errors.

094. Ten Years of Pediatric Poisonings in a Hospital of Mexico State

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Background: Poisoning represents one of the main reasons for admission to pediatric emergency services, especially in children under five years of age, who are more vulnerable to oral exposures. This study was carried out to evaluate the epidemiological aspects of poisoning in children from zero to five years old.
Methods: We performed a 10-year retrospective observational study (2012-2022) analyzing the database of a Poison Control Center of a hospital in Mexico State, from which all patients under five years of age were considered. The information was statistically analyzed using SPSS v25.
Results: One hundred and thirty-one patients were included in the study, representing 9.34% (n = 1402) of exposures reported during the study period. Of these cases, 51.9% were female and 48.1% were male. The mean age was 2.1 years. Accidental exposure represented 76.3% of the cases, followed by bites and stings (14.5%), therapeutic errors (6.1%), non-toxicological (2.3%) and adverse reactions (0.8%). Ingestion was the main route of exposure in 77.8% of patients. The substance categories were: 17.6% analgesics, 14.5% envenomations, 8.4% cleaning products, 6.9% sedative-hypnotics and 6.9% other. Of the patients, 74.5% were asymptomatic, 18.32% presented minor symptoms, 3.05% major symptoms and 3.8% were admitted to the pediatric intensive care unit. No deaths were recorded. The most common exposure site was home 88.5%, another family member's house 8.4%, hospital 2.3% and public area 0.8%. Finally, 63.6% of them did not require decontamination techniques, 32.8% received activated charcoal and in 3.8% gastric lavage was performed.
Conclusion: Our study shows that most exposures in children under five years of age were accidental and uncomplicated, requiring decontamination techniques in less than a third of the patients. This suggests that it is necessary to reinforce the knowledge of poisoning among emergency pediatricians to avoid unnecessary admissions and procedures, as well as underestimating poisonings that require urgent medical interventions.

095. Don't Clutch These Pearls: Pediatric Fatality From Intentional Ingestion of Benzonatate

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Background: A disturbing trend of increasing suicidal ingestions of benzonatate in the 0-16 year old (y/o) age group was recently described in NPDS data. Benzonatate prescriptions increased from an estimated 5.1 million patients in 2012 to 11.7 million patients in 2019.
Methods: A 13-year-old girl had a collapse witnessed by her stepmother. On BLS arrival 15 minutes later, the patient was pulseless, CPR was initiated, and the AED advised no shock. On ALS arrival, the patient was intubated, epinephrine was administered three times, and ROSC was achieved. EMS found bottles of amoxicillin and diosmin/hesperidin. Post-ROSC ECG revealed sinus tachycardia at 130 bpm, QRS 86 msec, and QTc 460 msec. VBG pH 6.773 / pCO2 40 mmHg, with serum HCO3 6 meq/L, and lactate of 18.9 mmol/L. A suicide note was later found alongside two prescription bottles of benzonatate 100mg (#90 each) with approximately 30 pills unaccounted for. Subsequent hospital courses were notable for cEEG with diffuse cerebral dysfunction on hospital day (HD)1 and absent brain rhythms on HD2 coinciding with a loss of brainstem reflexes. A nuclear medicine flow study demonstrated absence of intracranial radiotracer uptake on HD3, and the patient was terminally extubated on HD4. Arrival and postmortem blood samples were sent for benzonatate concentrations and are pending.
Discussion: Benzonatate results in rapid development of seizures, ventricular arrhythmias, and/or cardiac arrest in overdose. Increased use in suicidal ingestions is of great concern given its quick onset and lethality. Dysrhythmias are difficult to manage but may best be addressed with sodium bicarbonate and intralipid emulsion (similar to other local anesthetics).
Conclusion: Benzonatate is a rarely reported cause of poisoning fatality. Increased prescribing coupled with rising numbers of intentional ingestions with suicidal intent may result in more such cases if the dangers are not adequately relayed to providers and caregivers.

096. TikToxic: An Investigation of Various TikTok™ Trends and Their Effects on Calls to a Regional Poison Control Center

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Background: Social media platforms have marked popularity. Platforms such as TikTok™ have had challenges emerge that resulted in harm when attempted by adolescents. The impact of the Benadryl™ challenge and the NyQuil™ challenge on poison centers (PC) calls is unclear. We investigated how these challenges impacted a single large regional PC.
Methods: This retrospective observational study analyzed calls to a single regional PC in the year before and after the TikTok™ Benadryl™ challenge and the TikTok™ NyQuil™ challenge. Google™ trends were used to determine times of greatest interest. Data was obtained from a single regional PC for patients aged 6 to 19 years one year before and after peaks for both challenges. Generic codes for diphenhydramine and dextromethorphan were used for 'intentional-abuse', 'intentional-misuse', and 'intentional-unknown' coded calls. This study was deemed exempt by the IRB. Descriptive statistics were used.
Results: Peak interest for the Benadryl™ challenge was in October 2020. In the preceding year, 32 calls were made to the PC whereas 17 calls were made to the PC the year after the challenge. Average caller ages pre- and post-peak were 16.7 and 15.8 years, respectively. Peak interest for the NyQuil™ challenge was October 2022. In the preceding year, 19 calls were made to the PC whereas 18 calls were made in the year following the challenge. Average caller ages pre- and post-peak were 14.2 and 16.1 years, respectively.
Conclusion: No increase was noted in related calls to a single regional PC the year following peak interest in the NyQuil™ and Benadryl™ challenges. Limitations include voluntary reporting to the PC resulting in an underestimation of actual cases. While our PC did not have increased call numbers, poison centers and toxicologists need to be aware of these trends and aim to inform users of the poisoning risk.

097. I Drank What? Bifenthrin Exposure With Features of Type I and II Pyrethroid Toxicity: A Case Report

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Background: Bifenthrin is a pyrethroid insecticide widely available for residential and professional application. Highly concentrated, undiluted products intended for professional use can cause toxicity. Pyrethroids bind to open voltage-gated sodium channels causing continuous axon firing. Symptoms are usually mitigated by plasma cholinesterase. Type I pyrethroid syndrome manifests excitation, tremors, and seizures, whereas type II syndrome exhibits choreoathetosis and salivation. We present a patient who inadvertently ingested an estimated one-two ounce of Talstar P® insecticide (bifenthrin 7.9%, propylene glycol 5-10%) and experienced delayed onset of salivation and tremors.
Methods: This is a single patient encounter of a nine-year-old (29.5 kg) son of a professional pesticide operator who took home three-four ounces of Talstar P in a large, covered cup with a straw around 5:30pm. The patient was asymptomatic until 10:30pm when he experienced facial and extremity paresthesias that progressed to tremors. On examination he had twitching and muscle weakness. Initial VS: BP 130/76, P 109, oxygen saturation 100%. That evening he developed excessive tremors, urinary incontinence, and excessive secretions not treatable solely with suctioning. He was sedated, paralyzed, and intubated. Labs were unremarkable. The poison center recommended continuing benzodiazepines and paralytics. Neurology diagnosed seizure activity by continuous EEG and recommended levetiracetam, valproic acid, and midazolam. On day two, the patient remained intubated on midazolam and fentanyl. EEG was negative for seizures, but extremity tremors continued. On day three, the patient remained ventilated, had stable vital signs, responded to commands, and tremors resolved. An esophagogram showed suspected micro perforations, but an esophagogastroduodenoscopy showed no evidence of bleeding, ulceration, or injury. The patient developed pneumonia, improved, had no neurological deficits, and was discharged on day 10.
Conclusion: Residential grade pyrethroid exposures are common but generally do not cause significant symptoms. In contrast, industrial strength products may result in toxicity requiring critical care.

098. Comparative Analysis of Pediatric Drug Overdoses Requiring ICU: Before, During, and After the COVID-19 Pandemic

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Background: Drug overdoses are one of the leading causes of pediatric hospitalizations and can be predictive of suicide, second leading cause of death for 12–18-year-olds. Drug overdoses have steadily increased since the COVID-19 pandemic, requiring a large-scale comparative analysis of ingestion severity for patients presenting to Pediatric Intensive Care Unit (PICU) before and after that time.
Hypothesis: We hypothesized drug overdoses from opioids, non-opioid analgesics, antidepressants, anticonvulsants, stimulants, alcohols, or cannabis presenting to PICU during the COVID-19 pandemic had higher PICU mortality scores, Pediatric Risk of Mortality (PRISM) and Pediatric Index of Mortality (PIM), than those before and after pandemic.
Methods: This secondary analysis of drug overdoses from Virtual Pediatric Systems (VPS, LLC) database categorized three time periods: pre-COVID (January 1, 2019-February 28, 2020), peak-COVID (March 1, 2020-August 10, 2021), and post-COVID pandemic (August 11, 2021-June 30, 2023). Bivariate statistical analysis and multivariable log-linear regression models determined associations with mortality scoring (PRISM-III) stratified by COVID time-period.
Results: Patients identified: 35,125. Significant differences found for poisonings across COVID periods for race/ethnicity, age, and sex. There was an overall trend for higher PRISM and PIM scores during Peak-COVID; there were several sub-categories of ingestions that were an exception. Cannabis poisonings increased in the post-COVID pandemic (14.3%) compared pre-COVID (7.6%; $p < 0.001$) with increased PRISM-III scores across all three time periods ($p < 0.001$). PRISM-III for opioids was higher in peak COVID (4.4%) compared pre-COVID (3.2%) and post-COVID (4.0%; $p < 0.001$). Risk factors for higher mortality scores were similar in all three time periods, apart from anticonvulsants being associated with 13% higher severity (compared to without anti-convulsant poisonings) in post-COVID era (Adjusted Log-Odds Ratio: 1.13; 95% CI: 1.02, 1.25)
Conclusion: PRISM-III scores were higher in peak-COVID for most pediatric poisonings admitted to the PICU. This data is valuable in expanding preventative epidemiologic measures for pediatric populations.

099. Characterization of Intentional Self-Harm Exposures on School Property Before and After COVID-19 School Closures

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Background: Objective was to characterize self-harm exposures on school grounds before and after COVID-19 related school closures. Findings could inform education, management and prevention programs geared towards school staff.
Methods: After IRB approval, data from patients ages 0-21 years with a self-harm exposure occurring on school grounds between 01/01/2018-12/31/2022 were collected from three poison centers. Exposures were categorized into pre-pandemic school closure (PrSC) group- exposures between 01/01/2018- 03/14/2020 and post-pandemic school closure (PoSC) group—exposures between 09/02/2020-12/31/2022. No school exposures were reported between 03/14/2020-09/02/2020 (pandemic-related school closure period). Demographics, comorbidities, substances, and clinical effects were compared using SPSSv29.
Results: There were 271 exposures [PrSc 113 (41.7%); PoSC 158 (58.3%)]. In both groups, the majority were female (PrSC 87, 76%; PoSC 126, 80%) with a similar mean age (PrSC 14.45 ± 2.8 years; PoSC 14.29 ± 1.9 years). Nearly 26% (70) of all patients had a documented mental health condition. Group PoSC was more likely to have a reported mental health condition than the PrSC group ($p = 0.024$). In the PrSC group, the most commonly ingested substances were acetaminophen (32, 28%), NSAIDs (13, 11.4%), and non-drug products (11, 9.6%). In the PoSC group, the most commonly reported substances were acetaminophen (38, 24.2%), NSAIDs (19, 12.2%), and antidepressants (n = 18, 11.4%). The most common clinical effects reported included tachycardia (n = 57, 17.2%), mild central nervous system depression (n = 29, 8.8%), and vomiting (n = 28, 8.5%).
Conclusion: Self-harm attempts on school grounds increased overall after re-openings of the school's post-pandemic. During this period, patients were more likely to have mental health conditions and use antidepressants. These findings underscore COVID19's impact on pediatric mental health and may be useful to inform education/prevention strategies for school staff.

100. Unintentional Pediatric Poisonings Before and During the COVID-19 Pandemic: A Population-Based Study

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Background: The impact of the COVID-19 pandemic on unintentional pediatric poisonings is unclear.
Research Question: What were the changes in emergency department (ED) visits and hospitalizations for poisonings,

overall and by subtype, among children < 10 years before and during the COVID-19 pandemic?
Methods: A repeated cross-sectional study using interrupted time-series (ITS) analyses to examine changes in ED visits or hospitalizations for all children < 10 years in Ontario, Canada (1.48 million), over two time periods: pre-pandemic (January 2010-March 2020) and pandemic (April 2020-December 2021). Data was obtained from health administrative databases using ICD-10 codes.
Results: We identified 28,292 ED visits and 2,641 hospitalizations. The rate of poisoning per 100,000 person-years decreased by 14.6% for ED visits (40.2 pre- vs. 34.3 during) and increased by 35.9% for hospitalizations (3.5 pre- vs. 4.7 during the pandemic) during the pandemic. ED visits dropped immediately (Incidence Rate Ratio [IRR], 0.76; 95% CI, 0.70-0.82) at the onset of the pandemic, followed by a gradual return to baseline (quarterly change, IRR 1.04, 95% CI 1.03-1.06), while hospitalizations had an immediate increase (IRR 1.34; 95% CI, 1.08 - 1.66) without gradual change. During the pandemic, there were no changes in the rate of poisonings from household cleaners, prescription medications or alcohol. Poisonings from NSAIDS/acetaminophen decreased by 29.3% (11.04 pre- vs. 7.8 during) and by 83.9% for anti-infectives (3.73 pre- versus 0.60 ED visits during). Conversely, ED visits for cannabis poisonings increased 10.7-fold (0.45 pre- to 4.83 during), and hospitalizations increased 12.1-fold (0.16 pre- to 1.91 during). Excluding cannabis, there was no overall increase in poisoning hospitalizations during the pandemic (IRR, 0.88, 95% CI, 0.67-1.16).
Conclusion: The COVID-19 pandemic in Ontario was not associated with overall increases in unintentional pediatric poisonings. Notably, cannabis poisonings markedly increased during this timeframe, but the recent legalization of non-medical cannabis may better explain this.

101. Pediatric Exposures to Fentanyl Are Associated With Increased Fentanyl Availability in the Community

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Background: Fentanyl entered our region's drug supply in 2019 and has become the predominant illicit opioid. Exploratory pediatric unintentional exposures to fentanyl have increased both locally and nationally and > 90% of exposures occur in the child's home. We sought to determine the relationship of fentanyl availability in the community and pediatric unintentional exposures.
Hypothesis: Pediatric fentanyl exposures are associated with increased availability of fentanyl in the community.
Methods: This is a comparison of the availability of fentanyl in one state (fentanyl drug-seizures) and unintentional pediatric exposures to fentanyl. We queried a regional poison center database for cases of children (< six years old) with unintentional exposure to 'fentanyl(pharmaceutical)' or 'fentanyl(non-pharmaceutical)' from 1/1/2019-8/30/2023. Prescription, dermal, inhalational, and unconfirmed exposures were excluded. We obtained drug-seizure data from the DEA-HIDTA database from 1/1/2019-10/20/2023. We extrapolated data for 2023 to compare calendar years. "Dose units" were computed by using 500mcg of powder or a single pill.
Results: Drug-seizures of fentanyl increased from 102,609 dose-units in 2019 (1.5 kg powder, 101,859 pills) to 2,740,954 in 2023 (107.5 kg powder, 2,673,766 pills). Pediatric fentanyl exposures increased from 0 in 2019-2020 to 23 in 2023, increased in relation to the number of pills seized from 2019-2023 (0, 0, 1.5, 3.1, 8.6 cases/million pills), and had a positive curvilinear relationship to dose-units seized per year ($y=(1x10-12)\ x2 + (3x10-6)x - 1.4874$) (x-intercept = 433,240). This suggests that cases began increasing once approximately 400,000 dose-units were seized in the state and had accelerated increases in cases for all additional units seized.
Limitations: Poison center data do not reflect all pediatric fentanyl cases in the state. Analysis of a single state may not be generalizable.
Conclusion: We found an increase in pediatric fentanyl exposure that is associated with an increase in fentanyl-containing pills and dose-units in our community.

102. Increase in Illicit Fentanyl Exposures in Children Under Six Years Old

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Background: Fentanyl is a potent opioid that has become the predominant illicit opioid nationwide. In our region, illicit fentanyl entered the illicit market in 2020.
Hypothesis: Given increased illicit fentanyl availability and the exploratory nature of young children, we hypothesize a rise in exposures to illicit fentanyl in children under six.
Methods: We queried a regional poison center database (Toxicall) for cases of children < six years old with unintentional exposure to 'fentanyl(pharmaceutical)' or 'fentanyl(non-pharmaceutical)' from 1/1/2013-8/30/2023. Prescription, dermal, inhalational, and unconfirmed exposures were omitted.
Results: Forty-three cases met inclusion criteria and 17 were excluded (pharmaceutical fentanyl exposures), yielding 26 cases of pediatric (< six years old) exposures to illicit fentanyl. Annual cases increased from zero in 2013-2020, to two in 2021, nine in 2022, and 15 in the first eight months of 2023, corresponding to increasing fentanyl availability in the region. A 42.3% (n = 11) resulted in major effect (respiratory arrest, anoxic brain injury and/or death), 42.3% (n = 11)

resulted in moderate effect (moderate respiratory and mental status depression), and 18.5% (n = 4) resulted in minor or no effect. The most common clinical effects were respiratory depression (46.2%, n = 12), major CNS depression (34.6%, n = 9), and mild to moderate CNS depression (34.6%, n = 9). 57.6% (n = 15) had at least one dose of naloxone administered and two (7.6%) received naloxone infusions. Two children (7.6%) that did not receive naloxone were intubated for respiratory failure, and two (7.6%) received chest compressions. Confirmatory urine drug screen was obtained in 19 cases (73%) and all were positive for fentanyl. Limitations: analysis of regional data limits generalizability.
Conclusion: We have identified an increase in exposures of small children to illicit fentanyl predominantly resulting in moderate to major opioid effects. This emphasizes the need for heightened awareness and education regarding unintentional pediatric drug exposures.

103. Misclassification of Pediatric Fentanyl Exposures: An Analysis of Coding Errors From a Single Poison Center

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Background: The National Poison Data System (NPDS) is used to track nationwide trends in drug use and to perform research analyzing and characterizing exposures in the United States. While performing an analysis of pediatric fentanyl exposures, we noted coding patterns that may affect trend analysis and research on fentanyl using NPDS. Historically, a single code was used for exposures to pharmaceutical or illicit fentanyl. In October 2019, two separate substance codes were introduced: 'fentanyl (prescription)' and 'non-prescription fentanyl'.
Hypothesis: We hypothesize that some non-pharmaceutical fentanyl exposures may be inaccurately categorized as pharmaceutical fentanyl exposures.
Methods: This is a retrospective review of fentanyl exposure cases in children < six years old, from 2013-August 2023 in a single poison center database. Cases were screened for inclusion by searching the Toxicall® database (Computer Automation Systems, Inc. Aurora, CO) for those coded as 'fentanyl (prescription)' and 'non-prescription fentanyl'. Informational calls were excluded. We reviewed cases for coding accuracy of substance, route of exposure, and medical outcome.
Results: Forty-three cases were identified. Twenty-seven (63%) cases of illicit fentanyl exposure were miscoded as 'prescription fentanyl' rather than 'non-prescription fentanyl'. Five (12%) were incorrectly coded for route of exposure; one case of a child handling drug paraphernalia was coded as an ingestion, one case coded as an exposure pertained to opioid withdrawal treatment, and three instances of asymptomatic children near individuals smoking fentanyl were categorized as inhalational/nasal exposures. Limitations: we analyzed a small subgroup of patients in a single poison center which may limit generalizability.
Conclusion: Almost two-thirds of fentanyl related cases in children < six years were miscoded as prescription rather than non-prescription or non-pharmaceutical fentanyl. Centers should consider clarification and education for those who code cases. Clinicians and researchers should be aware of miscoding of fentanyl when analyzing or interpreting NPDS or poison center data.

104. Pediatric Brexpiprazole Ingestion Presenting With Prolonged Sedation and Delayed Symptoms

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Background: Brexpiprazole is a second-generation antipsychotic with a half-life of 91 hours. There is scarce literature on the delayed effects of brexpiprazole in pediatric ingestions.
Methods: This is a case report involving a patient evaluated by an inpatient consulting medical toxicology service at an academic pediatric hospital.
Results: A 22-month-old female presented to an emergency department one hour after she was found by her grandmother holding an empty bottle of brexpiprazole one mg. The bottle previously contained 30 tablets and 27 were missing. On arrival she was somnolent with a blood pressure of 91/53 mmHG, a heart rate of 110 bpm, and a blood sugar of 117 mg/dL. Workup was notable for negative acetaminophen and aspirin levels with a normal comprehensive metabolic panel. EKG showed sinus rhythm at a rate of 112 bpm, PR interval 118 ms, QRS 68 ms, and QTc 302 ms. She was given a 20 mL/kg crystalloid fluid bolus and transferred to a tertiary pediatric hospital. Her hospital course was notable for prolonged tachycardia and somnolence. Her heart rate ranged from 111-175 bpm, with tachycardia resolving 28 hours after ingestion. On the second day of hospitalization, the patient had two episodes of agitation and dystonia characterized by repeated jaw extension and flexion. Symptoms improved with 0.05 mg/kg lorazepam. On the third hospital day, the patient's mental status improved, and she returned to baseline. She was discharged from the hospital 77 hours after ingestion.

Conclusion: Our patient's ingestion of up to 27 mg of brexpiprazole resulted in prolonged somnolence, tachycardia, delayed agitation, and dystonia. Although delayed sedation has been previously reported, dystonic reactions in pediatric ingestions have not been previously described and could represent an adverse effect. Long observation times and hospital admissions should be considered in brexpiprazole ingestions.

105. Comparison of Serotonin and Norepinephrine Reuptake Inhibitor Toxicity in Overdose Using Toxicology Investigators Consortium Database*

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Background: Venlafaxine is anecdotally thought to cause more toxicity than other atypical antidepressants of the serotonin and norepinephrine reuptake inhibitor (SNRI) class, however, no data exists comparing outcomes of overdoses of these agents.
Methods: This study utilized the Toxicology Investigators Consortium's prospective case registry to evaluate single substance SNRI intentional overdoses from 2012 to 2023. We included patients aged > 12 years. Due to the low numbers, we excluded eight desvenlafaxine and one levomilnacipran exposure. We compared the rates of tachycardia (HR > 140 bpm), seizures, QRS prolongation, serotonin syndrome, intubation, and ICU admission between duloxetine and venlafaxine.
Results: We included 123 venlafaxine and 46 duloxetine overdoses. Venlafaxine had higher rates of tachycardia (n = 43, 35.0% vs. n = 8, 17.4%; p = 0.027) and seizure (n = 22, 17.9% vs. n = 2, 4.3%; p = 0.025). Rates of QRS prolongation > 120 ms (4.9% vs. 2.2%), serotonin syndrome (17.9% vs. 26.1%), intubation (8.9% vs. 6.5%), and ICU admission (3.3% vs. 4.3%) were not statistically different between venlafaxine and duloxetine overdose. The most frequent reported therapies were benzodiazepines (43.1% vs. 28.3%; p = NS) and cyproheptadine (4.1% vs. 6.5%; p = NS) in venlafaxine and duloxetine overdoses, respectively.
Conclusion: In retrospective database comparison, venlafaxine overdose is associated with increased rates of tachycardia and seizures but not QRS prolongation, serotonin syndrome, intubation, and ICU admission when compared to duloxetine overdose. Given that duloxetine has more potent inhibition of serotonin and norepinephrine reuptake, this data would suggest that there might be an additional unknown mechanism of epileptogenesis in venlafaxine toxicity. However, we were unable to assess dose response in the clinical presentation.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

106. Chlorpromazine Overdose: A Case Series

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Background: Chlorpromazine, the original first-generation antipsychotic medication, is still widely available and used in a number of psychiatric conditions. Named 'largactil' for its 'large activity' on different receptors, in overdose there is the potential for sedation, cardiotoxicity, hypotension and delirium.
Hypothesis: There is an association between dose ingested of chlorpromazine and ICU (intensive care unit)/intubation requirements.
Methods: We conducted a retrospective analysis of patients admitted to our toxicology tertiary referral hospital with chlorpromazine overdose between January 1987 and October 2023. Demographic information, details of ingestion, clinical effects, complications, interventions, length of stay (LOS) and ICU admission were extracted from a clinical database.
Results: A total of 305 presentations of chlorpromazine overdose occurred over 36 years. The trend in presentations decreased from 2007. The median age at presentation was 32 years (IQR: 25-40 years) and 190 (62%) were female. The median dose ingested was 1000 mg (IQR; 400-2000 mg). The majority of presentations (203; 67%) involved co-ingestion of other medication, typically benzodiazepines, paracetamol or antipsychotics. Of all presentations, 58 (19%) required ICU, but only 38 (12%) were intubated, single ingestions were slightly lower. Delirium was observed in 25 (8%) presentations and hypotension (defined as BP < 90 mmHg) in 12 (4%) presentations. This was consistent with chlorpromazine alone ingestions, delirium in eight presentations (8%) and hypotension in six (6%). Only one presentation required inotropes. Median LOS was 18 hrs (IQR: 12-28 hrs). For 277 patients with a reported dose, there was a significant difference in the median dose between patient intubated (850 mg; IQR: 375-2000 mg) and those not intubated (2000 mg; IQR: 800-3500 mg; p < 0.001), and between those admitted to ICU (p < 0.0001).
Conclusion: One fifth of chlorpromazine overdose admission are admitted to ICU and over half were intubated. There was a significant association between dose and requirement for intubation. Hypotension and delirium were uncommon.

107. Neurologic Sequelae After Intentional Massive Moxidectin Overdose

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Background: Moxidectin - an avermectin antiparasitic - is FDA-approved for treatment of onchocerciasis in humans (dose: eight mg/day for adults) but is also available in larger doses as a veterinary medication. Unfortunately, there are unsubstantiated claims online that large doses can treat other human diseases. As detailed in this case, massive overdoses can cause psychomotor agitation, psychotic features, and rhabdomyolysis.
Methods: A 38-year-old, 72.6 kg man with a history of polysubstance use disorder, bowel resection, and delusional parasitosis presented to an emergency department (ED) after intentionally ingesting four tubes of 2% moxidectin (288 mg per tube) intended for horses. He read online that "heroic doses" could cure his perceived scabies. Per his significant other, he was in his usual health before the ingestion but became tachycardic, diaphoretic, hallucinating, and exhibited psychomotor agitation after. Emergency medical services provided ketamine without effect. In the ED, haloperidol, benzodiazepines, ketamine, and an infusion of dexmedetomidine were also ineffective. He was sedated, intubated, and admitted to the ICU. Urine drug testing was positive for benzodiazepines and THC. Labs demonstrated no abnormalities of electrolytes, transaminases, or lactate. CT head without contrast revealed no acute intracranial process. On hospital day two, the patient was extubated but remained agitated despite administration of phenobarbital, haloperidol, and dexmedetomidine. Ketamine and lorazepam infusions were subsequently started. He developed mild rhabdomyolysis (CK 1061) during his hospitalization, which resolved. On hospital day six, his mental status improved. He was discharged home on hospital day 10.
Conclusion: Similar to overdoses with ivermectin (another avermectin drug), moxidectin overdose can manifest with psychomotor agitation, psychosis, and rhabdomyolysis. This patient's altered mentation and agitation persisted for seven days despite medications. Unfortunately, there are unsubstantiated online claims that large ingestions can have benefits, which raises the concern that others may also be at risk of overdose.

108. Persistent Neurologic Deficits After Oral Recreational Use of the Decongestant Propylhexedrine

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Background: Propylhexedrine (brand name: Benzedrex) is an over-the-counter nasal decongestant used recreationally for amphetamine-like effects. Prior reports have associated intravenous misuse with brainstem dysfunction and diplopia. This is a case of oral propylhexedrine ingestion resulting in persistent neurological impairment with associated MRI findings.
Methods: A 21-year-old man presented with neurologic symptoms after ingesting propylhexedrine that he had extracted from a 250 mg nasal inhaler into a lemon juice solution as per recommendations from an online forum. This was his first exposure to propylhexedrine. He simultaneously ingested one g of L-arginine to mitigate the risk of vasoconstriction, which had also been recommended. He developed flushing and euphoria before falling asleep. He awoke 12 hours later with dizziness, intractable vomiting, diplopia, and trouble walking. Examination revealed dysmetria, spontaneous horizontal nystagmus, and ataxia.
Results: Magnetic resonance imaging (MRI) revealed T2 enhancement concerning for vasogenic edema of the right posterior limbs of the internal capsule extending into the midbrain, cerebellar peduncles, and cerebellar white matter (see image). Workup for primary vascular or autoimmune etiologies was unrevealing. Expanded drug testing was positive for mitragynine and THC. Blood analyzed via liquid chromatography quadrupole time-of-flight mass spectrometry was positive for propylhexedrine. On hospital day six, the patient was discharged to physical rehabilitation with persistent dysmetria and ataxia.
Discussion: Propylhexedrine is an amphetamine-like nasal decongestant that may be diverted for recreational use. Previous cases report neurologic symptoms after IV misuse, but this case demonstrates neurologic dysfunction after oral ingestion. Furthermore, MRI findings are suggestive of vasospasm-related injury. Blood testing confirmed the presence of propylhexedrine. Although testing was also positive for mitragynine and THC, these have not been associated with similar neurologic deficits or MRI findings.
Conclusion: Recreational misuse of propylhexedrine may be associated with vasospasm-related injury resulting in neurologic impairment.

109. Case Series of Intrathecal Baclofen Overdose Treated With Therapeutic CSF Removal

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Background: Baclofen is a GABA-B receptor agonist with pre-synaptic and post-synaptic receptor activity. Toxicity varies from CNS depression to excitation and dysautonomia.

Intrathecal (IT) baclofen toxicity poses unique challenges in management.
Hypothesis: Removal of CSF after intrathecal baclofen overdose may shorten duration of baclofen toxicity.
Methods: This is a case series of two patients. Patient one is a 54-year-old male with PMH of TBI and spasticity admitted with hyperthermia, acute hypoxic respiratory failure, and status epilepticus after an IT baclofen overdose. His IT pump was adjusted, and he was treated with propofol, anti-epileptic agents (lamotrigine, levetiracetam), and removal of 19 mL of CSF from his pump reservoir. Patient two is a 63-year-old male with PMH of incomplete quadriplegia and spasticity who underwent operative removal and exchange of his IT baclofen pump, complicated by multiple episodes of bradycardic cardiac arrest after his replacement pump was initiated. Post-arrest ECG showed inferior wall STEMI. He underwent coronary stenting, transvenous pacemaker placement, and lumbar drain placement with an unspecified volume of CSF removed.
Results: For patient one, interrogation of IT pump revealed dosing error of 24-fold higher infusion rate than intended. CSF fluid analysis showed baclofen level of 31 mcg/mL. His hospitalization was complicated by persistent coma, ventilator-associated pneumonia, and femoral vein DVT. He was extubated on HD 8 (six days after CSF removal) and discharged 44 days after admission. Patient two had 10% of his baclofen pump volume unaccounted for intra-operatively concerning for IT overdose. He was extubated on HD three with hospitalization complicated by heart failure, renal failure, and hypoxic respiratory failure. He has been hospitalized for more than 12 days.
Conclusion: Therapeutic CSF removal shortly after IT baclofen overdose is a feasible management strategy of unclear clinical benefit. There is minimal literature correlating CSF baclofen levels to degree of toxicity.

110. Activated Charcoal Adsorption Kinetics and Capacity for Amitriptyline, Bupropion, and Hydroxychloroquine in Simulated Gastric and Intestinal Fluids

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Background: Activated charcoal (AC) is a commonly used oral adsorbent to prevent gastrointestinal absorption of life-threatening xenobiotics. Understanding the kinetics and capacity of AC for a given xenobiotic may better guide dosing recommendations to improve efficacy, minimize adverse effects (e.g., aspiration), and allow for the development of newer adsorbents. Amitriptyline, bupropion, and hydroxychloroquine are life-threatening xenobiotics where AC may have clinical benefit.
Research Question: What are the adsorption kinetics and maximum adsorption capacity (MAC) of AC for amitriptyline, bupropion, and hydroxychloroquine in simulated gastric and intestinal fluids?
Methods: 1) Adsorption kinetics: samples were prepared in simulated gastric fluid (SGF, pH 1.2) and simulated intestinal fluid (SIF, pH 6.8) with a 10:1 ratio of AC-to-adsorbate and incubated at 37°C. Concentrations of free adsorbate were measured over time via UV-Vis spectroscopy. 2) Optimal AC-to-adsorbate ratios were determined using 20-minute incubations at 37°C. 3) MAC in mg/g of AC was modeled using the Langmuir isotherm model.
Results: 1) Amitriptyline was absorbed to >95% by five minutes in both SGF and SIF. The optimal AC-to-amitriptyline ratio was 8:1. MACs were 177 mg/g and 485 mg/g in SGF and SIF, respectively. 2) Bupropion was absorbed to > 95% by five minutes in SIF and > 80% by 10 minutes in SGF. The optimal AC-to-bupropion ratio was 10:1. MACs were 191 mg/g and 500 mg/g in SGF and SIF, respectively. 3) Hydroxychloroquine was absorbed to >95% by 10 minutes in SIF and five minutes in SGF. The optimal AC-to-hydroxychloroquine ratio was 10:1. MACs were 208 mg/g and 262 mg/g in SGF and SIF, respectively.
Conclusion: All three drugs adsorbed to AC better in SIF than SGF. Amitriptyline had the lowest MAC in SGF. Hydroxychloroquine had the lowest MAC in SIF. Optimal AC-to-adsorbate ratio was lowest for amitriptyline at 8:1.

111. Ertapenem Treatment as an Antidote in Two Large Intentional Valproic Acid Overdoses

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Background: Valproic acid (VPA) is an antiepileptic drug used to treat seizures and bipolar disorder. VPA is well-absorbed, highly protein bound, and metabolized by the liver, with 50% eliminated as a glucuronide conjugate, which is converted back to VPA via acylpeptide hydrolase (ADEH) and reabsorbed. In the overdose setting, VPA toxicity presents as CNS and respiratory depression. Management is mainly supportive in addition to multidose activated charcoal (MDAC), levocarnitine, and hemodialysis. Recent reports have identified an interaction between carbapenems and VPA. It is thought that carbapenems inhibit ADEH, preventing enterohepatic recirculation of VPA. Studies have demonstrated marked reduction in plasma VPA levels when co-administered with carbapenems. These findings support the potential use of carbapenems as treatments in VPA overdoses.

Methods: We present two cases of large intentional VPA ingestions, presenting with CNS depression requiring intubation and mechanical ventilation. The first case, a 23-year-old male, ingested an estimated 40 g of VPA, with a peak level of 894 mg/dL and serum ammonia level of 740 mg/dL. He was treated with MDAC, levocarnitine, and following intubation was administered ertapenem one g. Continuous renal replacement therapy (CRRT) was attempted, however, was discontinued after five hours due to malfunctioning. VPA and ammonia levels drawn 15 h later were 241 mg/dL and 282 mg/dL, respectively. Within 24 h VPA levels were in the therapeutic range. The patient was eventually extubated and had a normal recovery. In the second case, a 33-year-old male took an unknown quantity of VPA. His peak VPA level was 317 mg/dL, and he received MDAC, levocarnitine, and ertapenem. A repeated VPA level drawn 11 hours later was 78 mg/dL. He was extubated the following day and had an uneventful recovery.
Conclusion: These cases demonstrate potential efficacy of ertapenem as antidotal therapy in the management of VPA toxicity.

112. Poor Outcomes Despite Fomepizole Use in Treatment of Acetaminophen Toxicity

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Background: Case reports and preclinical research suggest that fomepizole reduces acetaminophen (APAP) induced liver injury via inhibition of CYP2E1 conversion of APAP to NAPQI and inhibition of hepatocellular apoptosis. Poor outcomes associated with fomepizole use have not been reported.
Research Question: Is the use of fomepizole always associated with reduced liver injury after APAP overdose?
Methods: Chart review of two patients with delayed presentations of APAP overdose treated with N-acetylcysteine (NAC) and fomepizole.
Results: A 14-year-old female with estimated 20 g APAP ingestion had an APAP concentration ([APAP]) 14 hours post-ingestion of 177 mcg/ml. NAC and fomepizole were initiated 15- and 16-hours post-ingestion, respectively. An extended three bag NAC regiment and four doses of fomepizole over two days (total dose = 3330 mg) were provided. Initial ALT was 819 IU/L, which increased to > 6000 IU/L at 56 hours post-ingestion with INR of 10.6 and total bilirubin of 6.0 mg/dL. Encephalopathy occurred on hospital day three necessitating intubation. She received a liver transplant five days after hospital admission and was discharged home. A 24-year-old female ingested a handful of APAP; 14 hours post-ingestion [APAP] was 193 mcg/ml. "Double dose" NAC was initiated at 18 hours and continued for nine days. Three standard doses of fomepizole were given over two days (total dose = 2170 mg). ALT was 9646 IU/L at 48 hours post-ingestion with INR 10.5 and total bilirubin of 4.8 mg/dL. She developed encephalopathy and died 12 days post-ingestion.
Conclusion: Early reports of novel interventions typically overestimate efficacy. Both cases had elevated [APAP] when fomepizole was administered and should have received benefit from CYP2E1 inhibition, but experienced poor outcomes. While it is reasonable to administer fomepizole alongside NAC in patients at high risk of developing liver failure, additional research and clinical trials are warranted.

113. A Case of Hydroxocobalamin Triggering a Blood Leak Alarm and Preventing Hemodialysis in a Patient With Presumed Metformin Overdose

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Background: Hydroxocobalamin is primarily used as an antidote to cyanide poisoning however it is increasingly being used for its vasoactive effects in refractory hypotension. It is known that hydroxocobalamin imparts a pink hue upon bodily fluids. It has been noted that these optical properties may trigger a "blood leak alarm" on some hemodialysis machines causing an inappropriate shutdown of dialysis. Overriding the alarm is an incommodious and lengthy procedure, often requiring specialized personnel. These delays due to false blood leak alarms and the subsequent inability to provide dialysis have been reported in cases resulting in death.
Methods: This is a case report of dialysis being stopped due to a false blood leak alarm in a critically ill patient who had received hydroxocobalamin during her clinical course. A 21-year-old female with self-reported history of suicide attempts by cutting presented to the ED with abdominal pain after an overdose of an unknown medication. At presentation the patient had a severe acidosis (pH 6.75) with markedly elevated lactate (28 mmol/L). The patient received hydroxocobalamin, in addition to other therapies, for acidosis and refractory shock. Family then recovered an empty bottle of metformin from the patient's home.
Results: Intermittent hemodialysis was attempted however a blood leak alarm prevented the machine from running. Despite changing the filter, using a smaller dialyzer and changing the flow to concurrent the machine continued to alarm. Continuous renal replacement therapy was successfully initiated but the patient suffered cardiac arrest and ultimately expired.

Conclusion: This case report adds to existing literature detailing a concerning phenomenon which limits the performance of hemodialysis in a timely manner in some critically ill patients. It is our hope that medical professionals will use caution when considering administration of hydroxocobalamin and that manufacturers of hemodialysis machines will work to rectify this false alarm.

114. Prolonged Sedation From Chlordiazepoxide Resulting in a 37-Day Flumazenil Infusion – a Case Report

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Background: Bolus dosing of flumazenil is commonly used to treat iatrogenic benzodiazepine overdoses. However, given the variable duration of action of different benzodiazepines, repeated bolus dosing or a continuous infusion of flumazenil may be necessary. We describe a patient with alcoholic cirrhosis who was on a flumazenil infusion for 37-days due to prolonged sedation.
Methods: An 80-year-old man with a history of alcohol use disorder complicated by cirrhosis presented to the emergency department for abdominal distention. On day two, he developed alcohol withdrawal, for which he received a total of 350 mg of chlordiazepoxide during hospital days (HD) #2-4. On day four, the patient became increasingly somnolent and underwent an extensive but unrevealing medical workup. After bolus doses of flumazenil improved his mental status, a flumazenil infusion was started on HD #18, with subsequent improvement in his mental status. Several unsuccessful attempts were made to wean the patient from the flumazenil infusion, however the patient remained sedated. Serum and urine benzodiazepine concentrations were serially measured by liquid chromatography-mass spectrometry.
Results: Serum chlordiazepoxide and nordiazepam (an active metabolite) concentrations were 230 ng/mL and 265 ng/mL respectively on HD #21, despite no additional doses of benzodiazepines since HD #4. The patient had persistently elevated serum benzodiazepine metabolite concentrations throughout his hospital course, with a serum nordiazepam concentration of 134 ng/ml and undetectable chlordiazepoxide on HD #53. The flumazenil infusion was stopped on HD #55, 37 days after initiation, and the patient was discharged from the hospital on HD #76 to subacute rehabilitation.
Conclusion: Patients with cirrhosis may develop prolonged sedation from chlordiazepoxide due to its prolonged half-life and active metabolites. This patient had detectable metabolites of chlordiazepoxide weeks after his last dose, which appeared to cause prolonged sedation that was managed with prolonged flumazenil infusion.

115. Nalmefene Treatment of a Controlled-Release Morphine Overdose

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Background: Nalmefene is a long-acting opioid antagonist recently reintroduced to the United States market. The elimination half-life of nalmefene is 10.8 ± 5.2 hours, compared to 64 ± 12 minutes for naloxone. However, there is limited literature describing nalmefene treatment of long-acting opioid overdose, in particular controlled-release formulations.
Hypothesis: Nalmefene can treat opioid toxicity following controlled-release morphine overdose
Methods: This is a single patient case report. A 17-year-old female with schizophrenia ingested 20 fluoxetine 20 mg tablets, eight olanzapine 15 mg tablets, 20 hydrocodone 10 mg-acetaminophen 325 mg tablets, and eight controlled-release morphine sulfate 30 mg tablets.
Results: Paramedics evaluated her at home approximately 30 minutes after ingestion. She was hypopneic and bradypneic with a depressed mental status. Due to concern for opioid toxicity, two mg intramuscular naloxone was given with awakening and respiratory normalization. She arrived at the emergency department 15 minutes later. Vital signs were notable for tachycardia and normal respiratory parameters. She was awake with an unremarkable physical exam. Approximately 30 minutes after arrival, she developed obtundation, hypopnea, and bradypnea that resolved after administration of two mg intravenous naloxone. However, she remained somnolent. Approximately 80 minutes later (2.5 hours after ingestion), she developed respiratory depression with elevated end-tidal carbon dioxide, which normalized after two mg intravenous nalmefene and remained normal without additional interventions until medical clearance for psychiatric admission 17 hours after ingestion. Laboratory evaluation was notable for a four-hour acetaminophen concentration of 49 µg/mL (324.38 µmol/L) and urine drug screening positive for opiates and negative for fentanyl, methadone, cannabinoids, benzodiazepines, and barbiturates. Electrocardiography was unremarkable apart from new QTc prolongation (469 ms).
Conclusion: A single nalmefene dose antagonized opioid toxicity from controlled-release morphine, which has a therapeutic duration of action of 12 hours. Further study of nalmefene is warranted, in particular for treatment of long-acting opioid toxicity.

116. Rivastigmine in Treatment of Antimuscarinic Toxicity: A Case Series

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Background: Antimuscarinic toxicity is commonly encountered, requires intensive care monitoring, and places patients at risk for secondary injury in the setting of delirium and agitation. Physostigmine, the antidote of choice, has been unavailable since 2019. Rivastigmine, another tertiary amine available both in transdermal and oral form, has been hypothesized to be an alternative to physostigmine in the treatment of antimuscarinic delirium (AMD).
Methods: We conducted a retrospective chart review of patients treated with rivastigmine by a single toxicology consult service from July 2022 through October 2023. The primary outcome was improvement in patients' altered sensorium, with secondary outcomes including length of hospital stay, need for adjunctive therapies, and side effects reported.
Results: Nineteen patients were included. Sixteen (84.2%) were pediatric and three (15.8%) were adult; six patients (31.6%) were male, and 13 patients (68.4%) were female. The most common exposure was diphenhydramine, involved in 17 cases (89.5%). Fourteen patients (73.7%) received oral rivastigmine (median dose 3 mg, IQR 3-3 mg), three patients (15.8%) received transdermal patches (13.3 mg/24 hours), and two patients (10.5%) received both. Eight patients (42.1%) received chemical sedation prior to rivastigmine; of which, three (37.5%) needed additional sedation after rivastigmine. All patients demonstrated resolution of AMD after rivastigmine administration, although time to clinical improvement was unclear due to inconsistent documentation. Median time to medical clearance or to psychiatric consultation was 1 day. Median hospital length of stay was seven days. No adverse events were documented.
Conclusion: In this case series, all patients who received rivastigmine demonstrated clinical improvement of their AMD within one to two days with no documented adverse events. This is limited by the retrospective nature of this study and the limited documentation chronicling symptom resolution. In the setting of AMD, the use of rivastigmine *may be reasonable* when physostigmine is unavailable.

117. Survival Following Severe Diquat Toxicity Managed with Early Aggressive Therapy

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Background: Diquat is a non-selective dipyridyl herbicide that can be challenging to diagnose and carry a mortality rate of 85%. Factors contributing to this is rapid development of multi-system organ dysfunction including acute respiratory distress syndrome and shock. There is limited data in treatment following diquat toxicity that has meaningful changes in outcome.
Methods: A 77-year-old man presented with intractable vomiting and hypertension following accidental ingestion of a single swallow dark liquid in a sports bottle five hours prior to arrival. Past medical history included diabetes, hypertension, OSA, and CAD status-post stent and pacemaker placement. Initial vitals were significant for a blood pressure of 188/87 mmHg, heart rate of 72 bpm, respiratory rate 24 breaths/minute and oxygen saturation 90%. Bedside sodium dithionite testing performed five hours after ingestion demonstrated a bright green color, confirming diquat exposure. The patient was immediately started on deferoxamine, n-acetylcysteine, pantoprazole and hemodialysis. After 121 hours of hypertension, nicardipine was trialed but halted for significant systolic drop from 199 to 126 mmHg that progressed to 85 mmHg requiring a 24-hour course of norepinephrine. Approximately 48 hours post ingestion, empiric antibiotics were initiated due to fever and leukocytosis with concern for corrosive GI injury and pneumonia. Approximately 72 hours post ingestion, the patient began to have persistent hypoxemia with worsening infiltrates despite CPAP treatment requiring intubation. The patient clinically improved, was extubated after seven days and discharged to rehabilitation.
Results: Same day ingestion Diquat level was 870 ng/mL two hours into hemodialysis with values above 500 ng/mL during the first 24 hours after ingestion associated with "systemic toxicity".
Conclusion: We present a single case of unintentional diquat ingestion that received hemodialysis, deferoxamine, n-acetylcysteine, and pantoprazole within 10 hours of diquat ingestion who was successfully treated and discharged on hospital day 24 requiring weekly dialysis.

118. Phenytoin as an Antidote to Reverse Supratherapeutic Tacrolimus Levels

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Background: Tacrolimus is a calcineurin-inhibitor immunosuppressant used for prophylaxis of organ transplant rejection. Ritonavir/nirmaltrelvir are protease inhibitor antivirals used in adults at risk for severe coronavirus disease (COVID) 2019. Tacrolimus is a substrate for CYP3A4 while ritonavir is a potent CYP3A inhibitor.

Hypothesis: There is a growing body of evidence that phenytoin can be used as a CYP3A4 inducer to treat supratherapeutic tacrolimus levels.
Methods: This is a single case report involving a 73-year-old female one year post kidney and liver transplant presenting with confusion, nausea, vomiting, creatinine of 2.45 and hypomagnesemia. She had been on tacrolimus post-transplant and newly prescribed ritonavir/nirmaltrelvir for four days for COVID. On presentation she was empirically started on antibiotics for meningitis suspicion until her tacrolimus level resulted at a supratherapeutic 364 ng/mL (therapeutic trough 5-20 ng/mL).
Results: The patient was febrile, tachycardic (HR 111) and became severely agitated on admission. She continued with the meningitis treatment regimen until her cultures resulted negative. She was provided symptomatic care with intravenous fluids, magnesium repletion and sedation. Her home medications were withheld, and she was started on phenytoin to induce the CYP3A4 isoenzyme which rapidly reduced her level to 64 ng/mL in half a day. Over the course of the next two days, she returned to baseline mental status, vitals, creatinine, and her tacrolimus level was back to a therapeutic 20.4 ng/mL.
Discussion: Drug-drug interactions can be a significant source of morbidity. Tacrolimus has a narrow therapeutic index and drug interactions need to be vigilantly monitored. This case report showcases the utility of phenytoin as an antidote that by inducing CYP3A4 can increase the metabolism and clearance of tacrolimus.
Conclusion: We report a case of tacrolimus and ritonavir/nirmatrelvir interaction with a supratherapeutic tacrolimus level that was rapidly reversed with phenytoin.

119. Preparation Time for a Filtered Versus Unfiltered Bolus of Intravenous 20% Lipid Emulsion: A Simulation With Emergency Department Pharmacists

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Background: The manufacturer of intravenous lipid emulsion (ILE) recommends using a 1.2-micron in-line filter. Due to disease acuity, ILE is often administered as unfiltered boluses when treating drug toxicity. No study, to our knowledge, has compared preparation time or preparation difficulty for unfiltered versus filtered ILE boluses.
Methods: Four simulated 100 mL 20% ILE boluses were prepared in duplicate by three emergency department (ED) pharmacists using: 1) unfiltered needles; 2) 5-micron filter needles; 3) five-micron filter discs; and 4) intravenous sets with 1.2-micron in-line filters. The primary outcome was preparation time in seconds (s). The secondary outcome was preparation difficulty rated by each pharmacist on a five-point Likert scale, where one was very easy and five was very difficult.
Results: All three pharmacists were unable to prepare an ILE bolus using the five-micron filter needle due to excessive ILE loss. The mean preparation time for the unfiltered needles (100.3 s (SD 21.8 s)) was less than the five-micron filter discs (154 s (SD 32.4 s), $p = 0.007$) and the intravenous set with a 1.2-micron in-line filter (249.7 s (SD 64.5 s), $p < 0.001$). Preparation time was shorter with the five-micron filter discs compared with the intravenous set with the 1.2-micron in-line filter ($p = 0.009$). Preparation was subjectively easier with the unfiltered ILE bolus (median (interquartile range (IQR)): one (1-2)) compared to the five-micron filter discs (median (IQR): 4 (3-5), $p = 0.002$) or the 1.2-micron in-line filters (median (IQR)): three (2-5), $p = 0.009$). Ease of preparation did not differ significantly between the 5-micron filter discs and the 1.2-micron in-line filter ($p = 0.394$).
Conclusion: Though not recommended by the manufacturer, unfiltered ILE boluses appear to have easier preparation and faster preparation times versus filtered ILE boluses in this simulation with ED pharmacists.

120. Possible Increase in Alveolar-Arterial Gradient After an Unfiltered Bolus of Intravenous Lipid Emulsion in Two Cases of Drug-Induced Cardiac Arrest

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Background: Intravenous lipid emulsion (ILE) is often administered without in-line filters when used for drug-induced toxicity. The prescribing information recommends administering ILE with an in-line filter. Previous reports of pulmonary complications following the use of ILE for drug toxicity have not specified whether the ILE was filtered.
Methods: This report presents two cases of increased Alveolar-arterial oxygen (A-a) gradient following an unfiltered bolus of 20% ILE for drug-induced cardiac arrest.
Results: Case 1: 58-year-old male was intubated after ingesting lacosamide. The A-a gradient post-intubation was 242.2 mmHg. Asystolic cardiac arrest occurred with ROSC after two CPR rounds. An unfiltered 100 mL rapid bolus of 20% ILE was given immediately post-ROSC. His post-arrest A-a gradient was 405.4 mmHg. Respiratory status improved over the next four days. He was extubated on hospital day five and discharged

at baseline on hospital day ten. Case 2: 50-year-old female experienced cardiac arrest after ingesting diphenhydramine. ROSC intermittently occurred over 11 rounds of CPR and was permanently achieved after an unfiltered 140 mL rapid bolus of 20% ILE. Her post-arrest A-a gradient was 123 mmHg. Respiratory status improved within 24 hours and the patient was extubated on hospital day two. She was discharged in her normal state five days later.

Conclusions: Both cases showed a possible relationship between increased A-a gradient and unfiltered ILE. Filtration may decrease this phenomenon, as it may minimize large sized fat globule administration, which can increase pulmonary inflammation. Filtration, however, may not prevent this phenomenon, as at least one case report of a poisoned animal described an increased A-a gradient despite ILE filtration. It may be reasonable to consider filtering ILE in drug-induced cardiac arrest if it will not significantly delay administration.

121. A Comparison of Two-Bag and Three-Bag N-Acetylcysteine (NAC) Regimens for Acetaminophen Toxicity

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Background: The traditional three-bag n-acetylcysteine (NAC) protocol for acetaminophen (APAP) toxicity is associated with medication errors and non-allergic anaphylactoid reactions (NAARs). Studies have investigated alternative regimens with promising results – leading our institution to switch to a novel two-bag NAC regimen (150 mg/kg over one hour, followed by 150 mg/kg over 20 hours).

Research Question: The purpose of this preliminary analysis was to determine the incidence of NAARs requiring diphenhydramine or epinephrine treatment before and after this change.

Methods: Data was analyzed from an ongoing, broader retrospective observational study of patients requiring NAC due to APAP toxicity at two referral centers in a single health system over eight years. Data were abstracted directly from the electronic medical record. Prior to analysis, patients were separated into cohorts based on whether they received the two- or three-bag regimen. The primary outcome was incidence of epinephrine or diphenhydramine administration for NAARs. Administration of either medication was scrutinized to determine whether it was for a NAAR and excluded if not. Comparisons between groups were made using Chi square and Fisher's exact tests for categorical data and t-tests for continuous variables.

Results: We analyzed 280 patients in the two-bag group and 268 in the three-bag group. There were no significant differences in baseline characteristics. Epinephrine and diphenhydramine were administered 73 times with 32 administrations for NAARs. The incidence of NAARs was similar between the groups, 0.06% (n = 14) in the three-bag group vs. 0.07% (n = 18) in the two-bag group (p = 0.39).

Conclusion: We found no difference in NAARs requiring treatment with epinephrine or diphenhydramine between our two-bag protocol and the traditional approach. Recognizing the limitations of this study, ongoing future analysis of this cohort includes assessing NAAR frequency, liver injury incidence, and administration errors.

122. N-Acetylcysteine and Fomepizole Dosing Adjustment With High Flow CVVH in Acetaminophen Poisoning: A Case Series

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Background: N-acetylcysteine (NAC) and fomepizole clearance under typical CVVH flow rates (25-35 ml/kg/h) is reported to be minimal. We present two cases of acetaminophen (APAP) poisoning treated with high flow CVVH requiring adjustment of antidote dosing.

Methods: Case 1: 18-year-old male presented after acute ingestion of APAP 125 grams, with four-hour APAP level 739 mcg/mL. He received IV NAC and fomepizole. Five hours post-ingestion the patient developed shock, altered mental status and acidosis. He received a four-hour session of hemodialysis. APAP level after hemodialysis was 730 mcg/mL. Due to shock, he received high flow CVVH at 90 ml/kg/h rather than additional hemodialysis. NAC was continued at 12.5 mg/kg/hr supplemented with oral NAC 70 mg/kg every (q) 4 hours, and fomepizole dosing was ten mg/kg q6 hours. CVVH and fomepizole were discontinued when the patient's APAP level became undetectable 57 hours after ingestion. He never developed hepatotoxicity and made a full recovery. Case 2: 63-year-old female developed hepatotoxicity after taking 7.5 g APAP daily. Despite NAC at 12.5 mg/kg/h and fomepizole, the patient developed acidosis, coagulopathy and hyperammonemia (259 mCmol/L). CVVH was started at 51 mL/kg/h. NAC rate was increased to 25 mg/kg/h and fomepizole to 10 mg/kg q8h. The patient also received three sessions of plasma exchange followed by 75 mg/kg IV NAC. On hospital day four her acidosis, coagulopathy, and encephalopathy all significantly improved. Unfortunately, on hospital day seven the patient developed upper GI bleed and worsening mental status. She was provided comfort care by family and passed away.

Conclusion: NAC and fomepizole are minimally cleared at typical CVVH flow rate; however greater clearance is expected at higher rates and likely require dose adjustment of antidotes. Toxicologists should be aware that CVVH flow rates may be increased in critically ill patients and adjust antidote dosing to compensate.

123. Acetaminophen-Associated Methemoglobinemia, a National Poison Data System Case Series

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Background: Methemoglobinemia (MetHb) associated with acetaminophen (APAP) toxicity has previously been described in animals but rarely seen in humans. Our aim was to characterize cases of acetaminophen-associated methemoglobinemia.
Methods: We conducted a retrospective case series using data from the National Poison Data System evaluating human APAP ingestions coded with methemoglobinemia as a clinical effect from January 1, 2019 to January 31, 2022. Inclusion criteria were 1) primary APAP exposure coded with MetHb as a clinical effect; 2) reported % MetHb; 3) treatment at a healthcare facility and 4) outcome coded as ≥ moderate effect. Exclusion criteria: not followed to known outcome, minor or unrelated outcome and any co-ingestants associated with causing MetHb. Characteristics of interest include the proportion of APAP cases meeting "massive" criteria, treatment with methylene blue (MB) and fatal outcome.
Results: Fourteen cases met the inclusion criteria and four were excluded. All cases were acute adult APAP ingestions and four had co-ingestions. Median (IQR) peak APAP concentration was 143 mcg/mL (25 to 518). Six cases had an unknown time of ingestion. Six cases were presumed massive APAP ingestions. The median (IQR) highest reported MetHb level was 14.3% (12.6 to 21.8), and eight (80%) patients had clinical effects including cyanosis, chocolate-brown blood or SpO2 < 90% without improvement on oxygen. Methylene blue was administered in seven of ten cases with only one patient demonstrating clinical improvement after administration. Repeat MB doses were given in four cases. Hemolysis was reported in four cases: two of which occurred prior to MB administration, one after MB administration, and one with an unknown time frame. Five patients received some form of transfusion. Three patients died.
Conclusion: APAP-associated MetHb appears to be rare and in this series occurred more often in large APAP ingestions. Methylene blue administration was not effective in most cases.

124. Portal Venous Gas and Caustic Injury From Large-Volume 3% Hydrogen Peroxide Ingestion

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Background: Hydrogen peroxide (H2O2) is an oxidant used in many household and industrial applications. Ingestion of 3% solution typically results in no clinically significant caustic injury, while ingestion of concentrated solution is associated with gastrointestinal tract injuries.
Research Question: What are the clinical effects of large-volume ingestion of 3% H2O2?
Methods: This is a single patient chart review. A 26-year-old man presented to the emergency department with abdominal pain, nausea, and hematemesis 1.5 hours after a reported ingestion of 40 ounces (1,183 milliliters) of 3% hydrogen peroxide. Physical examination demonstrated epigastric and right upper quadrant tenderness. The patient did not experience any respiratory symptoms, hemodynamic changes, or neurologic deficits. Computed tomography (CT) of the abdomen with intravenous contrast was obtained, and esophagogastroduodenoscopy (EGD) was performed.
Results: CT of the abdomen showed extensive portal venous gas, thickening of the gastric antrum and pylorus, and a thickened, hypo-enhanced duodenum. EGD found erosions of the stomach and duodenum consistent with a Zargar 2A injury. The patient's diet was advanced during his course, and he could tolerate enteral nutrition at the time of discharge on hospital day four.
Conclusion: This large-volume ingestion of 3% H2O2 resulted in caustic injury of the gastrointestinal tract in addition to the anticipated liberation of free oxygen resulting in extensive portal venous gas.

125. Rectal Hydrogen Peroxide-Induced Portal Venous Emboli Treated With Hyperbaric Oxygen Therapy

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Background: Colitis and rectal bleeding as a result of rectal instillation of hydrogen peroxide has been described. There is one report in the literature describing portal venous gas embolism in the setting of rectal peroxide administration,

which was managed conservatively, resulting in resolution of emboli at 48 hours.
Hypothesis: Pneumatosis intestinalis and portal venous gas may result from rectal instillation of hydrogen peroxide and a potential treatment option is hyperbaric oxygen.
Methods: This is a single-patient chart review. A 44-year-old female presented to the ED after instilling an unknown amount of 3% concentration of hydrogen peroxide (H2O2) rectally. She was administering daily coffee enemas and unintentionally performed her enema with the H2O2 she had used to clean the bag. She evacuated immediately upon realizing her mistake. She sought medical attention 75 minutes after the exposure for rectal bleeding and abdominal pain. In the Emergency Department a saline enema was administered for decontamination and hydromorphone was given for pain. A CT scan revealed colitis of the descending colon, pneumatosis intestinalis of the sigmoid colon and air in the portal venous system. The patient was given intravenous antibiotics.
Results: A nearby hyperbaric center was consulted, and hyperbaric therapy was recommended. The patient was transported via ground ambulance and received two treatments of hyperbaric oxygen over the next 24 hours. A CT scan subsequently showed extensive colitis with significantly improved pneumatosis intestinalis and resolution of portal venous gas. She received five additional hyperbaric treatments for tissue necrosis. Her symptoms improved and she was able to be discharged home.
Conclusion: In this patient, pneumatosis intestinalis and portal venous gas after hydrogen peroxide enema was treated with hyperbaric oxygen and may have hastened resolution of air emboli.

126. Rising Frequency of Fatal Sodium Nitrite Exposures in the United States

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Background: Fatal sodium nitrite ingestions have been increasingly popularized by "suicide kits" available on the internet. National Poison Data System (NPDS) data from 2018-2019 identified this emerging trend associated with high mortality rates. It is unclear if this trend has continued despite increased national awareness and mitigation efforts.
Hypothesis: There is a small but notable increase in frequency of deaths associated with intentional sodium nitrite ingestions from 2019 to 2023 when compared to previous data.
Methods: This is a retrospective analysis of 2019-2022 NPDS data collected for sodium nitrite exposures, analyzing for both outcomes of intentional self-harm ingestions as well as frequency of exposures and treatment interventions. Cases which were followed to a known outcome were included for analysis.
Results: There were 124 cases of sodium nitrite ingestion identified during the study period. Of these, 59% (74) were intentional ingestions and 90% (67) were self-harm attempts. Twenty-eight (28) patients died following intentional self-harm ingestion; there were five deaths in the cohort not categorized as suicide attempts. Prevalence of intentional self-harm ingestion increased over time with 14 cases and six fatalities in 2019 up to 38 cases and 16 fatalities in 2022. Consistent with previous data, over 80% of deceased patients were given CPR, methylene blue, and oxygen (24, 23, and 23 cases, respectively in the attempted self-harm cohort). Many other interventions were trialed in lower percentages. All-reason exposures to sodium nitrite increased during the study period from 33 cases in 2020 to 61 cases in 2022.
Conclusion: Medical providers need to be aware of the increasing frequency of sodium nitrite exposures and the nearly 50% case fatality rate with intentional ingestions.

127. Rasburicase-Induced Methemoglobinemia in a Patient Without G6PD-Deficiency

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Background: Rasburicase is a recombinant urate-oxidase enzyme used in the treatment of hyperuricemia associated with tumor lysis syndrome. Rasburicase is well known to cause methemoglobinemia but typically this is not a rapidly occurring event except in patients with G6PD deficiency.
Methods: This is a single patient case report. An 11-month-old female presented for new onset leukemia with leukocytosis, thrombocytopenia, and anemia. The patient was noted to have an elevated uric acid level of 7.7 mg/dL and was treated with 1.5 mg intravenous rasburicase. Approximately three hours after receiving rasburicase, the patient developed perioral cyanosis and an oxygen saturation of 85%. Her hemoglobin was 5.4 g/dL and a VBG showed pH 7.45, pCO2 30.6 mmHg, and a methemoglobin level of 12.9%. She underwent endotracheal intubation and received one unit of packed red blood cells.
Results: An ABG was then obtained showing pH 7.27, pCO2 45.5 mmHg, pO2 127.2 mmHg, and methemoglobin level of 14.1%. The patient received 1 mg/kg of methylene blue and subsequently had rapid improvement in oxygenation. Her repeat ABG showed pH 7.39, pCO2 35.5 mmHg,

pO2 410.3 mmHg, and a methemoglobin level of 5.3%. The patient was successfully extubated within a few hours. The patient was screened for G6PD on her day of presentation and again on day five. Both tests were within normal limits.
Conclusion: Previously described cases of methemoglobinemia due to rasburicase have generally been associated with G6PD-deficiency. Methemoglobinemia after rasburicase has rarely been reported in patients with normal G6PD. This case adds to the body of evidence that rasburicase can rapidly cause methemoglobinemia even in patients without G6PD-deficiency. Clinicians should be aware of this potentially life-threatening adverse reaction and monitor all patients receiving rasburicase for the first time.

128. When Bodybuilding Meets "Body-Bleeding": A Case Report Showing the Interaction Between SARMs and Warfarin

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Background: It is known that many supplements and foods interact with warfarin which can lead to supratherapeutic INR levels and, consequently, life-threatening bleeding. In an era of designer performance enhancing drugs, Selective Androgen Receptor Modulators (SARMs), have become popular amongst the bodybuilding community due to their perceived ability to increase muscle mass without affecting natural testosterone production. Outside of bodybuilding forums and a few case reports suggesting an interaction between SARMs and warfarin, there is paucity of data on their potential medication interactions.
Method: This is a case of a 53-year-old man who presented to our ED due to tongue swelling. His past medical history was significant for mechanical mitral valve replacement on warfarin. He awoke with lingual and sublingual swelling, trismus, muffled voice, and drooling. He denied recent dental work, trauma, grapefruit ingestion, or medication adjustments. His only lifestyle change was the initiation of sublingual RAD140 one week prior. Physical exam showed lingual and sublingual edema, purple discoloration, concerning hematoma. During his short ED stay, his swelling worsened, compromising his airway.
Results: His labs were remarkable for PTT 154, PT-INR of 8.88 which rose to 10.09 after approximately six hours. Three weeks prior, his INR was 3.13. He was emergently intubated in the OR by ENT given worsening hematoma. Warfarin was not reversed due to mechanical valve. The patient was admitted in the ICU for six days and was ultimately extubated once his INR was 1.43.
Conclusion: This case demonstrates that potential SARMs interaction with warfarin leading to a supratherapeutic INR. Therefore, patients on warfarin who are coming in with spontaneous, nontraumatic hematoma formation that are found to have supratherapeutic INR levels should also be questioned on their use of SARMs. Furthermore, patients on warfarin should be educated by their provider on avoiding the use of SARMs.

129. Presenting a Case of an Alendronate Overdose Resulting in Colonic Pseudo-Obstruction, Mesenteric Ischemia, Sepsis, and Death

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Background: To our knowledge there have been no reported cases of fatal bisphosphonate overdoses, and this case report serves as a novel insight into this possibility.
Hypothesis: Alendronate and the inactive ingredient magnesium stearate can lead to severe gastrointestinal dysfunction, including colonic pseudo-obstruction.
Methods: This is a single patient chart review. We present the case study of an 84-year-old woman who presented to the Emergency Department as a bounce back after being seen for the accidental ingestion of approximately 420 mg of oral alendronate, which we believe caused a colonic pseudo-obstruction, possibly as a result of magnesium stearate as an inactive ingredient causing severe hypermagnesemia and colonic dilation, which was associated with sepsis, acute renal failure, and acute mesenteric ischemia ultimately resulting in her death.
Results: The initial emergency department visit was largely unremarkable except for a magnesium level of 2.8 and a calcium level of 10.5. The patient requested a milk and molasses enema for her chronic constipation and was discharged in stable condition following a large bowel movement. She returned around nine hours later with a magnesium of 6.5 and calcium of 11.5, a distended and peritoneal abdomen found to be caused by a colonic pseudo-obstruction, E. coli bacteremia, acute renal failure, and acute mesenteric ischemia without perforation and was subsequently taken to the operating room. She expired the next day from overwhelming sepsis.
Conclusion: Although there are no reported deaths from bisphosphonate overdose, we believe that this patient's demise can ultimately be linked to her accidental alendronate overdose, possibly as a result of the inactive ingredient magnesium stearate. Bisphosphonate overdoses can rarely require aggressive calcium supplementation and hemodialysis, and megacolon can be associated with hypermagnesemia.

130. Life-Threatening Subdural Hemorrhage Associated With Nattokinase

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Background: Nattokinase is an enzyme found in natto, traditional Japanese food made of soybeans which are fermented with the help of bacterium *Bacillus subtilis ssp*. natto. Nattokinase promotes fibrinolysis by degrading fibrin clot both directly and indirectly. Nattokinase is marketed as a dietary supplement to promote cardiovascular and circulatory health and is available on the internet and in stores. We present a case of life-threatening hemorrhage in a patient who was taking nattokinase.
Methods: This is a single-patient case report. An 87-year-old woman with a history of atrial fibrillation who presented to the hospital with altered mental status. She was taking "Doctor's Best Nattokinase" 2000 FU (enzyme activity in fibrinolytic units) daily for two months. She was not taking additional anticoagulants. There was no reported history of trauma. Last dose of nattokinase was more than 12 hours prior to hospital arrival. Initial brain CT revealed subdural hematoma.
Results: Initial laboratory analysis was notable for the following: platelets $463x10^9$/L, INR 1.1, PT 13 seconds, and fibrinogen concentration of 165 mg/dl. The patient was treated with one unit of cryoprecipitate with improvement of fibrinogen concentration to 403 mg/dl. The repeat brain CT was stable without additional bleeding.
Conclusion: Nattokinase is an enzyme found in fermented soybean that promotes fibrinolysis. It is marketed as a dietary supplement. We describe a case of a patient who developed life-threatening brain hemorrhage while taking nattokinase in absence of other anticoagulants. Patients taking nattokinase should be counseled about its potential for bleeding adverse effects. Reversal strategy with cryoprecipitate should be considered in patients with life-threatening hemorrhage.

131. DoorDashing an Overdose to Your Doorstep

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Background: Suicide attempts in young adults have been rising in recent years. Despite home medications being secured, medications can now be delivered to a person's doorstep within the hour. We report two cases where the patient ordered acetaminophen via an online delivery service.
Methods: This is a chart review of two case reports.
Results: Case one: A 16-year-old female with a past medical history of depression and three prior self-harm attempts on aripiprazole and fluoxetine was found vomiting at home. Knowing the patient had no access to her locked-up medications, her mother called emergency medical services (EMS). EMS discovered a 100-count acetaminophen 500 mg bottle had just been delivered via DoorDash® and was missing 18.5 grams. Her liver function tests on presentation were normal and her four-hour-acetaminophen level was 52 mcg/mL. She was admitted to the inpatient psychiatric unit. Case two: A 22-year-old female with a history of self-harm was discovered with a large bottle of acetaminophen missing 100 grams. All medications were secured and locked, and it was discovered that the patient had ordered acetaminophen via DoorDash® approximately nine hours prior. She was taken to the emergency department and was noted to be restless and altered. Her acetaminophen level was > 600 mcg/mL and her liver function tests were normal. Her pH was 7.2 with a lactate of 5.6 mmol/L. Her vital signs were stable. She was intubated for an altered mental status, given N-acetylcysteine, fomepizole and received hemodialysis. Her liver function tests remained normal throughout, and she was discharged home without sequelae.
Conclusion: This case report raises awareness of the ability of a teenager to order and get delivered xenobiotics to the doorstep within minutes. Lawmakers should consider implementing regulatory guidelines on potentially harmful substance delivery including OTC pharmaceuticals to minors.

132. Utility of a Multicenter Clinical Surveillance System to Describe the Variability of N-Acetyl Cysteine Treatment in Single Agent Acetaminophen Poisonings*

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Background: Acetaminophen (APAP) remains a common agent in acute poisonings and a cause of pharmaceutical-induced liver toxicity. The antidote N-acetyl cysteine (NAC) serves as recommended therapy informed by medical history, coingestants, extended-release formulations, serum APAP levels and/or timing of exposure to presentation.
Research Question: Can understanding the differences between APAP-poisoned patients receiving and not-receiving NAC within the Toxicology Investigators Consortium (ToxIC) registry help identify clinical variation in the treatment of such cases?

Methods: This cohort study consisted of prospectively collected data of single agent APAP poisoning reported to the ToxIC Core Registry January 1, 2019, to September 30, 2023. Participants record deidentified patient information from the electronic health record and evaluating medical toxicologist related to demographics, clinical presentation, and toxicologic treatment via REDCap^{TM}. Starting in 2019, ToxIC requires indication of toxicity nomogram (Rumack-Matthew) and extended-release formulation in APAP cases. Data for this preliminary analysis include standardized fields related to antidote treatment, hepatic toxicity (AST or ALT >1000, or ALT 100-1000 IU/L), and vital status.
Results: Among 2495 cases of APAP-only exposure in ToxIC over this period, 7.3% reported an extended release modified formula. 90.9% of all cases received NAC treatment. No statistically significant differences appeared for NAC treatment by age category, sex, or race/ethnicity. A higher percentage of those with hepatotoxicity (97.9%) received NAC compared to those without hepatotoxicity (88.9%; $p < 0.001$). Reported mortality was higher among those treated (1.6%) versus not treated with NAC (1.3%; $p = 0.03$). Line crossers (Rumack-Matthew nomograms) comprised 21.0% of all single APAP exposures, while 47.4% reported as non-line crossers. The remainder indicated no nomogram obtained (12.3%), no repeat APAP levels (1.6%), or status unknown/missing (17.6%).
Conclusion: ToxIC accrues a substantial set of APAP poisonings, additional fields to inform modeling single and poly-drug cases might include the timing and reasoning around nomogram utilization.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

133. Prolonged Critical Illness in an Adolescent Due to Massive Naproxen Ingestion

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Background: Critical illness is rare following even massive NSAID ingestions. We hypothesize that non-invasive support including diuresis and bicarbonate infusion may adequately treat oliguric renal failure and metabolic acidosis following massive naproxen ingestion.
Methods: Case report describing a massive suicidal naproxen ingestion in a 15-year-old female with a history of anxiety.
Results: Two hours after an unknown ingestion, the patient presented to a local Emergency Department obtunded and hypoventilatory after seizure-like activity. She was intubated for respiratory failure and was notably acidemic (ABG pH, 7.04 / pCO_2, 30.5 mmHg / bicarbonate 8 mEq/L). Family later reported up to 200 naproxen tablets unaccounted for. Acidemia persisted despite bicarbonate infusion (serial blood gasses 7.17 / 37 / 13; 7.21 / 34 / 15; 7.32 / 24 / 12; 7.4 / 29 / 18 over days zero to two); late oliguric renal failure (initial creatinine 0.85 mg/dL, peak creatinine 4.16, day three) and moderate transaminase derangement followed. Her course was complicated by refractory lactic acidosis, prolonged QTc (542 msec), coagulopathy with gastrointestinal hemorrhage requiring multiple platelet and plasma product transfusions. Multiorgan damage resolved on day 7 with supportive treatment including intravenous fluids, multiple vasopressors, and bumetanide infusions, and ventilatory support. Hemodialysis and ECMO were considered but not performed. She recovered fully and was discharged to acute inpatient rehabilitation on day 19. Testing for co-ingestions (acetaminophen, salicylate, ethylene glycol, iron) were unrevealing. Admission naproxen concentration was 1,200 mcg/mL (reference 30-90 mcg/mL).
Conclusion: Naproxen ingestions rarely cause severe illness. Nonetheless, isolated massive ingestions may generate severe metabolic derangement, renal failure and hemodynamic instability. Prolonged refractory acidemia with multiorgan involvement absent evidence of other ingestions should prompt suspicion for massive NSAID overdose. This case highlights the potential for naproxen to cause critical illness refractory to aggressive supports.

134. Adolescent Ibuprofen Exposures and Trends: 2017 - 2022

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Background: Ibuprofen overdose is commonly reported to poison centers, but infrequently results in serious toxicity. Given concerns regarding pediatric mental health during the pandemic, we examined trends in adolescent ibuprofen exposures between the pre-pandemic years and the pandemic years.
Methods: We performed a retrospective analysis of the National Poison Data System (NPDS) for ibuprofen single substance exposures in teenagers 13 to 19 years of age. Data were analyzed with a focus on clinical effects, laboratory findings, therapies, and outcomes. $\chi 2$ tests were performed to determine if there were significant changes in overdose frequency and severity between pre-pandemic years (2017–2019) to the pandemic years (2020–2022).
Results: There were 41,674 adolescent single substance ibuprofen exposures from 2017 to 2022. A majority (54.1%) of exposures occurred in teenagers aged 14-16. Although there

were significantly more ibuprofen exposures in the pandemic years compared to the pre-pandemic years ($p < 0.001$), the rates of hospital admission and clinical effects were similar ($p = NS$). The most common symptoms were abdominal pain (17.2%), nausea (16.8%), vomiting (15.1%) and CNS depression (5.8%). The most common laboratory findings were acidosis (3.3%) and increased anion gap (2.0%). Invasive therapies were utilized in a small minority of single substance ibuprofen exposures: 19 patients received hemodialysis, two received CRRT, and four were placed on ECMO.
Conclusion: During the COVID-19 pandemic, there was a significant increase in the number of adolescent single substance ibuprofen exposures coded in NPDS, but no increase in rates of hospital utilization or major clinical effects. This may be attributed to ibuprofen's excellent safety profile or that these overdoses represented suicidal gestures, rather than serious attempts. Although most resulted in minor or no clinical effects, a minority of teenagers demonstrated CNS depression, acidosis and some required renal replacement therapy.

135. Systemic Tranexamic Acid Toxicity Following Bronchoalveolar Lavage

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Background: Tranexamic acid is used clinically as a hemostatic agent. It is a lysine analog that acts as a competitive GABA-A and glycine receptor antagonist in the central nervous system. Potentially life-threatening systemic toxicity is characterized by altered mental status, myoclonus, and convulsions and has been reported following oral, intravenous, and intrathecal administration. Toxicity via other routes, such as bronchoalveolar lavage, is poorly described.
Hypothesis: Tranexamic acid can cause systemic toxicity via bronchoalveolar lavage.
Methods: This is a single patient case report.
Results: A 44-year-old male with a history of congenital pulmonary arteriovenous malformations underwent routine bronchoscopy for chronic hemoptysis. He was pretreated with nebulized tranexamic acid 500 mg three times daily for 48 hours, then received 1000 mg via bronchoalveolar lavage for hemostasis during bronchoscopy. Fentanyl, midazolam, ondansetron, and propofol were also administered during the procedure. The patient's home medications were albuterol, famotidine, warfarin, tiotropium, montelukast, losartan, and fluticasone-salmeterol. One hour post- procedure, he developed obtundation, myoclonus, lower extremity rigidity, bilateral clonus, and hyperthermia unresponsive to midazolam, dantrolene, and external cooling. These symptoms were controlled with vecuronium and propofol infusions, which were continued for 24 hours. Neuroimaging and electroencephalogram were both unremarkable. These symptoms resolved after three days, and he was discharged on hospital day 17 without any residual effects. A serum tranexamic acid concentration was obtained four hours post-bronchoscopy but has not yet resulted.
Conclusion: Tranexamic acid toxicity can occur via pulmonary instillation. The treatment is benzodiazepine administration and general anesthesia with propofol or general inhalational anesthetic to non-competitively restore function of GABA-A and glycine receptors. Adjunct neuromuscular blockade can also be considered. High doses of tranexamic acid by any route should be used carefully, especially in the setting of abnormalities that may predispose to excessive absorption such as arteriovenous malformations.

136. Atropine Toxicity From Ashwaganda Herbal Product

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Background: Ashwagandha, an herbal product marketed as an adaptogen, is used for various complaints. Despite being a member of the nightshade family, it has not been found to contain atropine and no anticholinergic effects from ashwagandha have been reported. Adulteration and contamination of herbal products, however, is a well-documented problem.
Hypothesis: Unexpected toxicity from an herbal product may be related to an adulterant.
Methods: This is a single patient case report with bedside toxicology consultation and confirmatory laboratory testing. A 50-year-old man presented to the Emergency Department (ED) as a stroke alert after being found altered on the bathroom floor at his place of work. His symptoms included agitated delirium, floccillation, tachycardia, dry skin and mucous membranes, and urinary retention. Stroke workup was unremarkable. An ECG revealed sinus tachycardia with narrow intervals. Toxicology was consulted and recommended an expanded urine drug panel and rivastigmine based on anticholinergic toxidrome. 6 mg was given by mouth. The encephalopathy and vital signs improved within an hour of

administration. The patient provided history that he had added a "generous tablespoon" of an ashwagandha product purchased online to a smoothie, which he drank on the morning of presentation. His home medication list did not contain medications with anticholinergic effects, and he denied use of over-the-counter drugs. The remaining ashwagandha product was obtained for testing at a commercial laboratory.
Results: The urine drug panel resulted on hospital day two and revealed atropine present. It was negative for all other drugs. Results of the product testing confirmed atropine presence in the patient's ashwagandha product but not a control.
Conclusion: Herbal products are poorly regulated and not subject to approval by the Food and Drug Administration. Adulteration is a known phenomenon. Patients should be treated based on symptoms and confirmatory testing done when possible.

137. Themes and Descriptions of Kratom Use in Social Media Data

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Background: Kratom is an herbal product increasingly utilized for its opioid and stimulant-like effects, including treatment of pain and opioid withdrawal. Kratom and its alkaloids are not approved for therapeutic use by the FDA. More research is needed to understand kratom use practices and associated adverse effects. Social media can provide novel experience data about the use of unregulated substances.
Research Question: What are the themes associated with kratom use reported among social media resources? Do differences exist in the frequency of themes reported across these resources?
Methods: We conducted a retrospective review of social media posts on Twitter and Reddit in 2023. Samples of Twitter and Reddit posts were reviewed and coded thematically. Reddit posts were restricted to a single 'kratom' subreddit. Counts within themes for Twitter and Reddit were recorded.
Results: Two hundred and eighty-five kratom-related Twitter posts were recorded and reviewed between 7/1/2023 and 9/10/2023. During this time, 5587 kratom-related Reddit posts were recorded: a sample of 200 posts were analyzed. Across both sources, frequent themes identified included (1) kratom use side effects (21.5% Reddit, 1.9% Twitter); (2) recipes/dosing/formulations (21.5% Reddit, 2.4% Twitter); (3) kratom as treatment for pain/opioid use disorder (OUD) (14.5% Reddit, 52.4% Twitter), and (4) kratom dependence/withdrawal (14% Reddit, 6.7% Twitter). Kratom side-effect sub themes included concerns about fatigue, paresthesia/musculoskeletal tremors, and serotonin toxicity associated with kratom use. Sub-themes associated with pain/OUD included weaning off kratom prior to surgery and using kratom in conjunction with other opioids (oxycodone, buprenorphine). Kratom withdrawal sub-themes included concerns about stopping kratom based on frequency, dose, and chronicity of kratom use.
Conclusion: Social media resources demonstrate robust discussion of kratom use, side effects, dosing/recipes, and withdrawal. Future studies will characterize kratom subthemes and descriptions to better understand the experiences of people who use kratom.

138. Tanta University Risk Model Stratifies the Risk of ICU Need in Poison Control Center Consultations

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Background: The aim of this study is to independently validate the predictive value of the Tanta University Risk Model (TRiM) for intensive care requirements in poison control center consultations by telephone.
Methods: Four hundred consecutive acutely poisoned patients were included in this study. During initial consultation of the poison control center, clinical and laboratory parameters were recorded. Patients who – at the time of consultation - were already ventilated or on vasopressors were excluded. The TRiM was calculated from the data according to the following equation: Tanta University Risk Model = -1.966*Glasgow Coma Scale-0.329*oxygen saturation (%)-0.212*diastolic blood pressure (mmHg)+0.27*respiratory rate (1/min)-0.33*standard bicarbonate (mmol/L). Forty-eight hours later, the patients' courses were followed up by phone. The Tanta University Risk Model was then compared to a composite endpoint indicating an ICU requirement (death in hospital, vasopressors, need for intubation).
Results: Four hundred consultations for acute intoxications could be analyzed. Thirty-seven of 400 patients had a complicated clinical course as defined by meeting the primary endpoint definition. Receiver operating characteristic analysis revealed the area under the curve to be 0.87 (95% confidence interval 0.83-0.90). A positive Tanta University Risk Model was defined > -73.46 using a cut-off derived from an

unrelated analysis of poisoned in-patients admitted to our own service. Thirty-one of 37 complicated courses had a positive Tanta University Risk Model, as compared to six complicated courses among 306 patients with a negative Tanta University Risk Model ($p < 0.000000001$, Fisher's exact test). Sixty-three patients had a positive Tanta University Risk Model score but an uneventful course. The negative predictive value of the Tanta University Risk Model was 0.98 (95% confidence interval 0.96-0.99), sensitivity was 0.81 and specificity 0.83.
Conclusion: The TRiM is significantly linked to outcome in poison control center consultations. Patients with a negative Tanta University Risk Model score are unlikely to need an ICU level of care.

139. Descriptive Analysis of the First And Only Medical Toxicology Intensive Care Unit in Turkiye: First Year Experience

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Background: Medical toxicology is not a recognized subspecialty in most countries. The aim of this study is to share the first year of experience of Turkey's first medical toxicology intensive care unit (ICU) which is directed by the only certified medical toxicologist across the country.
Method: This descriptive, cross-sectional study retrospectively investigated all clinical and laboratory characteristics of patients admitted to the Basaksehir Cam and Sakura City Hospital Medical Toxicology ICU between October 2022-October 2023. The cases were evaluated in terms of age, gender, type of poisoning, antidote, extracorporeal method usage, prognosis, length of hospital stay and mortality. The data was analyzed by the SPSS program for statistical comparisons.
Results: Eight hundred and ninety-eight patients were included, with an average age of 35.2 years (range: 18-94). Most were in the young group (18-25 years old, n = 329), while 7.9% were 60 or older (n = 71). Five hundred and forty-five (60.7%) patients were female, and 353 (29.3%) patients were male. Regarding medication, 567 patients took only one type of medication while others presented with multidrug overdose. The most common types of poisonings were acetaminophen and SSRIs. Specific antidotes were administered to 167 patients: N-acetylcysteine (NAC) for acetaminophen overdose (n = 118) and 10% ethanol for methanol intoxication (n = 27). Extracorporeal treatment (ECTR) was applied to 42 patients, including methanol poisoning (n = 25), lithium poisoning (n = 6) and metformin poisoning (n = 3). The average length of hospital stay was 2.9 days. The mortality rate was 1.78% (n = 16).
Conclusion: Patients directly cared for by medical toxicologists experienced favorable differences in LOS and mortality. Medical Toxicology ICUs should be considered as a potential model of care for future toxicology services, especially with current trends of increasing demand for service efficiency.

140. Results of the Spanish Toxic Surveillance System (STSS) in 2022: Acute Poisoning by Chemicals in Spain

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Background: Spanish Toxic Surveillance System (STSS) is a program running since 1999 that aims to report cases of acute poisoning by chemical products in Spanish EDs to the Health Ministry to evaluate the risks of exposure to these substances under the current EU regulations. We present the results of the 2022 Program.
Methods: The participating hospitals report all cases of intoxication due to household, agricultural, or industrial chemicals treated in their ED. The cases are uploaded to an online questionnaire and downloaded on a regular basis to a database (File Maker 11.0®) that allows a final yearly report to be presented to the Health Ministry.
Results: In 2022, the program collected 1,101 cases from 21 hospitals covering a population of about 10 million people. Mean age is 39 ± 23. The distribution by sex is even: 526 (48%) men (age 38 ± 23) and 543 (49%) women (age 41 ± 24). Young patients under 16 are 176 (16%). Domestic accidents are significantly prevalent (71%), followed by suicide gestures (13%) and occupational accidents (12%) ($p < 0.05$). The main involved chemicals are toxic gases (36%), caustics (25%), irritant gases (12%), detergents (8%), solvents (8%), and pesticides (4%). The main routes of entry are respiratory (52%) and oral (36%). Ocular (10%) and cutaneous contact (4%) are much less frequent ($p < 0.05$). 80% of the patients were symptomatic at admission, presenting with digestive (32%), respiratory (26%), neurological (25%), and ocular (11%) symptoms, most of them mild. 77% of cases received some treatment, mainly symptomatic (52%). In 32% of the cases, some antidote, mainly oxygen, was used in CO poisonings. Only three cases were admitted to the ICU. There were three lethal cases.
Conclusion: Acute poisoning by chemicals in Spain is a low-risk event caused mainly by domestic accidents mainly due to toxic gasses (CO) and cleaning caustic agents.

141. Intentional Ingestion of Dry-Chemical Fire Extinguisher Leading to Multiorgan Failure

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Background: Significant toxicity from exposure to the contents of modern fire extinguishers is rare. However, dry chemical extinguishers contain monoammonium phosphate which can cause significant electrolyte abnormalities, multiorgan failure and death when intentionally ingested.
Hypothesis: Ingestion of monoammonium phosphate can lead to hyperphosphatemia, metabolic abnormalities, and multi organ system failure necessitating early hemodialysis.
Methods: This is a single patient chart review. A male patient in his forties presented to the emergency department (ED) of a tertiary care hospital in cardiac arrest. Prior to the arrest, the patient was seen striking himself on the head with a fire extinguisher and then expelling the contents of the fire extinguisher into his mouth. He received 12 minutes of cardiopulmonary resuscitation (CPR) prior to arrival in the ED. In the ED, CPR was continued, and return of spontaneous circulation (ROSC) was achieved. He was intubated but was persistently hypoxic. Initial labs were notable for significant anion gap metabolic acidosis with pH of < 6.7, bicarb of 9, anion gap of 41, potassium of 6.8, and phosphorus > 40.
Results: Treatments provided included fluids, gastric contents aspiration, albuterol, insulin, furosemide, sodium bicarbonate, and esmolol for persistent tachycardia. He was admitted to the intensive care unit (ICU) and nephrology was consulted for emergent dialysis which was only provided for a total of 2.5 hours secondary to repeated clotting of the dialysis circuit despite an initial INR of 1.24. The patient's ICU course was complicated by kidney injury with high urine output and subsequent hypokalemia, Gram + cocci bacteremia likely secondary to aspiration pneumonia, and hypoxic ischemic encephalopathy. The patient ultimately died five days after his ingestion.
Conclusion: Intentional ingestions of monoammonium phosphate can lead to significant electrolyte abnormalities including hyperphosphatemia, multisystem organ failure, possibly coagulopathy, and can be fatal. Early dialysis may be warranted to correct renal injury and electrolyte abnormalities.

142. I Got a Fever: A Case Series of Occupational Exposure to Perfluoroisobutylene (PFIB)

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Background: Perfluoroisobutylene (PFIB) is a highly toxic perfluorocarbon produced during pyrolysis of polytetrafluoroethylene. The putative etiological agent of polymer fume fever, PFIB may lead to severe and potentially delayed pulmonary toxicity following significant exposure.
Hypothesis: Short-term high-level exposure to perfluoroisobutylene can lead to mild clinical toxicity.
Methods: This is a single case series. Four men, aged 35, 37, 51, and 56, were exposed to perfluoroisobutylene at a chemical plant while manipulating a line set, releasing a large volume of perfluoroisobutylene (30 ppm). All four men underwent in-situ decontamination via a 15-minute shower then presented to a local emergency department (ED) for evaluation.
Results: On presentation, all four patients were noted to have mucosal irritation on exam. The 56-year-old man, who was directly over the site of exposure, reported chest pressure and dyspnea. His vital signs were notable for tachycardia and hypoxia, requiring supplemental oxygen via non-rebreather. He was administered methylprednisolone 500 mg IV and nebulized N-acetylcysteine (NAC) prior to transfer to a tertiary care hospital. He was admitted to the ICU and treated with supplemental oxygen, a single dose of methylprednisolone 1000 mg IV, and nebulized NAC four times daily. He was discharged on hospital day two in stable condition without further intervention. The remaining three men who were within 3-5 feet of exposure initially reported cough and mucosal irritation, but were asymptomatic upon presentation to the outside ED. They were observed overnight without complication prior to discharge.
Conclusion: PFIB exposure causes mucosal irritation and is a potent pneumoedematogenic agent. Even transient exposures to concentrated gas can result in catastrophic lung injury. This case series demonstrates a brief but concentrated exposure resulting in relatively mild toxicity. While there is poor evidence for high-dose corticosteroid and nebulized NAC therapy, the above patient received both treatments and successfully recovered without invasive respiratory support.

DAY 3: LIGHTNING ORALS, ABSTRACTS 143-149

143. Adequacy and Characteristics of N-Acetylcysteine Treatment in Acetaminophen Poisonings Recommended by a Poison Center, a Medical Toxicologist, or Another Physician: A Comparative Study

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Background: N-acetylcysteine (NAC) is the established treatment for acetaminophen poisonings. While toxicological advice is often requested, it is not always given.
Research Question: Does toxicological consultation improve the adequacy of NAC treatment in acetaminophen poisonings?
Methods: This is a comparative retrospective cohort study of acetaminophen poisonings treated with NAC. Patients' records from two medical centers were digitally retrieved and undergone comprehensive review. Cases were divided into three groups according to the consulting or managing specialist: Poison center (PC), medical toxicologist (MT), or another physician, either emergency medicine or intensive care. Compared endpoints included adequacy of NAC initiation, dosing and termination (based on acceptable guidelines and predication tools, determined independently by a MT and a clinical pharmacist), duration of hospitalization, ICU transfer, occurrence of NAC adverse reactions and hepatotoxicity.
Results: Of 108 retrieved cases, in 50 (46.3%) a PC was consulted, and in 21 (19.4%) a bedside consultation was provided by a MT. There were no significant differences between groups regarding age, sex, acetaminophen ingested dose and time from ingestion to NAC. Some inadequacies of the NAC treatment were identified in 28 (25.9%) cases; initiation without appropriate indication was in 18 (64.2%) of them. There was a significantly higher number of cases with inadequate NAC treatment in patients managed without any toxicological consultation: 16 cases (43.2%) vs. 11 (22%) cases with PC advice and one (4.8%) case with a MT involved ($p = 0.011$, Xi^2 test). There was a trend to superiority of a MT over PC that did not reach statistical significance. Cases treated without any toxicological consultation had a significantly longer duration of hospitalization, a higher rate of ICU transfer, and more reports of NAC adverse reactions. Hepatotoxicity was uncommon with no difference between groups.
Conclusion: Based on the results, toxicological consultation improves the adequacy of NAC treatment in acetaminophen poisonings.

144. Octreotide Administration Methods in Sulfonylurea Poisoning: A Retrospective Chart Review

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Background: Sulfonylureas frequently lead to hypoglycemia with overdose or alterations in pharmacokinetics. Despite reports supporting use of subcutaneous/IV octreotide, there is scant data comparing the different routes of octreotide administration in sulfonylurea-induced hypoglycemia.
Hypothesis: Our primary outcome is to evaluate the efficacy of continuous octreotide infusion in patients with sulfonylurea-induced hypoglycemia, compared to subcutaneous and intravenous administration.
Methods: This is a multi-center retrospective chart review of patients with sulfonylurea-induced hypoglycemia who were treated with octreotide. Data abstracted included: demographics, treatment methods, and medical outcomes. Outcomes included: hypoglycemic events, amount of dextrose given, and length of stay. Descriptive statistics were used to compare octreotide administration methods.
Results: Twenty-nine patients were included. Twenty-four were female, and five were male. The average age of pediatric patients was seven and adult patients was 74. The most common sulfonylurea involved was glipizide. Twelve patients received IV octreotide, 15 patients received subcutaneous octreotide, one patient received IV and subcutaneous octreotide, and four patients received octreotide infusion. Three of the four patients who received infusions also received IV octreotide. Patients who received infusions of octreotide required more pre- and post-octreotide dextrose (42 grams, 256 grams) compared to subcutaneous (25 grams, 122 grams) and IV octreotide only (34 grams, 124 grams). There was a median of zero hypoglycemic events after subcutaneous or IV octreotide, and 1.5 after octreotide infusion. The median length of stay in the hospital was 64.5 hours, 38 hours, and 60 hours between subcutaneous, IV, and infusion groups.
Conclusion: Our analysis suggests octreotide infusions were associated with higher pre- and post-octreotide dextrose administration and hypoglycemic events post-octreotide, as compared to SC or IV. Our study is limited by its retrospective nature. Future investigations, including prospective studies, are needed to determine the optimal approach to octreotide administration in sulfonylurea-induced hypoglycemia.

145. Calcium Precipitation in Bedside Calcium Gel Mixing for Dermal Hydrofluoric Acid Exposure Treatment

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Background: Commercially produced calcium gels for the treatment of hydrofluoric acid (HF) exposure are infrequently stocked by hospitals. A common Poison Center recommendation is to mix a calcium salt with a water-soluble gel to produce 2.5% calcium gel.
Hypothesis: Does mixing 10% calcium chloride or gluconate solutions with different brands of water-based gels result in calcium precipitation and reduced calcium concentrations in resulting solutions?
Methods: This is a basic science experiment. After conducting a survey of AAPCC Poison Center HF treatment guidelines, a ratio of 10 mL of 10% calcium salt (calcium chloride or calcium gluconate) to 30 mL of gel was mixed with six brands of water-based gel and one brand petroleum-based by hand for 15-20 seconds to create 2.5% solutions. The resulting mixtures were photographed and assessed visually for precipitation and viscosity, and the solutions (excluding precipitate) were analyzed for total calcium concentration using a Beckman AU700 chemistry analyzer.
Results: After mixing, the majority of samples showed rapid precipitation and loss of gel-like viscosity. Calcium concentrations in the mixes were lower than the expected 2.5% for both calcium gluconate (43-76% lower) and calcium chloride (10-29% lower) indicating that calcium precipitated out of solution. Viscosity rapidly decreased from > 1000 centiPoise (cP) (e.g., gel) to < 100 cP (e.g., water) in four of six solutions, and remained > 1000 cP for the remaining two. Limitations: Calcium concentration was not measured in the solid precipitate and not all available healthcare gels were analyzed.
Conclusion: We found that the common practice of mixing calcium-containing solutions with commonly available gels resulted in immediate precipitation, loss of gel-viscosity, and a reduction in dissolved calcium concentration. The common recommendation to mix a calcium gel at bedside may result in reduced calcium content and an unreliable product for treatment of dermal HF exposures.

146. Perspectives From Individuals With Alcohol Use Disorder (AUD) on Ingestible Electronic Systems to Measure Adherence to Medications for AUD

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Background: Adherence to pharmacotherapy for alcohol use disorder (AUD) combined with psychotherapy significantly improves retention in AUD care and helps individuals achieve drinking goals. Digital pill systems (DPS) that integrate ingestible radiofrequency chips to measure adherence are a novel strategy to measure and support adherence to medications for AUD (MAUD). Previous data indicates that the DPS is feasible and acceptable for chronic diseases like diabetes, hypertension, and HIV treatment/prevention. This investigation provides formative data surrounding perspectives towards DPS among individuals with AUD.
Hypothesis: We hypothesized participants would be accepting of and willing to use DPS for MAUD adherence.
Methods: Semi-structured qualitative interviews assessed attitudes towards DPS among adult patients with AUD admitted to an inpatient level IV American Society of Addiction Medicine (ASAM) detox unit, Addiction Recovery Program (ARP) at Brigham and Women's Faulkner Hospital (BWFH). Interviews collected feedback on DPS design and explored perceptions of real-world applications. Interviews were analyzed using a framework matrix.
Results: We enrolled 20 participants (median age: 52, range: 29-71). Thirteen were male (65%), seventeen white (85%), and three Hispanic or Latino (15%). Most participants found the DPS acceptable, but only half were willing to use it for MAUD. Given adequate reminder systems (e.g., pillboxes), many participants cited alcohol cravings as adherence barriers over forgetfulness. Reactions to real-time messages after missed MAUD doses were positive, though notification frequency preferences varied. Most reported wearable reader design concerns, preferring wrist over neck readers. While participants had few DPS-specific privacy concerns, some cited hesitancy about sharing data with their physician.
Conclusion: Individuals with AUD find the DPS acceptable, with some willing to use it for MAUD. Key challenges to deploying this system include improving design and demonstrating utility over other adherence tools. Future exploration should define the structure of interventions linked to DPS data and hardware iterations to improve acceptability.

147. Substance and Treatment Experience and Motivation to Change Reported During Peer Recovery Intervention in the Emergency Department

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Background: Emergency department (ED) Screening, Brief Intervention, and Referral to Treatment (SBIRT) can identify patients with substance use that do not present with acute overdose.
Research Question: Are there differences in patients that screen positive for substance use vs. individuals who present with acute intoxication/overdose?
Methods: Retrospective chart review of ED visits from nine hospitals in the DC/Baltimore area from April 2019-June 2021. The health system utilizes a validated SBIRT system with peer recovery coaches (PRCs) for ED patients that are clinically stable and willing to participate. We compared characteristics of patients that presented with acute overdose vs. those who screened positive but presented with a non-intoxication concern.
Results: Of 537,373 encounters, there were 3800 (0.7%) visits for overdose and 48,633 (9.1%) positive screens. Overdose patients were more likely to engage with a PRC (33% vs. 23%, $p < 0.0001$). They were also more likely to report motivation to change (84% vs. 76%, $p < 0.001$) and enter a treatment program (78% vs. 63%, $p < 0.001$). More overdose patients were enrolled in a treatment program at the time of their ED visit (19% vs. 12%, $p < 0.001$). Overdose patients were more likely to have had previous treatment (11% vs. 8%, $p = 0.04$), with a higher median number of treatment attempts (1 vs. 0 (0-6), $p < 0.01$). Patients who screened positive were more likely to use cannabis (13% vs. 72%, $p < 0.001$), whereas those with overdose were more likely to use opioids (59% vs. 20.5%, $p < 0.001$) and report polysubstance use (39% vs. 18%, $p < 0.001$).
Conclusion: There were differences in drugs used, and treatment motivation and experience between ED patients who screened positive for drug use and those that overdosed. Individuals that screened positive also used high risk drugs and engaged in polysubstance use. Future initiatives should focus on identifying and further engaging this large at-risk population.

148. Experience of a Medical Toxicology Clinic With Follow-Up of Rattlesnake Envenomation Patients: A Focus on Delayed Complications

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Background: In its first year, a referral toxicology center captured over half of rattlesnake envenomation (RSE) patients in follow-up visits.
Hypothesis: Routine follow-up of RSE patients by medical toxicologists is feasible. Infections and mobility complications may be more commonly detected with routine follow-up of RSE patients.
Methods: This is a retrospective review of RSE follow-ups at a single center between October 1, 2022 and Oct 31, 2023. Patients were identified using the departmental patient and snakebite logs. Data from the initial hospitalization and follow-up visit were reviewed by JK and MS. Patients without initial presentation data were excluded. For non-objective variables, consensus review was achieved. Infections, opioid prescriptions, and patient-reported mobility restrictions and pain were analyzed. Descriptive statistics were used.
Results: Thirty-four patients were included, representing 68% of inpatient RSE treated (n = 50). 85% were men; 56% (n = 19) were upper extremity envenomations, most (n = 14) to the finger. Median time to follow-up from last antivenom was six days (IQR 5-7). Most encounters were in-person clinic visits (94%; n = 32); the remainder were video-telemedicine encounters. Infections occurred in 12% of follow-ups (n = 4); all were finger envenomations. Two were readmitted for washout and intravenous antibiotics, one occurred after failure of oral antibiotics prescribed at first follow-up. Seventy-five percent (n = 3) of infections reported non-recommended initial management, two of which applied a tourniquet and "sucked out venom". Forty-seven percent (n = 16) reported significant mobility restrictions. Of these, seven (41%) were lower extremity envenomations and five (31%) reported continued use of wheelchair/walker. Pain was persistent/not improving in 24% of follow-ups (n = 8). Of the 22 patients prescribed opioids at hospital discharge, 10 (45%) reported continued use; 27% (n = 6) were re-prescribed opioids.
Conclusion: Infections and mobility restrictions were more common than expected. Limitations include bias towards follow-up completion for patients experiencing complications.

149. Advanced Virtual Support for Operational Forces (ADVISOR) Toxicology Service: Retrospective Review of Operational Military-Related Managed With Virtual Toxicology Consultation

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Background: Military operations occur worldwide, and conducting high-quality, cost-effective care in the austere setting remains a priority. Not all deployed healthcare providers are physicians or have specialty training, and access to expert consultation can be limited in the operational setting. Despite this, US service members are at risk for complex injuries and exposures that may require expert consultation. The Advanced Virtual Support for Operational Forces (ADVISOR) was established in June 2017 to fill this gap. Over 100 volunteer physicians provide real-time, expert, telemedicine consultation around the globe. Medical

toxicology is one service provided. The study objective was to describe the types of cases managed with the help of medical toxicology through the ADVISOR line.

Methods: In this retrospective review, we queried the ADVISOR database and reviewed cases classified under Toxicology from December 2020 to October 2023. Case dates, location of the call, and case narratives were reviewed. The type of encounter, including training or real world, was also reviewed.

Results: A total of 19 cases were identified during the study period. Three of the 19 calls during this time frame were training calls, and the remaining were real-world scenarios. A total of seven different toxicologists managed the 19 calls. All the real-world calls originated from outside of the US. All the toxicologists available for consultation were in different geographic areas. Select cases included puffer fish envenomation, scorpion sting, snake envenomation, drug reaction, amphetamine ingestion, environmental exposure, acetaminophen overdose, diphenhydramine overdose, dextromethorphan overdose, and hydrocarbon exposure.

Conclusion: The ADVISOR line has been used in real-world operational scenarios and in training scenarios between December 2020 and October 2023. Toxicology remains an active sub-specialty available for worldwide consultation through the ADVISOR line. A variety of cases ranging from overdose to envenomation were managed.

DAY 3: MODERATED POSTERS, ABSTRACTS 150-156

150. Efficacy of Crotalidae equine immune F(ab')$_2$ (Anavip®) at Establishing Control in Louisiana Non-Rattlesnake Crotalid Envenomations

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Background: Copperheads (Agkistrodon contortrix) and cottonmouths (Agkistrodon piscivorus) are responsible for the majority (82.4%) of identified snake envenomations in Louisiana. While the Food and Drug Administration approved use of Crotalidae equine immune F(ab')$_2$ (Anavip®) for Agkistrodon envenomations, there is limited data evaluating the efficacy of Anavip® for this indication.

Research Question: How effective is Anavip® at controlling Agkistrodon envenomations?

Methods: This is a retrospective, IRB approved study of patients receiving Anavip® in a Louisiana hospital system between 2020 and 2023. Demographics, snake types, clinical effects, medication administrations, treatment responses, and adverse effects were collected by chart review. Cases were excluded if the snake was identified as a rattlesnake, Crotalidae-polyvalent ovine immune Fab (CroFab®) was administered at any time, or records were unavailable.

Results: Forty-seven patients received Anavip®; 17 cases met exclusion criteria. Of the 30 cases included, the snake was identified as either copperhead (n = 18) or cottonmouth species (n = 5), or was an unidentified Crotalid (n = 7). All cases had objective signs of envenomation. Twenty-four were mild severity, five were moderate, and one was severe due to hypotension with vomiting. No cases were associated with hemotoxicity/coagulopathy. All patients received 10 control vials initially, with 19 (63%) patients (11 copperhead, two cottonmouth, six unidentified) requiring additional control vials. The mean number of vials to establish control was 17 (95% CI 14.3 to 19.7) with a median of 19.

Conclusion: Additional Anavip®, beyond an initial 10 vials, was required to establish control in a majority of non-rattlesnake envenomations, including a majority of identified Agkistrodon envenomations and cases with mild severity. A Louisiana Poison Center review reported 29.7% of all Crotalid envenomations who received CroFab® alone required additional vials to establish control after the initial dose. A head-to-head trial is needed to compare efficacy between CroFab® and Anavip® for Agkistrodon envenomations.

151. Sidewinder (*Crotalus cerastes*) Bites Reported to the ToxIC North American Snakebite Registry (NASBR)*

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Background: The Sidewinder (*Crotalus cerastes*) is a rattlesnake native to the southwestern United States. Bites by this species are uncommon, and few reports of envenomation exist.

Research Question: What clinical course follows bites by the Sidewinder?

Methods: This is a review of Sidewinder bites prospectively reported to the NASBR from January 1, 2013 to July 31,

2023. Beginning in 2017, species identification was qualified as "definite" or "likely" by the treating medical toxicologist based on specific criteria. Hemotoxicity was defined as platelets < 120 K/mm3 or fibrinogen < 150 mg/dL. Variables analyzed included demographics, bite location, clinical manifestations, management, and outcomes. Descriptive statistics were used.

Results: Eleven Sidewinder bites were reported; one was considered 'dry'. Species identification was 'definite' in 6/7 cases reported after 2016. Locations included Arizona (8), Texas (2), and California (1). Age range was 10 – 70 years. Nine (82%) were male. Swelling was reported in nine (82%) cases. Neurotoxicity occurred in two (18%) cases. Both exhibited fasciculations, and one had objective weakness. No hemotoxicity was reported. There were no reports of systemic toxicity (i.e., emesis, diarrhea, angioedema, hypotension, bleeding), tissue necrosis, compartment syndrome, or rhabdomyolysis. Antivenom was administered in nine (82%) cases. Seven received Fab, with a median dose of 11 (IQR 8.5-13.5) vials, two received Fab2 (doses = 14 and 18 vials). Length of stay was < 48 hours in 91% (n = 10) of cases. Ten cases reported follow up, five included laboratory data. No readmissions or late hemotoxicity were reported. One case reported delayed rash that resolved without treatment. Persistent paresthesias and weakness were reported in one case at day 11 follow up. Details of this case have been published.

Conclusion: Sidewinder envenomations reported to the NASBR were associated with swelling and neurotoxicity but did not exhibit hematologic toxicity, systemic toxicity, or tissue necrosis.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

152. N-Acetylcysteine Dosing Strategy and Duration of Therapy in Massive Acetaminophen Overdoses Treated Within Eight Hours

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Background: Using stoichiometric modeling, standard n-acetylcysteine dosing (S-NAC) has been questioned for massive acetaminophen (APAP) ingestions defined as [APAP] > two-times the Rumack-Matthew treatment line (RM-line). The rate of high dose maintenance infusion (HD-NAC) is based on the acetaminophen ratio (AR), where $AR=[APAP]_{measured}/[APAP]_{RM\text{-}line}$ at a given time. It remains unproven that S-NAC is insufficient for the treatment of massive APAP ingestions, particularly regarding patient-centered outcomes.

Methods: Single PC retrospective review, 6/2019-8/2023. Inclusion: patients ≥ 13-years-old with AR > two measured within four to eight hours post-ingestion for whom S-NAC or HD-NAC was initiated before eight-hours post-ingestion. Exclusion: incomplete data, NAC administration errors, extracorporeal toxin removal. Primary outcome: number of 16-hour maintenance infusions administered beyond initial three-bag protocol. Secondary outcomes: AST/ALT > 1000 U/L, INR > 2.0, transplant, and death. Descriptive statistics characterize the cohort. Comparisons via independent samples t-tests. Sensitivity analyses exclude cases where additional infusions were exclusively due to residual detectable [APAP], and cases with anti-peristaltic co-ingestions.

Results: Sixty-one cases were included. Twenty-eight S-NAC cases: mean age 30-years (range 14-69), mean AR 2.54 (95% CI: 2.31-2.77), 43% (12/28) with co-ingestions, 29.6% (8/28) required additional maintenance infusions (mean 0.5, 95% CI:0.11-0.89). 33 HD-NAC cases: mean age 33-years (range 13-83), mean AR 2.60 (95% CI:2.43-2.78), 42.4% (14/33) with co-ingestions, 30.3% (10/33) required additional maintenance infusions (mean 0.42, 95% CI:0.16-0.69). One HD-NAC case with AST/ALT > 1000 U/L (AR 2.6, ibuprofen co-ingestion). None with INR > 2.0, transplant, or death. No statistically significant differences in mean AR or additional maintenance infusions were observed, including sensitivity analyses.

Conclusion: In this cohort, HD-NAC was not associated with a decreased number of maintenance infusions compared to S-NAC. S-NAC was not associated with negative outcomes. Limitations include retrospective nature and poison center data reliant on clinical reporting. Future prospective studies are needed to evaluate potential patient-centered benefit associated with HD-NAC.

153. Drug Shortage Outcomes and Solutions Reported to the ToxIC Registry Over a Six-Month Period*

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Background: Drug shortages have become increasingly common and often involve antidotes. Data describing the impact of antidotal shortages on patients and hospitals, and mitigation strategies hospitals employ, are limited.

Hypothesis: Antidotal shortages adversely affect poisoned patients and hospitals.
Methods: This is an analysis of data reported to the drug shortage sub-registry of the Toxicology Investigators Consortium (ToxIC). This sub-registry was created in January 2023. It tracks shortage mitigation strategies and outcome metrics including level of care, length of stay, cost, morbidity, and mortality. The sub-registry was queried on October 23, 2023. Finalized data were available from January to June 2023. Rates of shortage, institutional responses, and adverse outcomes were calculated.
Results: Nineteen poisoned patients whose encounters were impacted by shortage were identified from January to June 2023, representing 0.5% of all patients reported during this period. Drugs involved were physostigmine (12/19 cases), calcium disodium edetate (4/19), dimercaprol (one), glucagon (one), and baclofen (one). Physostigmine shortage was mitigated by substitution in eight cases: five patients received rivastigmine, two received benzodiazepines, and one received dexmedetomidine. Calcium disodium edetate shortage necessitated interinstitutional sharing (two cases), compounding (one), and succimer substitution (one). Four patients did not receive any pharmacotherapy because of physostigmine shortage. Eleven patients were adversely impacted: seven had increased length of stay, three required a higher level of care, and one required intubation. Excessive somnolence from dexmedetomidine was the only adverse reaction from substitution reported. Delay to treatment and increased hospitalization cost were each reported in three cases. No patients suffered death or permanent morbidity.
Conclusion: Over a six-month period, care of poisoned patients was rarely affected by shortage. Shortages predominantly involved physostigmine and calcium disodium edetate, and were mitigated with multiple strategies including substitution, compounding, and interinstitutional sharing. Eleven shortages (58%) adversely impacted patients, however no mortality or permanent morbidity resulted.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

154. Real World Delays in Antivenom Administration: Patient, Snake or Hospital Factors (ASP-33)

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Background: Early antivenom administration is essential for effective treatment. We investigated the delays in antivenom administration.
Methods: We reviewed snakebites from the Australian Snakebite Project (2006-2021) given antivenom, presenting to hospital within 12 hours. We extracted demographics, time of bite, hospital arrival, blood collection, antivenom treatment and hospital transfer.
Results: There were 1096 patients who presented within 12h of a snakebite and were given antivenom: median age 41-years-old (interquartile range [IQR]: 25-57 y); 796 (73%) males. A pressure bandage was applied in 1018 (93%), a median of 15 min (IQR: 5-30 min) post-bite. The snake was identified in 872 patients (80%), including 333 brown snakes (30%), 173 tiger snakes (16%), 75 rough-scaled snakes (7%), 89 red-bellied black snakes (8%), 49 taipans (5%) and 29 death adders (3%). One thousand and nineteen patients (93%) were systemically envenomed, and 77 (7%) received antivenom without envenoming. Median time to hospital was 60 min (IQR: 30-105 min), to first blood tests was 90min (IQR: 60-155 min) and to antivenom was 230 min (IQR: 150-345 min). There was a median delay in blood tests of 20 min (IQR: 10-39 min) and a median delay to antivenom of 145 min (IQR: 81-246 min). Three hundred and thirty-three patients (30%) were transferred to another hospital, a median time of 258 min (IQR: 153-398 min) after arriving at the first. Time to antivenom in the 333 was similar to those not transferred. Time to antivenom was significantly shorter for patients given antivenom prior to transfer, median 110 min (IQR: 51-175 min), compared to patients not transferred, median 235 min (IQR: 155-335 min; $p < 0.001$). In 988 patients (90%) presenting within three hours, time to antivenom and delay in antivenom were similar. The median length of hospital stay was 40 h (IQR: 24-66 h).
Conclusion: Antivenom administration was delayed on average by 2.5 h after hospital presentation. Patients requiring transfer received antivenom in a similar time, but earlier if administered prior to transfer, highlighting the possible benefits of pragmatic clinical decision making rather than waiting for laboratory results.

155. The Paqui® One Chip Challenge, A National Poison Data System Case Series

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Background: Capsaicin, a chili pepper extract, has been used in numerous medicinal and culinary products (i.e.,

hot chips). In recent years, the viral "One Chip Challenge", marketed by Paqui®, involved eating a single chip made with the extremely potent Carolina Reaper pepper and Scorpion pepper, each more than one million Scoville Heat Units. Ingestion has been associated with adverse effects including non-ST elevation myocardial infarction and a death reported in the media. We evaluated the adverse effects from the "One Chip Challenge" using national poison center data.
Methods: This was a retrospective case series using data from the National Poison Data System evaluating human exposure cases coded with "Paqui Chips" in the product code field from January 1, 2021 to September 29, 2023. Exclusion criteria included other capsaicin-containing products. The primary outcomes were proportion of cases resulting in a hospital visit and those with ≥ moderate effects.
Results: There were 718 cases included. Seventy-eight percent of patients were between 6-19 years of age with 80% male. Most exposures occurred at school (56%) or home (38%). Sixty-eight percent were treated on site, six percent were treated at a healthcare facility, six percent were lost to follow-up or left against medical advice and 0.6% (four patients) were admitted to a hospital. Medical outcomes included 59% with no effect, not followed or judged as non-toxic, 29% with minor effect, 7.9% with moderate effect, 0.1% with major effect and no deaths. Clinical effects included 45% abdominal pain, 35% oral irritation, 26% vomiting, 14% ocular irritation, 1.9% chest pain, 1% shortness of breath, and 1% edema. Limitations include paucity of follow up on many cases, potential coding errors and underrepresentation of cases reported to poison centers.
Conclusion: Although there were a few moderate effects and hospitalizations, most Paqui® chip exposures were treated at home and had minor effects.

156. Characteristics and Outcomes of Enteral Caustic Exposures Described in the Toxicology Investigators' Consortium (ToxIC) Core Registry*

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Background: Ingestion of caustic xenobiotics causes variable morbidity and mortality, and treatment options are limited. Post-exposure risk stratification relies on nonspecific symptoms and multidisciplinary consultation to directly visualize gastrointestinal mucosa with esophagogastroduodenoscopy (EGD). Research question: How frequently is EGD performed in patients with enteral caustic exposures after bedside evaluation by a medical toxicologist?
Methods: This is a secondary analysis of patients with enteral exposure to caustic and household products evaluated by a medical toxicologist and recorded in the Toxicology Investigators Consortium (ToxIC) Core Registry between 2013-2023. Patients were excluded for non-enteral route of exposure or ingestion of non-caustic agent (e.g. toothpaste). Agents were categorized as acid, alkali, oxidizing, or laundry detergent pod, referring to ingredients in safety data sheets for branded products. Primary outcome was EGD; secondary outcomes were mortality, severity of injury, treatment with steroids, and suicidal intent. Statistical analysis was performed using IBM SPSS for Macintosh version 29.0.
Results: Six hundred and forty-two patients met inclusion criteria. One hundred and nineteen (18.5%) patients underwent EGD. Sixty (9.3%) had no injury. Twenty-four (3.7%) had grade I, 10 (1.6%) had grade IIa, four (0.6%) had grade IIb, five (0.8%) had grade III, and one had grade IV injuries. Six patients died; seven underwent surgical intervention. Twenty-two (3.4%) received steroids. Two hundred and sixty-eight (41.7%) ingestions were suicide attempts. Oxidizing agents were most frequently ingested (36.4%) followed by alkali (26.9%), acid (18.8%), and laundry detergent pods (19.4%). Long term complications were rarely recorded.
Conclusion: Though often recommended, especially in intentional ingestion, EGD is uncommonly performed in caustic exposures evaluated by toxicologists. Limitations include lack of insight into treating clinicians' medical decision-making, incomplete data availability, as not all patients designated as having corrosive injury were denoted to have EGD, very low rates of secondary outcomes, and reporting and sampling biases.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

DAY 3: POSTERS, ABSTRACTS 157-216

157. Trends in Intentional Nitrous Oxide (N_2O) Abuse and Misuse in Patients Aged 13 Years and Older Reported to US Poison Centers From 2003-2022

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Background: This study aimed to describe recent trends and patterns of intentional N_2O abuse and misuse exposures in the United States.
Methods: In this retrospective study, we examined intentional N_2O abuse and misuse exposures in patients (≥ 13 yrs.)

reported to the National Poison Data System from 1/1/2003-12/31/2022. Cases with N_2O listed as the primary agent were included. Demographic trends, clinical effects, and outcomes were assessed.

Results: Between 2003 and 2022, there were 1236 cases of intentional N_2O abuse and misuse exposures for individuals ≥ 13 years old. The majority of exposures occurred in males (64.9%). Most involved exposures in young adults aged 20-39 (60.8%) and adolescents aged 13-19 (18.4%). Cases of abuse/misuse steadily increased over the study period. Between 2003 and 2022 there was a 390% increase (29 to 142) in overall yearly number of cases. The most dramatic rise occurred from 2017 to 2022. During the study period, there was an 888% increase (8 to 79) in the monthly number of cases that resulted in worse than minor clinical outcome. Clinical effects most commonly reported: miscellaneous (n = 188, 12.8%), tachycardia (n = 186, 12.7%), confusion (n=175, 11.9%), numbness (n = 138, 9.4%), ataxia (n = 128, 8.7%), agitation (n = 108, 7.4%), peripheral neuropathy (n = 106, 7.2%). In 1.9% (n = 24) of cases, clinical effect duration was anticipated to be permanent. Of the 1,074 cases managed in a health care facility, 584 (54.3%) were treated and released, 140 (13.0%) were admitted to a critical care unit, and 217 (20.2%) were admitted to a non-critical care unit.

Conclusion: Over the past two decades, US Poison Centers have reported a sharp rise in cases of N_2O abuse/misuse, especially among younger patients. Heightened public awareness of the health risks associated with N_2O abuse and early recognition of clinical manifestations by healthcare providers are important steps in addressing this emerging public health issue.

158. Using Internet Snapshot Surveys to Enhance Our Understanding of the Availability of Nitrous Oxide

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Background: Nitrous oxide (N_2O) is widely used recreationally for its euphoric effects and there are increasing reports of N_2O related neuropathy.

Hypothesis: What is the availability of N_2O to UK based potential consumers from Internet suppliers?

Methods: Using the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) internet snapshot methodology, we undertook an English language internet snapshot survey in October 2023 to gather information on the availability and price of N_2O from online retailers.

Results: Fifty-six websites selling N_2O were identified; none required potential purchasers to supply identification/age verification. Fifty-two (93%) listed catering as the intended purpose for N_2O supply, two listed motor sport, one medical use; one did not give a reason. Fifty-two (93%) of the websites were UK based and one was USA based. Forty-four (79%) websites sold associated catering paraphernalia, most commonly whipped cream dispensers. Eight-gram canisters (often referred to as "whippets" or "nangs") were commonly sold in multiples of 24 whilst 640 g canisters were sold in multiples of six. The mean price for N_2O was 0.09 US$/g. 19 (34%) websites sold quantities of over 600 canisters without the need to provide proof of commercial/business use. Cost per gram of eight-gram canisters decreased from 0.16 US$/g for 64 canisters to 0.07 US$/g for 600 canisters. Only 17 (30%) websites provided safety advice, and none sold vitamin B12 or methionine to prevent neuropathy.

Conclusions: N_2O is widely available to purchase via the Internet to UK based consumers. Despite selling in quantities/products not intended for legitimate use, most sites listed catering as the reason for supply and many encouraged users to buy wholesale quantities without providing age verification or proof of plans for commercial/ business use. Further work is required to determine the impact of the UK classification of N_2O in November 2023 on its availability.

159. Clinical, Radiological and Biochemical Features in Patients Presenting With Nitrous Oxide Related Neurological Complications

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Background: Chronic recreational use of nitrous oxide (N_2O) can lead to function vitamin B12 deficiency and associated neurological complications.

Research Question: How to characterize the clinical, radiological and biochemical features in patients presenting to a large inner-city ED with neurological complications secondary to N_2O use.

Methods: Retrospective case note review of patients aged over 18 years presenting to a large inner-city ED between 01/2020 and 12/2022 with neurological symptoms secondary to N_2O use. Data extracted from medical records included: demographic data; amount/duration of N_2O use; clinical symptoms/signs; initial investigations.

Results: Thirty patients were identified; mean ± SD age was 24.2±3.5 years and 62% were male. One patient underlying hypertension and 21 had underlying mental health conditions. Five (17%) used less than 100 g/day, 16 (53%) used 100 to 1,000 g/day and nine (30%) used more than 1,000 g/day. Nineteen (63%) had used N_2O for more than six months

prior to presentation; seven (23%) for less than one month and four (13%) for one to six months. Clinical features: 27 (90%) had numbness/sensory changes, 24 (80%) had motor weakness and 18 (60%) had ataxia. Hematological markers: i) mean hemoglobin 128.8±37.3 g/L and one was anemic; ii) mean MCV 85.5±29.5 fL and five had a raised MCV; iii) mean active Vitamin B12 58.4±41.4 pmol/L (NR 25-108 pmol/L); five had a low active vitamin B12. Radiological imaging: 19 patients had MRI spine and/or brain imaging; 12 (63%) showed subacute combined degeneration of the cord and seven were normal. Biomarkers of vitamin B12 inactivation: i) Homocysteine: 22 (73%) were elevated, mean 72.1±58.1 micromol/L (NR 0-15 micromol/L); ii) Methylmalonic acid: 26 (87%) were elevated, mean 1964.9±2687.3 nmol/L (NR 0-280 nmol/L).

Conclusion: N_2O related peripheral neuropathy is an important emerging issue, patients often have normal vitamin B12 but homocysteine and methylmalonic acid are useful biomarkers.

160. Acute Toxicity of Recreational Substances in Adolescents in Emergency Department: 67 Cases

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Background: The consumption of recreational drugs in adolescents, an ascending phenomenon, can lead to dependence and which sometimes progresses to medical complications including acute intoxication.

Research Question: The aim of this work was to study the epidemiological factors, and clinical aspects of acute consumption of recreational drugs in the adolescent population.

Methods: This was a prospective descriptive study with a twenty-seven-month data collection. We included all patients aged from 10 to 19 who consulted the emergency department for acute intoxication by recreational drugs. Results: We enrolled 67 adolescents who represented 20% of all patients consulting for recreational drug intoxication. The median age was 17 years (17 % were under 16) and 84% were male. Fourteen patients were transported to our emergency department by an ambulance. We reported single substance use in 44 cases (67%). The most incriminated substance was cannabis (66%). Ecstasy-cannabis association was found in nine patients. A co-ingestion with ethanol was reported in 13%. The most frequent symptoms were anxiety (28%), agitation (27%), headache (19%), and hallucinations (15%). Seizures were described in three patients. On arrival, 11 patients had an altered state of consciousness and three were comatose (GCS ‹9). Fifteen % had hyperlactatemia. Urine drug screening was performed in half of cases (28 were positive for cannabis and 11 for ecstasy). Most patients (85%) were medically discharged, and the number of patients admitted to the intensive care was six of whom four required mechanical ventilation. The average length of stay at ED was 5.6 hours.

Conclusion: Cannabis and ecstasy are the substances most incriminated during acute intoxication with recreational drugs in adolescents. The predominant clinical manifestations were anxiety and agitation.

161. Changes in Urine Drug Opiate Screen in Adolescent Population

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Background: Overdoses in adolescents have been rising over the past decade. Emergency department (ED) visits for both acute overdoses and for adolescents in opioid withdrawal have risen post-COVID. Urine drug screens have limited utility in emergency department management but are routinely obtained for medical screening and in the management of patients with substance use disorder. Our primary goal was to measure the sensitivity of the opiate urine drug assay over time in opioid-related presentations to the emergency department.

Methods: We reviewed ED presentations at all emergency departments within a single health system that were directly related to opioids from 1/1/2014 -12/31/2022. For each patient included, we identified whether a urine drug screen was obtained and the results from this screen. The urine drug screen available at all sites was an enzyme-multiplied immunoassay with an opiate screen (morphine antibody), but no fentanyl screen. The percent positivity for each drug category on EMIT testing was calculated. Chi-squared tests were used to compare positivity rates between years.

Results: Opiate positivity declined over the last nine years. Positivity rates from 2020-22 were 5% + 2 vs. 82% + 6 from 2014-19 ($p < .001$) Performance of UDS also declined over time (76% [2014-19] vs. 46% [2020-22]; $p < .001$). UDS was more likely to be performed in patients after a suicide attempt or when presenting after illicit use (66% vs. 38%; $p = .004$).

Conclusion: Opiate screen positivity decreased the last nine years and may reflect wider use of fentanyl amongst adolescents starting in 2020, a delayed shift compared to adults. Regional differences in drug use may influence our findings and may not be reflective of national trends.

162. Tianeptine Withdrawal Complicated by Bradycardia and Successfully Managed With Buprenorphine

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Background: Tianeptine is an atypical antidepressant not approved for prescription use in the United States. It has mixed receptor effects, one of which is agonism of μ-opioid receptors.
Method: This is a single patient case report.
Results: A 41-year-old man presented with withdrawal symptoms after stopping tianeptine. He reported ingesting the product, "Pegasus", daily over the last year. He used up to seven bottles a day. A day after his last use, he developed myalgias, rhinorrhea, and diarrhea. He was seen initially at another facility and prescribed gabapentin and trazodone, but his symptoms continued. A day later he presented to the ED with sinus bradycardia and hypertension (220/114 mmHg). An electrocardiogram showed sinus bradycardia with a rate of 35 bpm. Intervals were normal. He was given lorazepam and hydralazine and was admitted for telemetry monitoring. He had no chest pain, and his troponin was < 0.04 mg/dL. He remained bradycardic and withdrawal symptoms worsened. He was then started on eight mg of buprenorphine. Symptoms of withdrawal improved and 48 hours after the last dose of tianeptine his heart rate normalized, and blood pressure improved. He was discharged from the hospital on maintenance dosing of buprenorphine-naloxone at a dose of eight mg twice a day. Unique to prior literature on tianeptine overdose and withdrawal, this patient developed accelerated hypertension and bradycardia. Our patient improved with standard antihypertensive treatment and time. Buprenorphine was effective in controlling his more prominent withdrawal symptoms (myalgias, diarrhea, rhinorrhea). Initial effects of opiate agonist therapy were short-lived (about 1-2 hours), but after two days of treatment the patient was overall and consistently improved.
Conclusion: Buprenorphine can be an effective treatment for tianeptine withdrawal. With significant doses of tianeptine, withdrawal may be complicated by bradycardia and accelerated hypertension.

163. Trends in Addiction Medicine Board Certification Among Medical Toxicologists

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Background: Despite the fact that the specialties of medical toxicology (MT) and addiction medicine (AM) have significant overlap in core content and patient population, board certification is obtained via distinct pathways. Pathways to AM board certification currently include completion of an ACGME-accredited fellowship or an approved practice pathway (which will close in 2025).
Research Question: How many board-certified medical toxicologists have obtained board certification in AM and how many MT fellowship programs have at least one faculty with such dual certification?
Methods: We examined board certification data from the American Board of Medical Specialties (ABMS) from 2012 to 2023. From this data, we extracted total numbers of board-certified medical toxicologists who are also board-certified in AM and trends over time. In addition, by reviewing the faculty profiles found on MT fellowship program websites, we determined the number of MT fellowship programs that had at least one faculty member with dual board certification in MT and AM and examined trends over time.
Results: The total number of board-certified medical toxicologists also certified in AM by ABMS increased from 22 in 2016 to 112 in 2023, a mean increase of 12.8 per year (range 5-37; IQR 11). In 2021, 14% (75/555) of medical toxicologists were certified in AM. In 2023, this percentage increased to 18% (112/625). In 2017, 57% (16/28) of MT fellowship programs had at least one faculty member who was dual boarded in MT and AM. This increased to 81% (25/31) in 2023.
Conclusion: Almost 1/5 of board-certified medical toxicologists are also board certified in AM. Over 4/5 of MT fellowship programs have at least one faculty member with such dual board certification. Both the percentage of medical toxicologists with board certification in AM and the percentage of MT fellowship programs with AM boarded faculty are increasing over time.

164. Urban-Rural Discrepancies in Buprenorphine Access: Five Year Study of 159 Georgia Counties

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Background: Despite patients' improved access to buprenorphine prescribers via telehealth and removal of the X waiver, the rate of opioid overdose-related deaths continues to rise in the American South. In addition to changes in buprenorphine access over the COVID-19 health emergency, Georgia's 159 counties sit in a shifting geographic and demographic landscape of opioid use disorder (OUD).

Research Question: What county-level factors in Georgia affect access to buprenorphine?
Methods: This is a cross-sectional study of county-level data collected by the Georgia Prescription Drug Monitoring Program (PDMP).
Results: Per-capita buprenorphine prescriptions filled in 2019 per 1,000 residents was 55.58 in rural counties, and 36.62 in urban counties (p= 0.0013). Impoverished counties (≥20% of the population below the federal poverty level) did not differ from wealthy counties (p = NS), and counties with less than 10% uninsured did not differ from counties with greater than 15% uninsured (p = NS). There was not a difference in per-capita buprenorphine prescriptions between majority white and majority non-white counties (p = NS). Over all counties, per capita buprenorphine prescriptions dropped from 49.14 per 1,000 residents in 2019 to 43.85 per 1,000 residents in 2021 (p = 0.0003). Between 2019 and 2021 prescriptions filled in rural counties dropped from 55.58 per 1,000 residents to 48.45 (p = 0.0009). In urban and suburban counties per capita buprenorphine prescriptions did not significantly change over the same time (p = NS).
Conclusion: Before the COVID-19 pandemic, differing access to buprenorphine prescriptions between rural and urban counties was not explained by poverty, racial demographics, or insurance status. Despite increased prescriber flexibility with telehealth appointments, rural communities suffered from significant losses in buprenorphine prescriptions not experienced by urban communities. This suggests the pandemic exacerbated geographic access barriers to prescriptions and filling pharmacies.

165. Reddit Discussions of Xylazine Associated Wounds

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Background: Xylazine is increasingly present in the illicit opioid supply. The development of necrotic ulcers has been associated with xylazine use in people who use drugs (PWUD). Little is known about these wounds and PWUD often use internet forums such as Reddit to discuss their experiences with xylazine associated wounds.
Research Question: Do social media forums such as Reddit contain valuable information on peoples' experiences with xylazine-associated wounds?
Methods: We collected Reddit data between 2016 and 2022 from the pushshift.io application programming interface and extracted all posts mentioning xylazine. We filtered posts based on wound-related keywords (e.g., wound, ulcer, necrosis) using natural language processing methods, and extracted a random sample for manual analysis. We included all posts mentioned within threads that contained xylazine as a keyword in the title and excluded posts that only included images without further context from the final sample.
Results: The total number of xylazine mentioning posts increased from approximately 7000 in 2016 to over 35,000 in 2022 (over 100 subreddits). From a sample of 287 posts mentioning wound-related keywords, 111 consecutive posts were manually reviewed for thematic coding. The most common post themes were discussions on the pathophysiology of xylazine 49/111 (44%) and wound locations 18/111 (16%). Important themes that came up less frequently included posts about how xylazine wounds impacted treatment with Medications for Opioid Use Disorder (MOUD), management of xylazine withdrawal, and the ability to access treatment.
Conclusion: Reddit is a source to anonymously discuss issues related to drug use. The number of posts about xylazine has been increasing over time. Reddit posts suggest the people with possible xylazine exposure are seeking information about wounds and discuss challenges for people who use drugs. Further studies should address bidirectional approaches to disseminate wound management information via Reddit.

166. Methadone, Micro-Inductions, and a Membrane Oxygenator: Management of a Mixed Iatrogenic Withdrawal Syndrome During Veno-Venous Extracorporeal Membrane Oxygenation

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Background: Analgosedation during extracorporeal membrane oxygenation (ECMO) presents unique challenges, often necessitating prolonged administration of opioids, GABA-A agonists, and α2 agonists. This can result in dependency and withdrawal symptoms, and is further complicated by altered pharmacokinetics in lipophilic, highly protein-bound xenobiotics. We present a case report of mixed iatrogenic withdrawal in an adult on VV-ECMO.

Methods: This is a case report of a 35-year-old female, post-motor vehicle collision, who developed hypoxemic respiratory failure requiring intubation on hospital day (HD) four and subsequent (VV) ECMO cannulation (HD 11). Toxicology consultation (HD 52) was sought for agitated withdrawal symptoms experienced during previous analgosedation de-escalation attempts. She was on a complex regimen including hydromorphone (5 mg/hr), dexmedetomidine (1.4 mcg/kg/hr), methadone (240 mg/day), lorazepam (8 mg/day), midazolam (14-20 mg/day), diazepam (20 mg/day), phenobarbital (520 mg/day), and oxycodone (20 mg/day).
Results: Serum methadone concentrations after an 80 mg dose were 121 ng/mL (3h) and 104 ng/mL (8h). Phenobarbital concentration was 47.4 mg/L at nadir, increasing to 60.2 mg/L following a 10 mg/kg IV bolus, then declined to 50.2 mg/L over five hours. Pre- and post-oxygenator phenobarbital concentrations, measured at three, four, and five hours, were 55.5/47.9, 57.0/52.7, and 54.1/50.2 mg/L, respectively. A subdissociative ketamine infusion and quetiapine were started. An intravenous buprenorphine micro-induction enabled discontinuation of hydromorphone, oxycodone and methadone. Symptom-evoked phenobarbital facilitated discontinuation of lorazepam, midazolam and diazepam. Clonidine facilitated dexmedetomidine discontinuation. VV-ECMO was decannulated uneventfully.
Conclusion: This case highlights sequestration of phenobarbital ($8.0 \pm 0.5\%$ decline) during ECMO, consistent with prior reports for mildly lipophilic xenobiotics ($\log p = 1.47$). Methadone ($\log p = 4.77$) had lower than anticipated concentrations. Despite buprenorphine exhibiting similar lipophilicity ($\log p = 4.98$), a successful micro-induction was achieved without precipitated withdrawal.

167. Mu Opioid Receptors? More Like Musical Chairs: Management of Samidorphin Precipitated Opioid Withdrawal with Sublingual Buprenorphine

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Background: Samidorphan is a μ-opioid receptor antagonist and partial agonist at the K and δ- opioid receptors. It is often administered to offset metabolic adverse effects associated with olanzapine. Samidorphan use in opioid dependent patients may result in precipitated withdrawal, which can be difficult to manage given its high affinity for the μ-opioid receptor and prolonged duration of action.
Hypothesis: Large doses of buprenorphine (>16 g) will be required to attenuate precipitated withdrawal due to samidorphan.
Methods: This is a single patient chart review. A 36-year-old female, with a history of opioid use disorder and bipolar I disorder, presented with vomiting and diarrhea. Patient reported daily use of intravenous heroin during preceding years, with her last dose four hours prior to presentation. Within minutes of her first dose of newly prescribed olanzapine (10 mg)/samidorphan (10 mg), she experienced nausea, vomiting, abdominal discomfort, and diarrhea. She presented to the emergency department three hours after symptom onset. Her vital signs were within normal limits, aside from tachypnea with a respiratory rate of 24. Her physical examination was significant for clear rhinorrhea, reactive mydriasis, prominent piloerection, and repeated yawning.
Results: Ondansetron and promethazine were administered. Given the suspicion for precipitated opioid withdrawal, 8 mg sublingual buprenorphine was administered with near complete symptomatic relief. Her symptoms did not recur before discharge.
Conclusion: Given buprenorphine's eightfold lower affinity for the μ-opioid receptor compared to samidorphan the clinical response from a single 8 mg sublingual dose was unexpected. Confounders may have skewed the clinical course, including rapid onset emesis with self-decontamination, misrepresentation of the duration of symptoms, and individual pharmacodynamic and/or pharmacogenomic factors. Further research is warranted to determine the optimal management strategy for samidorphan precipitated withdrawal. This may include administration of full μ-opioid receptor agonists or rapid induction with buprenorphine.

168. Opioid Drug Concealment and Treatment Requirements in ED Patients With Confirmed Opioid Overdose*

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Background: Patients with intestinal concealment of opioids present diagnostic, therapeutic, ethical, and medicolegal challenges. Drug concealment continues to be a risk factor for subsequent clinical deterioration, however data to support management of fentanyl concealment is limited.
Research Question: We aimed to describe the treatment requirements of illicit opioid internal concealment in a robust population of ED patients with confirmed opioid overdose.

Methods: This is a subgroup analysis of an ongoing prospective cohort from the Toxicology Investigators Consortium Fentalog Study Group, a study of 10 EDs across the United States. Adult patients with drug concealment as means of exposure and confirmatory opioid testing were included. Descriptive analysis of naloxone dosing and hospital length of stay was based on chart review.
Results: Six patients were included out of 1624 patients in the Fentalog study (September 2020-September 2023). Out of the six patients, one received activated charcoal and four received naloxone. Of those who received naloxone, three patients received three doses and one patient received five doses followed by an infusion. The average cumulative dose of naloxone excluding infusion was 2.62 mg (range: 1.6 - 4.8 mg). The patient who was initiated on a naloxone infusion was maintained at a rate of 0.1 mg/hr for 23 hours. One patient was admitted to the intensive care unit, three were admitted to the general medicine floor, and one patient left against medical advice. The average length of stay was 40.5 hours (range 5 - 109). Of the admitted patients, all were discharged without complications.
Conclusion: Most patients needed multiple doses of naloxone with one requiring a naloxone infusion. The average length of stay was prolonged and demonstrated large variability. Due to small sample size and inability to distinguish between specific concealment types (i.e., drug packers, stuffers), ongoing research is needed to better characterize and stratify this patient population.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

169. Geographic Variability of Novel Potent Opioids and Associated Emerging Substances Detected in Emergency Department Patients*

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Background: Over the past decade, there has been a proliferation in illicit opioids created to subvert existing legislation about structurally novel substances with mu opioid activity. Novel potent opioids (NPOs)—e.g., nitazenes and brorphine--rose in popularity shortly after the DEA scheduling of all fentanyl derivatives in 2018. While these NPOs have been responsible for several clusters of overdose deaths in the US, the geographic prevalence of these compounds has yet to be described.
Methods: This is a prospective observational study derived from the Toxicology Investigators Consortium Fentalog Study Group, an ongoing multicenter project from 10 sites across the US. Consecutive patients presenting to participating emergency departments between October 6, 2020-July 3, 2023 with a suspected opioid overdose who tested positive for NPOs were included. Toxicology analysis of waste serum was performed in a central lab via liquid chromatography quadrupole time-of-flight mass spectroscopy. Geographic distribution was based on the index ED visit location and analyzed using descriptive statistics.
Results: Over the study period, 1,266 patients had complete toxicology results, with 20 of these testing positive for NPOs. Atlanta, GA had the highest absolute and proportional number of NBDOs detected (five patients, 8.8%). Metonitazene was the most common NPO detected (8/20 patients). 5/5 patients from Atlanta also tested positive for flualprazolam, and 4/5 tested positive for eutylone. Protonitazene was only detected in two patients from New York, NY; both patients were also positive for flubromazolam, bromazolam, and xylazine. All three patients from Newark, NJ were positive for N-piperidinyl etonitazene and negative for benzodiazepines. Benzodiazepines were found in 15/20 (75%) of all NPO-positive patients.
Conclusion: NPOs were most prevalent on the East Coast. Relative numbers of NPOs were low in the overall illicit opioid overdose population. Future study is needed to determine associations with adverse clinical outcomes.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

170. Buprenorphine and Naloxone Prescribing After Opioid Overdose: A Report From Ten Academic Hospital Systems*

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Background: Hospital encounters after opioid overdose represent an opportunity to start medications for opioid use disorder (OUD) and prescribe naloxone. With widespread presence of fentanyl analogs in the drug supply, little is known about provision of buprenorphine and/or naloxone after opioid overdose, particularly for unintentional opioid use.

Research Question: We aimed to identify differences in buprenorphine and naloxone prescribing after opioid overdose in patients who did and did not report current opioid use.
Methods: The Toxicology Investigators Consortium Fentalog Study is an ongoing prospective multicenter cohort study consisting of 10 US hospitals. Patients are included if they present with suspected opioid overdose and have residual blood available for comprehensive drug testing. Clinical data is obtained via chart review. Chi-square tests were conducted for categorical variables, and regression analyses were conducted to determine the effects of race, ethnicity, and gender.
Results: Between September 2020 and October 2023, 1689 patients met inclusion criteria. Of these, 1377 reported current opioid use and 312 did not. Patients reporting current opioid use more frequently received buprenorphine (n = 128, 9.3%) than those that did not (n = 9, 2.9%, $p < 0.001$). There was no association between naloxone prescribing and self-reported current opioid use (41.5% vs. 41.7%, p = NS). Black patients had lower odds of receiving naloxone upon discharge (OR: 0.93; 95%CI: 0.87, 0.99), but no difference in buprenorphine prescriptions (OR: 1.02; 95% CI: 0.98, 1.05).
Conclusion: The overall frequency of buprenorphine prescriptions was low. There were racial disparities in naloxone prescribing. Clinicians must continue to address barriers to providing these medications post-overdose.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

171. Opioid Use Disorder Associated With More Frequent Opioid Medication Administration in ED Patients With Cellulitis

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Background: Opioid use disorder (OUD) patients seek emergency care for conditions associated with substance use, such as cellulitis/abscess. Few studies have examined ED-based pain treatment for OUD patients. Treating acute pain for OUD patients may improve engagement during hospitalization and minimize self-directed discharge and fatal opioid overdose.
Hypothesis: Among ED patients treated for cellulitis/abscess, (1) clinicians more often treat OUD patients with non-opioid pain medications, and (2) OUD patients receive more non-opioid analgesics and fewer opioid analgesics.
Methods: We conducted a retrospective cohort study of ED patients treated for cellulitis/abscess in a single, urban academic healthcare system between 2017-2023. Primary outcome was type of first dose analgesic (opioid vs. non-opioid) administered. Secondary outcomes included total non-opioid medication administrations and total opioid medication administrations. OUD patients were identified as those who received naloxone in the ED or at ED discharge within six months of their visit or an ICD-10 code. Univariate and multivariable logistic regression and Poisson modeling was performed using SAS.
Results: In adult ED patients, there were 29,936 visits for cellulitis and abscess. Of these, 17,246 visits (57.6%) were treated with an analgesic during the initial 24 hours and 497 (2.9%) were OUD patients. OUD patients were primarily 26-50 years old, male, white, and non-Hispanic. After adjusting for confounding, OUD patients had 2.2 higher odds of receiving an opioid as their first analgesic (95% CI 1.81-2.77). OUD patients received a median of one non-opioid and two opioid analgesics. Poisson models showed opioid administrations among OUD patients were 1.3 times higher compared to non-OUD patients ($p < 0.0001$).
Conclusion: OUD patients treated for cellulitis/abscess had higher odds of receiving opioids as first-dose therapy and greater opioid administration incidence rate for acute pain. Future work will evaluate differences in total opioid dose administered, time intervals between opioid/non-opioid analgesics, and ED disposition.

172. A Novel Use of "The Three Day rule:" Post Discharge Methadone Dosing in the Emergency Department

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Background: Methadone is a medically necessary and lifesaving medication for many patients with opioid use disorder. To adequately address these patient needs, methadone should be offered in the hospital, but barriers exist that limit its continuation upon discharge. The code of federal regulations allows for methadone dosing as an inpatient as well as outpatient dispensing for up to three days to facilitate linkage to treatment.
Research Question: We created a new workflow for discharging patients on methadone to return to the emergency department (ED) for uninterrupted dosing as a quality initiative to see if this would facilitate continuity of treatment.
Methods: Our addiction medicine team changed hospital methadone policy to better allow hospitalization as a window of opportunity to start methadone. This necessitated the creation of a warm-handoff process to link patients to

methadone clinics if that linkage could not happen immediately on discharge. Thus, our team created the "ED Bridge" process, which utilized the "three day rule" to dispense methadone from the ED post hospital discharge. We then followed every patient we directed through this workflow as an observational cohort for outcomes and trends.
Results: Of the patients for whom ED bridge dosing was planned, 40.4% completed all bridge dosing and 17.3% received at least one but not all bridge doses. Established methadone patients made up 38.1% of successful linkages and 61.9% were patients who were newly started on methadone in the hospital.
Conclusion: How to improve methadone as a treatment option remains an ongoing question for policymakers and advocates. Our ED bridge workflow allows us to expand access and continuation of methadone now using existing laws and regulations, and to better utilize hospitals as a point of entry into methadone treatment.

173. Inadvertent Injection and Subsequent Surgical Removal of Extended-Release Buprenorphine

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Background: Buprenorphine is available as a subcutaneous extended-release injection indicated for the treatment of moderate to severe opioid use disorder. The management of an inadvertent injection of extended-release buprenorphine in an opioid-naive patient has not been previously described in the literature.
Hypothesis: Surgical excision of the depot formed by subcutaneous injection of extended-release buprenorphine leads to decreased buprenorphine absorption and improved clinical symptoms.
Methods: This is a case report of a single patient. A 38-year-old opioid-naive man with a history of methamphetamine use inadvertently received 300 mg extended-release buprenorphine with subsequent development of adverse effects evidenced by nausea, vomiting, dizziness, and lethargy. These symptoms persisted over a period of four days before the patient presented to the emergency department. The surgery team was consulted and successfully excised the extended-release buprenorphine depot from the patient's abdominal wall five days after administration. Serum levels of buprenorphine were obtained after the depot removal.
Results: Three serum buprenorphine levels were obtained after surgical excision of the buprenorphine depot. The serum concentration of buprenorphine was 1.7 ng/mL at 13 and 24 hours after excision, and 1.5 ng/mL at 40 hours after excision. The patient's clinical picture gradually improved over the subsequent three days. He ultimately left the hospital against medical advice 55 hours after buprenorphine depot excision. The known half-life of extended-release buprenorphine is 43 to 60 days.
Conclusion: Surgical excision of an inadvertently injected extended-release buprenorphine depot effectively removed unabsorbed buprenorphine. This is demonstrated by resolution of buprenorphine's adverse effects in an opioid-naive patient and decreased serum concentrations of buprenorphine over time.

174. Medication Administration and Resource Utilization in Psychiatric Patients With Substance Use Disorder During Prolonged Emergency Department Boarding Times

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Background: Patients presenting to the emergency department (ED) with psychiatric complaints often have comorbidities and substance use disorders (SUD). Due to limited bed capacity, these patients can have long boarding times. Errors of medication omission while boarding can lead to withdrawal and other adverse patient outcomes.
Research Question: To examine ED visits for psychiatric complaints in patients with SUD to describe resource utilization and administration of medications for withdrawal.
Methods: This study is a retrospective review of data collected by the National Hospital Ambulatory Medical Care Survey between 2014-2020. We included ED visits where the primary reason for visit was for a psychiatric complaint. We examined demographic data and visit characteristics, resource use, and withdrawal medications administered. We used descriptive statistics including proportions to describe the data, and spearman's rho (SR) or Pearson's correlation coefficient (PC) as applicable to describe trends. All p-values were reported at the 0.05 confidence level.
Results: From 2014-2020, there were an estimated 93.8 million ED visits with a primary psychiatric reason for visit. The mean length of stay was 49 hours. Most patients (58.1%) were 25-64 years of age, male (51.2%), and white (74.3%). Comorbidities included hypertension (27.9%), SUD (22.7%), other cardiac disease (19.6%), pulmonary disease (15.3%), and diabetes (6.5%). Urine toxicology screens were obtained in 34% and blood ethanol concentrations in 14.7%. The most common medications administered were benzodiazepines (4%) and antipsychotics (2.6%). Nicotine replacement therapy was administered in less than 0.1%. Buprenorphine was administered during 0.24% of visits and

there was no increase in administration over time. Naloxone was administered during 3.6% of visits.
Conclusions: Patients presenting to the ED with psychiatric complaints frequently had medical comorbidities and SUD. Medication administration for withdrawal states was rare despite long boarding times.

175. Preliminary Results From the Drug Overdose Toxico-Surveillance (DOTS) Reporting Program: Admission Status by Sociodemographic Characteristics*

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Background: The opioid overdose crisis has evolved to become poly-substance with novel psychoactive substances and adulterants. Real-time surveillance is needed to follow the trends to inform public health decision making and clinical management.
Research Question: What are the preliminary findings for characteristics among hospital admission status among patients seen in emergency departments for severe or life-threatening opioid and stimulant overdoses?
Method: The Drug Overdose Toxico-Surveillance (DOTS) Reporting Program launched a drug overdose surveillance system consisting of 17 medical toxicology sites to monitor severe opioid and stimulant drug overdoses presenting to the emergency department (Food and Drug Administration (FDA) Contract #75F40122D00028/75F40123F19002). Data forms captured demographic, clinical features, treatments, and admission status via chart review. Analyses consisted of examining sociodemographic characteristics by admission status.
Result: Three hundred and sixty-nine patients were approached for consent. Sixty-one declined consent and 10 were not able to provide a blood specimen. Two hundred and nineteen of the remaining 298 have completed clinical data to date. The mean age of patients was 45 years (SD 14.5), and 25% of the patients were 57 or older. However, there were no differences in age categories among admission status. Male admissions were 61 of 157 (39%) while female admissions were 29 of 62 (47%). Black/African American patients who consented were 125 of 137 (91%) with 42/125 (34%) admitted while Caucasian/White patients who consented were 75 of 105 (71%) with 43/75 (57%) admitted.
Conclusion: Gender and racial differences were noted in the rate of hospital admissions for severe opioid and stimulant overdoses. A high response rate was noted among African Americans however, these are still preliminary data. Future sensitivity analyses will evaluate if there are demographic differences between those who provided informed consent compared to those who declined.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

176. Maintaining Buprenorphine for Patients With Opioid Use Disorder Who Are Discharged Back to a Correctional Facility: A Case Series

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Background: Patients often present to the emergency department (ED) from correctional facilities (CF) due to opioid withdrawal. There are several barriers to patients being maintained on buprenorphine while incarcerated. When patients with a history of opioid use disorder (OUD) are induced on buprenorphine in the ED, they may subsequently experience opioid withdrawal soon after returning to the CF, prompting a presentation back to the ED.
Methods: This is a retrospective four patient chart review. The medical toxicology team was consulted for opioid withdrawal management for patients who presented from a CF. The patients were each diagnosed with OUD, severe based on DSM-5 criteria, and subsequently induced on buprenorphine. Upon discharge, each patient was provided with a letter advocating for the patient to be maintained on buprenorphine while incarcerated. Two patients were able to report on post-discharge outcomes. The CF was contacted for follow-up on two patients.
Results: The advocacy letter included: institutional letterhead; descriptions of the diagnosis of OUD, the patient's recommended buprenorphine regimen, and the evidence-based benefits of buprenorphine for OUD; an appeal to maintain the buprenorphine prescription while the patient was incarcerated; contact information for an outpatient OUD clinic; and signatures of the medical toxicology team. Patient 1 was incarcerated at a jail, Patient 3 at a prison, and Patient 4 at a jail, and all were maintained on buprenorphine. Patient 2 was incarcerated at a jail, was not maintained on buprenorphine (the jail did not have buprenorphine on formulary) and represented to the hospital due to opioid withdrawal.

Conclusion: These cases highlight a role for medical toxicologists to advocate for patients to be maintained on buprenorphine upon discharge back to a CF. Limitations include the small sample size, and the possibility that patients may have been maintained on buprenorphine for reasons other than the advocacy letter.

177. Prevalence of Novel Psychoactive Substances in Routine Prescription Drug Monitoring Clinical Urine Specimens

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Background: Novel psychoactive substances (NPS), also known as "legal highs", are designed to have similar effects to recreational drugs while circumventing legality issues. Use began to rise in 2010 and, as of 2022, more than 1,000 different NPS have been identified.
Hypothesis: The objective of this surveillance study was to determine the frequency of NPS compounds in deidentified remnant clinical toxicology urine specimens from a large clinical drug testing laboratory.
Methods: Deidentified remnant specimens that had been submitted for clinical drug testing were analyzed from March-July 2023. A three-point calibration curve was used to quantitate 85 NPS compounds in 6 NPS categories: fentanyl analogs, designer benzodiazepines, designer opioids, designer stimulants, synthetic cannabinoids, and other illicit compounds.
Results: In total, 3,734 specimens were analyzed. Of these, 13.1% tested positive for an NPS. Of the positive specimens, 7.5% contained only one NPS class and 5.6% contained two or more NPS classes. The class with the highest specimen positivity was other illicit additives (8.2% positive). Xylazine was the most commonly detected analyte, observed in 8.1% of specimens. Of the specimens containing xylazine, 97.7% were seen with fentanyl and fentanyl analogs and seven samples had no presence of fentanyl or fentanyl analogs.
Conclusion: In the 3734 randomly selected clinical toxicology specimens that were analyzed during the surveillance study, NPS were detected in 13.1% of specimens. Treatment decisions may be predicated upon NPS urinalysis results. This surveillance information can provide physicians insights into the necessity of NPS testing for higher-risk individuals in prescription drug monitoring programs; without NPS testing an individual may appear compliant with prescribed medications. NPS in clinical samples may also give insight into medicolegal matters and help identify when a drug has been obtained illicitly and what else may have been in the drug.

178. Implementation of Standardized Emergency Department Discharge Instructions to Increase Access to Naloxone and Buprenorphine-Naloxone

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Background: Emergency department (ED) encounters for opioid overdoses or withdrawal serve as a critical opportunity to deliver lifesaving medications to a high-risk population. Upon discharge, many of these patients do not receive appropriate prescriptions for naloxone or buprenorphine-naloxone. As workflow and time constraints contribute to under-prescribing of these therapies, we developed a standardized set of discharge instructions to reduce practical barriers to naloxone and buprenorphine-naloxone at ED discharge.
Hypothesis: Utilization of standardized discharge instructions with prepopulated medication orders will increase prescribing of naloxone and buprenorphine-naloxone at ED discharge for patients with opioid use disorder (OUD) and/or opioid overdose.
Methods: A panel of interdisciplinary experts (emergency medicine, medical toxicology, quality, informatics) created a standardized set of discharge instructions that included information on overdose prevention. In addition, an order for a naloxone discharge kit was auto-populated while a prescription for buprenorphine-naloxone was recommended. We subsequently evaluated use of naloxone and buprenorphine-naloxone in patients who presented to the ED with features of OUD, or after an opioid overdose. We compared prescribing rates pre- and post-implementation using descriptive statistics to evaluate impact. This study does not constitute human subjects research and is exempt from Institutional Review Board evaluation.
Results: From 6/14/22-10/31/22 (approximately 4.5 months), emergency providers within our health system ordered 46 naloxone kits, and 45 prescriptions for buprenorphine-naloxone. After the implementation of the new order set on 06/14/2023, we saw an increase in the number of naloxone prescriptions to 139 (a 202% increase) and buprenorphine-naloxone to 60 (a 33% increase) during the same time period in 2023.
Conclusion: This represents a low-cost and low-burden intervention with immediate patient benefits. Future study directions from this data could include optimizing the intervention geared towards buprenorphine-naloxone or studying the impact of the prescriptions at the individual patient level.

179. Opioid Overdose Response Simulation for Pre-Clinical Medical Students: Training Future Physicians for the Present Crisis

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Background: Opioid overdose deaths continue to rise in the US, and approximately 40% occur with bystanders present. Early training of medical professionals in educating lay people in opioid overdose response may increase naloxone use and reduce fatalities.
Research Question: Is a single case-based simulation training in opioid overdose identification, response, and layperson naloxone education effective in increasing confidence in these skills and acceptable for pre-clinical medical students?
Methods: We trained first- and second-year medical students in opioid overdose response and layperson education in intranasal naloxone administration via one 60-minute case-based simulation session. Pre- and post-session surveys assessed confidence when performing or teaching opioid overdose response and training acceptability using a Likert scale (1 = strongly disagree, to 5 = strongly agree). Paired t-tests were used to analyze pre- and post-session survey confidence levels.
Results: Thirty-five medical students completed the training, and 21 (60%) completed both pre- and post-session surveys. The training increased the mean confidence level in opioid overdose identification (+1.81 points (95% CI 1.26-2.36, $p < 0.01$)), administering naloxone in a healthcare setting (+1.71 points (95% CI 1.12-2.31, $p < 0.01$)), administering naloxone in a non-healthcare setting (+1.43 points (95% CI 0.81-2.05, $p < 0.01$)), and training others in naloxone use (+1.33 points (95% CI 0.83-1.84, $p < 0.01$)). After the training, students also reported a greater likelihood that they would administer naloxone if needed (+2.48 points (95% CI 1.82-3.13, $p < 0.01$)). A majority (95.2%) found the training appropriate, relevant, and would recommend it to peers.
Conclusion: A single case-based simulation training in opioid overdose identification, response, and layperson naloxone education was effective in building confidence in these skills and acceptable to pre-clinical medical students. These findings can inform medical school curricula to address the opioid crisis.

180. Implementation of an Emergency Department Naloxone Distribution Program

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Background: Only 37% of patients treated for unintentional opioid overdoses at an urban academic emergency department (ED) were given an intranasal (IN) naloxone prescription at discharge over a 3-month period in 2021; unknown prescription fill rate. We implemented an electronic medical record Best Practice Advisory triggered "kit in hand" distribution program at ED discharge in March 2023.
Hypothesis: Naloxone kit distribution will increase following program implementation.
Methods: Retrospective, observational study of adult ED patients with unintentional opioid overdose three months prior to, and three months after naloxone distribution program implementation. Patients who were incarcerated, expired, or required hospital observation or admission were excluded. Reasons eligible patients did not receive naloxone kits and demographics are reported. Univariate and multivariable regression were performed to identify differences in those that received a kit compared to those that did not.
Results: A total of 349 patients were included; 160 prior to (median age 39.5 years, 74.4% males, 63.1% White, 83.7% non-Hispanic) and 189 post implementations (median age 41 years, 75.7% males, 52.9% White, 81.5% non-Hispanic). Prior to implementation, 67.5% of patients received a naloxone prescription at discharge with only 23% known to have picked up the prescription. After implementation, 56.1% of patients left the ED with a naloxone kit in hand, and 6.9% of patients received a prescription. There were no differences between age, sex, race, ethnicity, or time of discharge from ED following comparison of those that received a naloxone kit and eligible patients that did not.
Conclusion: Provider intent to distribute IN naloxone kits was unchanged by the BPA driven distribution program (67.5% prescriptions vs. 63.0% prescription or kit dispense); but overall kit in hand at discharge was improved. Opportunities for program improvement were identified where kits intended to be ordered in notes but not ordered or ordered but ultimately not dispensed.

181. Medical Student Led Program to Increase Buprenorphine Prescriptions From an Emergency Department

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Background: Emergency Departments (ED) are often the first point of contact for individuals experiencing opioid overdose. Despite the recent establishment of buprenorphine as the standard of care for opioid use disorder (OUD) treatment, our ED's buprenorphine prescription rate remained low (< 1.5%), indicating significant barriers.
Hypothesis: Medical student-led interventions targeting provider-reported barriers substantially increase ED buprenorphine prescription rates.
Methods: This is a pre-post study at the largest ED in San Francisco. We included patients who either screened "yes" at triage for opioid use or had the word "opioid," "opiate," or "overdose" in their primary diagnosis or chief complaint as a proxy for patients with medication needs for OUD. Root cause analysis was conducted via medical student interviews with 30 ED providers, which guided the design of four unique interventions: establishing auto-populated OUD patient discharge care instructions, updating the buprenorphine initiation guideline on the ED's open-access clinical information hub, redesigning provider-facing signage on OUD treatment protocols and consult resources, and delivering three targeted educational lectures to all ED providers (attendings, residents, and advanced practice providers). Pre- and post-intervention ED buprenorphine prescription rates were analyzed using t-test, and prescriptions were categorized into new (not on buprenorphine the past month), old (been on buprenorphine the past month), and unspecified.
Results: Following a multi-method intervention, the buprenorphine prescription rate increased by 246%, from 1.46% to 3.59% ($p < 0.001$). Notably, there was a particular rise in new buprenorphine prescriptions, increasing from 41.3% to 57.5% among all prescribed buprenorphine from the ED.
Conclusion: ED buprenorphine prescription rates for patients with OUD more than doubled following targeted interventions stemming from an ED-specific root cause analysis. These findings can guide future efforts in ED medication prescription and linkage to OUD care. Given existing racial and socioeconomic disparities in OUD disease burden, future studies should identify interventions that mitigate buprenorphine prescription disparities.

182. "Start to Breathe" Pilot: Assessment of Knowledge Transfer From AHA's Layperson Opioid Overdose eModule to an Opioid Overdose Simulation

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Background: Educating the public on the recognition of an opioid toxidrome and the administration of naloxone may improve mortality in opioid overdose. A clinical simulation program developed a community-based program to train laypeople how to recognize and respond to an opioid overdose called "Start to Breathe." The aim of this pilot study was to assess the retention of knowledge from the online module to a high-fidelity simulation.
Research Question: Can participants retain and apply the online didactic knowledge and skills to an opioid overdose simulation?
Methods: The American Heart Association's Opioid Overdose Response Training for Laypersons online module was used for the didactic portion of this study. Fifteen pre-medical students participated in the pilot study. Participants completed the eModule and were individually presented with a simulated overdose victim to manage. Two independent emergency medicine faculty assessed participants' performance with a seven-point checklist and time to naloxone administration. Participants also completed a post-survey (five-point Likert scale ranging from poor to excellent) to gauge the effectiveness of the online module.
Results: Participants achieved an average of 13.2/14 total points on the performance checklist. The average time to the first dose of naloxone was 86 seconds. On the post-survey, participants answered an average of 4.53 when asked "To what degree did the online module prepare you to respond to a simulated opioid overdose?" and an average of 4.6 when asked, "How well do you feel this experience prepared you to respond to a real opioid overdose?"
Conclusion: This pilot study suggests that knowledge and skills acquired by a layperson from a self-directed online learning program can be effectively applied to a high-fidelity simulated opioid overdose patient. The online module is effective as the didactic component of simulation education for layperson training in opioid overdose recognition and reversal.

183. Incorporating Quantitative Drug Analysis Into Non-Fatal Drug Overdose Surveillance: The Toxicology Investigators Consortium Drug Overdose Toxico-Surveillance (DOTS) Reporting Program*

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Background: While postmortem drug overdose evaluations typically measure quantitative drug concentrations to determine cause and manner of death, such granular laboratory data is uncommonly available in non-fatal drug overdose surveillance systems. Given that most overdoses are polydrug exposures, understanding the contribution of these drugs to non-fatal drug overdoses is imperative to optimize clinical management and public health interventions.
Research Question: How can medical toxicologists implement a nationwide surveillance program to improve the understanding of polydrug overdoses.
Methods: Under Food and Drug Administration (FDA) Contract #75F40122D00028/75F40123F19002, the American College of Medical Toxicology's (ACMT) Toxicology Investigators Consortium (ToxIC) invited medical toxicology sites from around the United States to participate in the development of a surveillance system to enroll patients with severe opioid and stimulant overdoses through emergency departments. Since 2010, ToxIC has overseen a nationwide registry of patients seen by medical toxicologists at the bedside. A partnership was developed with the Center for Forensic Science Research and Education (CFSRE) to perform qualitative blood analysis employing a panel of > 1100 substances through liquid chromatography quadrupole time-of-flight mass spectrometry and quantitative measurements using liquid chromatography tandem quadrupole mass spectrometry. Chart review and patient interview forms were developed to collect clinical and behavioral data.
Results: Seventeen sites participated in the Drug Overdose Toxico-Surveillance (DOTS) Reporting Program, which represented 9 of 10 U.S. federal regions including inner-city and rural areas. Blood samples were sent to the laboratory every 60 days. Interviews were conducted to understand the patient's acute and chronic substance use, which is critical to understanding quantitative toxicological results. From April 1, 2023, to October 6, 2023, a total of 905 patients were screened and 298 consented and enrolled.
Conclusion: In Spring 2023, a novel drug overdose reporting program was successfully launched at 17 sites nationwide through the ACMT ToxIC network and CFSRE.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

184. A Case of Suspected Xylazine Withdrawal Mimicking Sepsis and Precipitated Withdrawal

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Background: Xylazine, an alpha-2 agonist, has been identified as an increasingly prevalent adulterant in the illicit opioid supply. Patients who regularly use illicit opioids are at risk for xylazine withdrawal.
Hypothesis: Xylazine withdrawal can present as a hyperadrenergic state mimicking sepsis and/or precipitated withdrawal.
Methods: This is a single case report. A 38-year-old male with opioid use disorder was admitted for management of opioid withdrawal and was treated with escalating doses of buprenorphine-naloxone (88 mg total loading-dose). He exhibited worsening hyperthermia, tachycardia, hypertension, tachypnea, abdominal pain, and leukocytosis requiring admission to the intensive care unit.
Results: In the ICU, exam revealed tremulousness, intermittent inattention, diaphoresis, and choreiform movements, which improved over the subsequent four days. He underwent broad work-up including CT angiography of the chest, abdomen, and pelvis, blood cultures, urinalysis, and respiratory viral panel, all of which were unrevealing apart from mild ileus. Liquid chromatography-mass spectrometry urine testing detected fentanyl, methoxyacetylfentanyl, and xylazine. He was treated in the ICU with buprenorphine-naloxone (8mg-2mg twice daily), clonidine, hydroxyzine, anti-psychotics (haloperidol, prochlorperazine, metoclopramide), and lorazepam. Patient later confirmed history of regular, heavy opioid use with an estimated 75-100 bags per day via insufflation. He stated his supply was sourced from Philadelphia; an area known for high prevalence of xylazine adulteration. The patient continued to improve with scheduled buprenorphine-naloxone, clonidine taper, and benzodiazepines as needed. He was discharged on hospital day nine with ongoing clonidine taper and buprenorphine-naloxone (12 mg - 3 mg twice daily).
Conclusion: Xylazine adulteration of the illicit opioid supply can cause a complicated withdrawal syndrome mimicking sepsis-like dysautonomia including tachycardia, tachypnea, hyperthermia, and leukocytosis, as well as precipitated withdrawal that does not respond to escalating doses of buprenorphine. A high index of suspicion for xylazine withdrawal is required in any opioid withdrawal patient who does not adequately respond to typical opioid agonist therapy.

185. Severe Precipitated Opioid Withdrawal Treated With High-Dose Continuous Fentanyl Infusion in a Patient With Chronic M30 Use

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Background: M30 tablets contain high doses of fentanyl, with 60% of tablets seized by the DEA in 2022 containing at least 2,000 mcg. These tablets are increasingly accessible and inexpensive, leading to high daily doses of fentanyl in chronic users.
Hypothesis: Chronic M30 users can develop severe precipitated withdrawal that can be refractory to traditional treatment modalities.
Methods: This is a single case report of a patient treated for opioid withdrawal. The patient is a 30-year-old male who was admitted to the hospital with septic arthritis of the knee and thoracic spine osteomyelitis. He reported smoking 60 M30 fentanyl tablets daily. Eight hours after his last fentanyl use, he began experiencing symptoms of opioid withdrawal for which he was treated in the ED with 8 mg of buprenorphine. One hour later he endorsed worsening symptoms of withdrawal and was given an additional 8 mg. He then experienced severe precipitated withdrawal and toxicology was consulted.
Results: On our initial evaluation he was in severe withdrawal characterized by agitation, muscle aches, diaphoresis, diarrhea, vomiting, hypertension, and tachycardia. To stabilize him prior to surgical washout, he was treated with full opioid agonist with intravenous fentanyl and hydromorphone. On hospital day one he received a total of 1700 mcg of fentanyl and 22 mg of hydromorphone but continued to have pain and objective signs of opioid withdrawal, including profuse diaphoresis and loose stools. He was ultimately stabilized on a fentanyl PCA at a maximum rate of 400 mcg/hr. At this dose he was alert and breathing spontaneously with mid-sized pupils and endorsing mild symptoms of withdrawal. He was gradually weaned from fentanyl and transitioned to methadone.
Conclusion: Patients with a history of chronic large quantity M30 use may require high doses of parenteral opioids to treat withdrawal symptoms when other modalities are ineffective.

186. A Case of Acute Nicotine Intoxication Resulting in Cardiopulmonary Arrest Due to Ingestion of High-Concentration Solution for Electronic Cigarettes

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Background: An increase of nicotine intoxication following an accidental or intentional ingestion/injection of nicotine solution has been feared worldwide. However, the clinical course of toxic symptoms after ingesting highly concentrated solutions is largely unknown.
Hypothesis: Ingestion of large amounts of nicotine can cause circulatory failure, respiratory muscle paralysis, and central neurogenic respiratory depression within minutes.
Methods: This is a single patient chart review. A 36-year-old woman with bipolar disorder intentionally ingested orally the entire amount of nicotine (10 g) in propylene glycol solution (100 mL) for electronic-cigarettes. Ten minutes after ingestion, she was already in cardiac arrest. Return of spontaneous circulation (ROSC) was achieved after 25 minutes, and then we performed gastric lavage, administered activated charcoal, and initiated targeted temperature management, under mechanical ventilation.
Results: In this case, no ventricular fibrillation occurred. Head CT scan performed at emergency room (ER) showed cerebral edema, and an upper gastrointestinal endoscopy revealed extensive esophagogastric mucosal erosion. On the other hand, vasopressors were no longer needed 10 hours after ingestion. On day four, esophagogastric mucosal erosion improved; however, respiratory depression worsened and widespread ischemic change in the brain was observed. On day eight, the patient's condition worsened toward brain death. The nicotine plasma concentration was 6569.1 μg/L in the ER and 85.3 μg/L at 30 hours after ingestion.
Conclusion: Ingestion of high-concentration nicotine solution, 200 times the lethal dose, led to cardiac arrest within a few minutes, resulting in irreversible brain damage. Metabolism was rapid and the plasma nicotine concentration fell below the lethal range after 30 hours, but the respiratory muscle paralysis and progression of cerebral edema were thought to be due to the direct toxicity of nicotine in addition to hypoxic encephalopathy.

187. Trends in Alcohol Withdrawal Management: A Single-Site Analysis of the Toxicology Investigators Consortium (ToxIC) Core Registry 2017-2022*

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Background: Alcohol withdrawal syndrome (AWS) is a life-threatening condition with multiple management modalities available. While benzodiazepines are the mainstay of treatment, we aim to elucidate the use of other medications, including phenobarbital, ketamine, and dexmedetomidine, in the management of AWS.
Hypothesis: Phenobarbital, ketamine, and dexmedetomidine are used with increasing frequency during the study time-period to manage AWS.
Methods: This is a retrospective review of de-identified cases submitted to the ToxIC Core Registry from a single health system between January 1, 2017 and December 31, 2022. All adult cases in which AWS was the sole reason for toxicology consultation were included. Descriptive statistics were used for analysis.
Results: This cohort included 457 cases of AWS. The average age was 51 years (22-84 years), with 77.7% male (n = 355) and 22.3% female (n = 102). Neuromuscular hyperactivity, including tremor, was present in 49.0% (n = 224) of cases, agitation in 25.2% (n = 115), delirium in 16.0% (n = 73), hallucinations in 12.0% (n = 55), and seizures in 11.6% (n = 53). Intubation was performed in 7.7% (n = 35) of cases. In 2017, more patients were managed with benzodiazepines alone than phenobarbital with or without benzodiazepines (66.7% vs. 25.9%). In each year from 2018 to 2022, more patients received phenobarbital with or without benzodiazepines than benzodiazepines alone (82.8% vs. 17.2% in 2018, 77.8% vs. 22.2% in 2019, 80.0% vs. 11.3% in 2020, 75.2% vs. 19.7% in 2021, and 66.1% vs. 27.4% in 2022). Ketamine and dexmedetomidine were used in no cases in 2017 but were administered in 3.0% (n = 5) and 3.6% (n = 6) of cases, respectively, in 2022.
Conclusion: An approach incorporating phenobarbital has replaced a benzodiazepine-only strategy as the most common method for managing AWS in our single-center cohort. Use of ketamine and dexmedetomidine showed an overall increase during this period. Limitations include self-reported, retrospective data from one site and the potential for missed cases.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

188. Treatment of Severe Alcohol Withdrawal, a Cross-Sectional Study of the Toxicology Investigators Consortium Database*

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Background: There is no consensus standard of care in escalation of therapeutic agents for the treatment of severe alcohol withdrawal. We sought to quantify medications used by medical toxicology services to treat severe alcohol withdrawal and describe patient outcomes by treatment group.
Methods: In this cross-sectional study, we queried the Toxicology Investigators Consortium database for patients with alcohol withdrawal that received phenobarbital, dexmedetomidine, or ketamine from November 2020 – May 2023. We used descriptive statistics to report therapeutics administered and patient outcomes of intubation/ventilator support and death for each treatment group. We compared outcomes of the most common treatment strategies, benzodiazepines plus phenobarbital versus phenobarbital monotherapy.
Results: We identified 1,017 patients that received one of the designated medications. Phenobarbital plus benzodiazepines were used to treat 555 patients (51%) and phenobarbital monotherapy was used for 391 (36%). We found no significant difference in the frequency of intubation (difference in proportions 1.0%, 95% CI -1.9 to 3.8) or death (difference in proportions 0.9%, 95% CI -0.1 to 1.9) between these groups. Multiple combinations of phenobarbital, benzodiazepines, dexmedetomidine, or ketamine were used. Statistical analysis of different combination therapies was not pursued due to multiple groups with a very small number of patients. A total of 60 patients (6%) received dexmedetomidine and 19 patients (2%) received ketamine. Twenty-one patients (35%) treated with dexmedetomidine and seven patients (37%) treated with ketamine received ventilator support. No patients treated with dexmedetomidine or ketamine died. Four patients were treated with dexmedetomidine monotherapy; one of these patients received ventilator support.
Conclusion: Variations in the selection of agents to treat severe alcohol withdrawal exist among toxicologists, with benzodiazepines and phenobarbital being the most commonly used agents. We found no significant difference in the number of intubations or deaths between patients receiving phenobarbital plus benzodiazepines and those receiving phenobarbital alone.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

189. Use of Toxicologist Approval to Improve Utilization of Toxic Alcohol Testing

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Background: A scarcity of helium, a non-renewable resource, threatens our ability to perform gas chromatographic testing. In response, we evaluated our health system's catalog of tests requiring helium and made recommendations to reduce inefficiencies in their use.

Hypothesis: Use of a toxicologist approval process would limit use of toxic alcohol assays requiring helium.
Methods: A panel of interdisciplinary experts evaluated the past-year use of toxicologic tests requiring helium. Toxic alcohols (methanol, ethylene glycol, and isopropanol) were identified as tests whose use could be streamlined through a medical toxicology approval process. This group created a process for obtaining medical toxicology approval using the established on-call system, and developed an electronic health record ordering panel that informed prescribers of the need for approval and allowed them to document the same. Our team communicated these changes to providers through a structured communication plan.
Results: From July 1, 2021 to July 5, 2022, providers within our health system ordered blood tests for methanol (n = 95), ethylene glycol (n = 93), and isopropyl alcohol (n = 58). On July 6, 2022, our approval process went live. From July 6, 2022 to July 10, 2023, providers ordered blood tests for methanol (n = 35), ethylene glycol (n = 38), isopropyl alcohol (n = 23). Our overall utilization of toxic alcohol testing decreased by over 60%. There was no increase in adverse event reporting during the post-intervention period.
Conclusion: Ongoing helium shortages mandate judicious use of testing for toxic alcohols. This study demonstrated that the development and implementation of a comprehensive pre-approval process was successful in preserving capacity.

190. Serum Ethanol Levels Do Not Correlate With Serum Lactate Levels

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Background: Presentations to the emergency department (ED) with ethanol intoxication are common and often seen in patients with underlying comorbid conditions. Serum lactate is a biomarker that is used in evaluating for shock, ischemia, and metabolic dysfunction. There is a hypothesized association between acute ethanol intoxication and elevated serum lactate due to alteration in the cellular redox state. Due to uncertainty of interpretation, providers may defer lactate testing in ethanol intoxicated patients; however, the extent of this association has not been quantified.
Methods: We performed a retrospective cohort study of adult patients who had a serum ethanol concentration > 50 mg/dL with a concurrent lactate concentration measured during an ED encounter in the Veterans Health Administration (VHA) from 2010 to 2019 which includes approximately 111 EDs. De-identified data was obtained with the VA corporate data warehouse and processed via Microsoft SQL query. Descriptive statistics and regression analysis were performed.
Results: Our search identified 223,433 visits with a serum ethanol concentration > 50 mg/dL. Of these visits, 4,776 had a corresponding serum lactate measurement. The final cohort was 96% male with an age range of 20 to 90 years old with median age of 58. On regression analysis, there was poor correlation found between ethanol and lactate with Pearson's correlation coefficient -0.01916 with p = 0.2192.
Conclusion: We found poor correlation between serum ethanol and lactate levels in this VHA ED patient population. An elevated serum lactate level should not be attributed to acute ethanol intoxication and ethanol intoxication should not be a deterrent to obtaining serum lactate levels when otherwise indicated. This data is limited due to its retrospective nature and the potential for cofounders. Prospective study could be conducted in the future to elucidate any potential relationship between serum ethanol and lactate levels.

191. Retrospective Chart Review of Patients With Alcohol Use Disorder and Suspected Alcoholic Ketoacidosis

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Background: Chronic alcohol use and co-morbid conditions such as alcoholic ketoacidosis (AKA) are common in adult patients in the emergency department, yet the diagnosis and treatment of AKA can be delayed due to variability in presenting symptoms. To date, there have been no emergency department based studies attempting to characterize this population. This study aims to describe laboratory findings, treatment, and outcomes in suspected AKA in order to increase understanding of this disease.
Research Question: In patients with alcohol use disorder, what laboratory findings are commonly seen in patients with AKA?
Methods: This is a retrospective chart review of a prospectively collected database of patients at a single suburban emergency department. A sample of patients with suspected AKA was identified when a medical toxicologist was formally or informally consulted by emergency medicine providers for suspected AKA. Patients ultimately diagnosed with a condition other than AKA were excluded. Patient charts were reviewed for pertinent laboratory findings in addition to treatment and disposition. These findings were summarized for mean, median and range.
Results: Fifty-one visits were identified among 20 patients between January 2018 and April 2023. We found that patients had a median initial pH of 7.3 and median anion gap of 26; were euglycemic to hypoglycemic with a median glucose of 138 mmol/L; had a significant lactic acidosis with a median of 7.7 mmol/L and maximum of 20.3 mmol/L; and most patients had an elevated beta-hydroxybutyrate levels with a median 1.3 mmol/L and maximum of 5 mmol/L.

Conclusion: We found a wide range of levels of acidosis and lactate elevation. Most patients were given crystalloid fluid bolus in the emergency department and admitted for continued fluid resuscitation. Majority of patients responded well to treatment and were subsequently discharged.

192. Research Priorities for Intentional Overdoses: An Approach to Advance Medical Toxicology Research Through Patient Engagement

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Background: Medical toxicologists are experts in treating patients who intentionally overdose, but medical toxicology research has not routinely engaged patients for patient-centered outcomes research (PCOR).
Research Question: What are five research priorities for intentional overdoses from a patient-centered perspective?
Methods: A total of nine patient experts were recruited by medical toxicologists, community partners and stakeholders (e.g., American Foundation for Suicide Prevention and the Addiction Policy Forum). Patient engagement strategies and material were developed in partnership with the University of South Carolina Patient Engagement Studio. After introductory one-on-one sessions, patient experts shared their stories in a group listening session with the project team. Eight research priorities were drafted and sent to the patient experts and medical toxicology researchers for feedback. An interactive session (open to all interested medical toxicology researchers) was held to discuss and finalize these research priorities with the patient experts. A post-session survey resulted in the selection of the top five research priorities.
Results: Thirteen participants (seven patient experts, three team members, and two medical toxicology researchers) responded to the post-session survey. The top five research priorities included: 1) Examine the impact of engaging peer recovery coaches/peer recovery support specialists early in the patient's care post-overdose; 2) Develop and test interventions that can be implemented through an interdisciplinary group (e.g., medical toxicologists, peer specialists) to improve post-overdose care; 3) Examine how to provide caregivers with resources post-overdose for adolescents; 4) Develop culturally appropriate questions for medical toxicologists (and other providers) to systematically understand the patient's background, history, overdose intent, and current experiences; and 5) Develop interventions and policies that reduce stigma/bias for those who intentionally overdose.
Conclusion: Research priorities from patient perspectives on intentional overdose were developed. This partnership with patient experts, stakeholders, and project team members is a foundation for future medical toxicology PCOR.

193. Comparison of Substance Use Trends Using Poison Center and State Police Uniform Crime Report Data Sources

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Background: We aimed to investigate the correlation between trends in drug related arrests reported to a single state Uniformed Crime Reporting Program and correlating exposures documented in the state poison center (PC) data.
Methods: We extracted PC data spanning 2020 to 2022 and analyzed exposures involving select illicit substances: amphetamine/methamphetamine, cocaine, heroin, phencyclidine, lysergic acid diethylamide (LSD), and morphine. Annual trends in drug exposures reported in the PC were juxtaposed with data on drug-related arrests published by the uniform crime reporting section of the state police department.
Results: Methamphetamine and amphetamine exposures decreased by 5.6% (47 less exposures) in 2021 and 7.6% (60 less exposures) in 2022 compared to the preceding year. Similarly, drug-related arrests decreased by 4.6% (203 less arrests) in 2021 and 5% (209 less arrests) in 2022 compared to the preceding year. Cocaine exposures decreased by 6% (14 less exposures) in 2021. Correspondingly, cocaine-related arrests indicated a 22% decrease (749 less arrests) that same year. Phencyclidine exposures and related arrests decreased by 30% in 2021 (10 exposures and 16 arrests). In 2022, phencyclidine exposures decreased by 32 % (7 less exposures), while phencyclidine related arrests decreased by 21% (18 less arrests). LSD-related exposures and arrests showed steady reductions, declining by 54% and 41% in exposures and 18% and 66% in arrests during 2021 and 2022, respectively. Morphine related exposures (19% and 14%) and arrests (30% and 6%) declined in 2021 and 2022, respectively. Heroin exposures decreased by 3% (67 less exposures) in 2022, while heroin-related arrests decreased by 23% in 2022 (373 less arrests).
Conclusions: This study underscores the importance of using several unique data sources to detect change in substance use trends. It also highlights the importance of in state

collaboration between poison centers and state officials to perform comprehensive drugs surveillance trends.

194. Trends in Cocaine Exposures Reported to the US Poison Centers

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Background: Cocaine use remains prevalent in society. According to United States CDC Wonder, overdose deaths involving stimulants, including cocaine, totaled 32,537 in 2021. The present study sought to evaluate the recent trends in cocaine exposures reported to the National Poison Data System (NPDS).
Methods: We queried NPDS for cocaine exposures between 2018 and 2022. We descriptively assessed the relevant demographic and clinical characteristics. Poisson regression models were used to evaluate the trends in the number and rates (per 100,000 human exposures) of cocaine exposures. Percent changes from the first year of the study (2018) were reported with the corresponding 95% confidence intervals (95% CI).
Results: Overall, there were 26,723 cocaine exposures reported to the poison centers (PCs) during the study period, 21.9% being single substance exposures. Among cases, the age groups 30 to 39 (26.3%) and 20 to 29 (25.0%) were most common. Males accounted for 63.2% of cases. Benzodiazepines were the most frequently co-occurring substances (13.9%). Intentional abuse (40.4%) and suspected suicides (35.1%) were the most common exposure reasons. Approximately 23% of cases were admitted to a critical care unit. Major effects were seen in 19.1% of cases with a case fatality rate of 3.8%. Intravenous fluids and benzodiazepines were the most frequent therapies. Tachycardia, agitation, and hypertension were the most commonly seen clinical effects. The frequency of cocaine exposures decreased by 9.8% (95% CI: 6.9%, 12.4%, $p < 0.001$). The rate of cocaine exposures decreased by 10.1% (95% CI: 8.2%, 14.2%, $p < 0.001$).
Conclusion: While our study results demonstrate a decrease in reports of cocaine exposures made to PCs, they remain common. Exposures in young age groups were more common and the majority were multi-substance. Continued surveillance efforts are key to track the population effects of cocaine and to help guide public health prevention.

195. Patterns of Buprenorphine Exposures Reported to the US Poison Centers

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Background: Expanding access to office-based buprenorphine therapy has been a key measure to respond to the current opioid crisis, with prescriptions increasing significantly. The present study sought to evaluate the recent trends in buprenorphine exposures reported to the US poison centers (PCs).
Methods: We queried the National Poison Data System (NPDS) for buprenorphine exposures from 2018 to 2022. We descriptively assessed the relevant demographic and clinical characteristics. Poisson regression models were used to evaluate the trends in the number and rates (per 100,000 human exposures) of buprenorphine exposures. Percent changes from the first year of the study (2018) were reported with the corresponding 95% confidence intervals (95% CI).
Results: Overall, there were 22,463 buprenorphine exposures reported to US PCs, 59.2% being single substance exposures. One third of the exposures (36.3%) were in patients 20-39 years old. Approximately 26% of cases were seen in children under five years of age and 53.4% were males. Ingestion was the most common route of exposure. The most frequently co-occurring substances were atypical antipsychotics (17.5%). Unintentional reasons (28.6%) and suspected suicides (19.8%) were the most common reasons for exposure. Approximately 19% of the cases were admitted to a critical care unit. Major effects were seen in 8.5% of cases with the case fatality rate being 0.4%. Central nervous system depression, vomiting, and agitation were the most commonly seen clinical effects. The frequency of buprenorphine exposures decreased by 4.4% (95% CI: 3.4%, 7.4%, $p < 0.001$). The exposures increased between 2018 and 2020 but decreased thereafter. The rate decreased by 5.1% (95% CI: 2.2%, 9.2%, $p < 0.001$).
Conclusion: The current five-year study revealed that overall buprenorphine exposures have decreased. However, a significant proportion of these exposures were seen in young children, signaling an urgent requirement for renewed preventive efforts and public health education campaigns to protect children from exposure.

196. Impact of a Customized Harm Reduction Training Program on Emergency Medicine Resident Knowledge, Confidence, and Satisfaction

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Background: The application of Harm Reduction (HR) principles and strategies to treat patients with substance use disorder (SUD) improves health outcomes, yet medical school and residency curricula provide little education on foundational HR principles and strategies. Studies reveal that few emergency medicine (EM) physicians incorporate routine screening, intervention, and referrals into their

practice, and many feel unprepared and uncomfortable caring for patients with SUD. We developed a training program incorporating SUD and HR principles for EM resident physicians and assessed its impact on their knowledge and confidence in treating patients with SUD.

Methods: Our training program consisted of two components: an online module and in-person simulation-based module. The online module introduced and reinforced participant knowledge. The in-person simulation-based module focused on physician interview skills, HR philosophy and skills, and medical ethics. We conducted pre- and post- program assessments on participants' knowledge of HR and surveyed their impression of, application of, and confidence in HR principles.

Results: Thirty-five residents participated in our program. Seventy-eight percent of participants completed the online module and 76% completed the in-person module. Seventeen residents completed both the pre- & post-training assessments and 14 completed both pre- & post-training surveys. Scores on the assessments increased after training (11.3 to 13.1, $p < 0.0001$). Survey responses revealed increased confidence of the participants' abilities in the following: 1) Assessment of patient's readiness to change risky substance use (48 vs. 72.1, $p < 0.0005$); 2) Discussion of HR strategies with patients (45.25 vs. 76.6, $p < 0.00$); 3) Assessment of patient's interest in and readiness for treatment (48.44 vs. 71, $p < 0.001$); 4) Familiarization with local treatment options and how to access them (32.95 vs. 47.62, $p < 0.04$).

Conclusion: This customized hybrid training program resulted in significant improvement in resident knowledge regarding SUD and HR. The program also improved the resident physicians' confidence and skills in working with patients who have SUD.

197. Is Chronic Pain Associated With Fentanyl or Fentanyl-Analog Overdoses in ED Patients?*

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Background: While the current wave of the opioid epidemic is driven by fentanyl and synthetic analogues (fentalogs), it remains unclear whether chronic pain and prescription opioid misuse are risk factors for fentalog overdose.

Hypothesis: Among emergency departments (ED) patients presenting with confirmed opioid overdose, are chronic pain and prescription opioid history associated with fentalog overdose (compared to prescription opioids)?

Methods: The ToxIC Fentalog Study is an ongoing prospective observational cohort from 2020-present at 10 participating hospitals across the US. Qualitative toxicological analyses were performed on waste serum using liquid chromatography quadrupole time-of-flight mass spectrometry to detect over 1100 psychoactive substances. History of chronic pain and prescription opioid use were assessed via chart review. Associations between chronic pain, prescription opioid misuse, and confirmed fentalog overdose (compared to prescription opioid overdose without fentalogs) were assessed using logistic multivariable regression models.

Results: Of the 1289 patients with toxicology results available, 203 (15.7%) had past medical histories of chronic pain, and 239 (18.5%) had a prior prescription opioid misuse history. Among those reporting chronic pain, 41.4% (N = 84) also had current or previous prescription opioid misuse histories. Compared to confirmed prescription opioid overdose, those with chronic pain and prescription opioid misuse histories were significantly less likely to present with fentalog overdose (aOR: 0.89; 95% CI: 0.80, 0.99). An interactive effect was found between chronic pain and prescription opioid misuse such that chronic pain was not associated with a reduced odds of fentalog overdose alone (controlling for prescription opioid misuse) in the multivariable model (aOR: 0.99; 95% CI: 0.92, 1.06).

Conclusion: In ED patients with confirmed opioid overdose, prescription opioid misuse history modified the association between chronic pain and prescription opioid overdose (compared to fentalog overdose). Future work should focus on improving overdose prevention programs for those with chronic pain and prescription misuse histories.

ToxIC: This research was performed by the ACMT Toxicology Investigators Consortium

198. Carbonyl Iron Ingestion With Elevated Serum Iron Concentration

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Background: Carbonyl iron is a form of6reduced elemental iron available over the counter as a dietary supplement; acute overdoses are rarely reported.
Methods: Single patient case report. A 14-year-old female ingested 30 combination 65 mg carbonyl iron and 125 mg ascorbic acid tablets: a 36 mg/kg dose of elemental iron. Prior to the presentation, she had one episode of vomiting. Initial vital signs were notable only for mild tachycardia. Physical examination was normal. Abdominal radiography showed no radiopaque foreign bodies. Serum iron concentration nine hours post-ingestion was 557 mcg/dL (99.7 micromol/L). Renal and hepatic function testing were within normal limits. Iron concentrations decreased to 484 mcg/dL, 74 mcg/dL, 34 mcg/dL at 12, 24 and 27 hours post-ingestion, respectively. Deferoxamine was not administered given the patient was asymptomatic and had decreasing iron concentrations. She remained asymptomatic over a 30-hour observation period and was then medically cleared for psychiatric hospitalization.
Results: Carbonyl iron is used to treat iron deficiency anemia. Studies in animals and humans have shown it has a favorable side effect profile relative to iron salts, such as ferrous sulfate. The LD50 for carbonyl iron is > five g/kg compared to 319 mg/kg for ferrous sulfate. Why this patient developed elevated serum iron concentrations exceeding established toxic thresholds with minimal symptoms is not well understood. This is a scenario in which serum iron concentrations do not reflect the same potential for toxicity that is seen following an iron salt ingestion. Thus, treatments dependent on serum iron concentrations, namely chelation therapy, may be applied needlessly.
Conclusion: Carbonyl iron can elevate serum iron concentrations into the toxic range without causing clear symptoms or sequelae of iron poisoning. Treatment guidelines solely based on serum iron concentrations may not apply to patients who ingest carbonyl iron.

199. 1,4 Butanediol Toxicity Presenting With High Anion Gap Metabolic Acidosis

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Background: The gamma-hydroxybutyrate (GHB) precursor 1,4-butanediol (1,4-BD) is used as an industrial solvent and drug of abuse. It is rapidly metabolized to GHB via alcohol and aldehyde dehydrogenases. GHB and its precursor chemicals rarely cause high anion gap metabolic acidosis with elevated osmolar gap, findings classically associated with toxic alcohol ingestion.
Hypothesis: Ingestion of 1,4-BD can cause a high anion gap metabolic acidosis with elevated osmolar gap.
Methods: Single patient case report. A 43-year-old man developed rapid onset obtundation and bradypnea in an auto repair shop. He was brought to the emergency department, where he was comatose, bradycardic (50 beats/minute), and bradypneic (eight breaths/minute). He was intubated for airway protection following no improvement with naloxone. Orogastric suction aspirated 350 mL of red-colored sweet-smelling fluid. Laboratory evaluation was notable for bicarbonate 16 mmol/L, anion gap 28 mEq/L, serum osmolarity 312 mOsm/kg (osmolarity gap 23 mOsm/kg), and lactic acid 9.3 mmol/L. Ethanol and beta-hydroxybutyrate concentrations were undetectable. Venous blood gas demonstrated pH 7.1 and pCO2 62 mmHg. Fomepizole was administered due to concern for toxic alcohol ingestion; hemodialysis was deferred due to rapidly improving acid-base status. Ethylene glycol, methanol, and diethylene glycol concentrations were undetectable. Following self-extubation later that day, he endorsed ingesting 1,4-BD and was discharged on hospital day four with no sequelae. Urine testing for GHB showed a concentration of 200 µg/mL (normal < 10 µg/mL). Gastric aspirate 1,4-BD concentration by liquid chromatography-tandem mass spectrometry was 162 µg/mL.
Conclusion: High anion gap metabolic acidosis with osmolar gap can occur following 1,4-BD ingestion. Consequently, GHB and precursors should be considered as part of this differential diagnosis in obtunded patients. Larger ingestions may benefit from gastric aspiration and alcohol dehydrogenase inhibition to limit continued absorption and conversion to GHB.

200. Tianeptine Exposures On the Rise: NPDS 2018-2023

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Background: Tianeptine is an atypical antidepressant with opioid agonist effects. Description of exposures reported to poison centers in the United States is limited to data through

2017. This study provides more up to date data on annual exposures, outcomes, and concomitant exposures.
Methods: This is a retrospective, observational study using the National Poison Data System. Exposures to tianeptine from 1/1/2018 through 9/30/2023 were extracted from the database. We performed descriptive statistics on single and multiple substance cases and linear regression on change over time. Medical outcomes and level of care are limited to single substance cases.
Results: There were 1,082 tianeptine exposures over the period. Seven-hundred seventeen were single substance and 365 were multiple substance exposures. Exposures increased every year; there were 86 exposures in 2018, 105 in 2019, 151 in 2020, 210 in 2021, 246 in 2022, and 284 through September 2023; this was an increase of about 42 cases per year ($p < 0.001$). Exposures per month were mostly in legal states except for one outlier month. Most exposures were in males (730; 67.5%) with a mean age of 37.1 years. Reason for exposure were mostly intentional abuse (39.7%), withdrawal (17.7%), and suspected suicide (14.0%). Intentional abuse increased from 23.3% to 43.1% ($p = 0.0307$) and withdrawal decreased from 20.9% to 13.0% ($p = 0.0308$) Concomitant exposures included phenibut (18.6%), ethanol (17.3%), benzodiazepines (14.8%), kratom (10.7%), gabapentin (7.4%), amphetamines (6.3%), and kava kava or kava (5.2 %).
Conclusion: Tianeptine exposures increased from 2018 through September of 2023. Concomitant exposures are similar to previously reported studies. Outcomes were mostly moderate and about half were admitted to a healthcare facility.

201. Systemic Ketamine Toxicity Following Dermal Application of a Compounded Analgesic Cream

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Background: Ketamine is a NMDA receptor antagonist commonly used as a dissociative anesthetic and analgesic that is conventionally administered via the intravenous, intramuscular, or intranasal route. Ketamine-compounded topical preparation use has increased for the treatment of neuropathic pain and pruritus with limited reports of significant side effects. Systemic absorption of these products may lead to unintended adverse psychotropic effects and toxicity.
Hypothesis: Dermal absorption of a ketamine-compounded product can cause systemic toxicity.
Methods: This is a single-patient case report of a 61-year-old male who presented to an emergency department after being stopped by the police for erratic driving. Just prior to this, he applied a large amount of cream containing 10% ketamine, 5% lidocaine, and 5% amitriptyline to his perineal region for pain caused by pyoderma gangrenosum.
Result: Upon arrival, the patient was agitated and undressing himself. Vital signs showed blood pressure 119/76; heart rate 108; temperature 99.9°F; RR 18; SpO2 94% on room air. Exam was notable for numerous ulcerative lesions involving the groin and sacral area, diaphoresis, and torsional nystagmus. EKG was sinus tachycardia with a QRS of 92 ms. Labs demonstrated a WBC count of 19,200. Computed tomography of his brain revealed no acute intracranial abnormality. The patient's agitation and nystagmus resolved within five hours of presentation, and he was discharged. Mass spectrometry of the patient's urine revealed ketamine (32,300 ng/mL), nortriptyline, lidocaine, and N,N-Dimethyltryptamine (18.1 ng/mL).
Conclusion: This patient's toxidrome was consistent with ketamine toxicity, which is supported by the significantly elevated urine ketamine level and exam findings including agitation and torsional nystagmus. Emergency physicians, toxicologists, and dermatologists should be aware that topical ketamine can produce systemic toxicity, especially when applied to areas of skin with impaired barrier function or near the perianal region, where absorption via the gastrointestinal tract is possible.

202. Treatment of Yew Toxicity With ECMO After Failure of Sodium Bicarbonate

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Background: The yew plant (Taxus baccata) is well known to be toxic. Its bark, leaves, and seeds contain taxine alkaloids, which inhibit sodium and calcium channels in cardiomyocytes. This blockade causes cardiac dysrhythmias that can precipitate cardiogenic shock. We present a case of a patient who developed acute cardiogenic shock after yew ingestion requiring extracorporeal membrane oxygenation (ECMO) despite sodium bicarbonate administration.
Methods: A 17-year-old healthy male was brought to the Emergency Department (ED) after ingestion a "large amount" of common yew (Taxus baccata) in a suicide attempt. Two hours after dinner, he was found minimally responsive with

"spasm-like" movements and surrounded by vomitus. On arrival to the ED, he was somnolent and found to have a wide complex tachydysrhythmia prior to experiencing a cardiac arrest. Cardiopulmonary resuscitation was performed for approximately two minutes with administration of one mg of epinephrine and one shock prior to return of spontaneous circulation. The wide complex tachycardia persisted, and a lidocaine infusion was started. The patient was given two doses of 100 mEq of sodium bicarbonate without response. An echocardiogram showed decreased ejection fraction (EF), and the ECMO team immediately cannulated the patient at bedside. Over the next few hours, the QRS complex narrowed with slow resolution to normal sinus rhythm. The patient was decannulated the next day with the return of his baseline mental status. Repeated echocardiograms showed improvement of his EF over the next few days.
Conclusion: The treatment of yew toxicity is still largely based on case reports with variable response to sodium bicarbonate. This case demonstrates the value of early ECMO consideration when sodium bicarbonate fails to address the cardiac toxicity.

203. Plasma Exchange for the Treatment of Amatoxin-Induced Acute Liver Failure and Coagulopathy

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Background: Ingestion of cyclopeptide containing mushrooms is rare and optimal treatment of these patients is poorly understood. Here, we report a case of Amanita phalloides consumption resulting in acute liver failure.
Methods: This is a single patient case report.
Results: A 62-year-old male patient presented to the emergency department (ED) approximately eighteen hours after ingestion of mushroom he had foraged for in his backyard for abdominal pain and vomiting. In the ED, he was hemodynamically stable. Laboratory studies were significant for bicarbonate 12 mMol/L, anion gap 22, creatinine 3.2 mg/dL, BUN 55 mg/dL, ALT 817 IU/L, AST 705 IU/L, lactate 4.1 mMol/L, WBC 11.4, INR 1.9, and pH 7.19. The patient was admitted to the transplant intensive care unit and started on N-acetylcysteine bolus and infusion, multi-dose activated charcoal, and penicillin G infusion at 40 million units per day for three days. On hospital day two, ALT was > 5000 IU/L and AST was 6378, INR 5.3, and ammonia 187 uMol/L. He was started on continuous renal replacement therapy for hyperammonemia and underwent three total treatments of plasma exchange with improvement of his ammonia and coagulation profile. On hospital day seven, the patient's kidney injury had resolved, and his liver injury had markedly improved and he was discharged home.
Conclusion: In addition to N-acetylcysteine, multi-dose activated charcoal, and penicillin G, plasma exchange and continuous renal replacement therapy should be considered when treating patients who have ingested a cyclopeptide containing mushroom as a part of supportive care.

204. *Nerium Oleander* Toxicity With Hyperkalemia Successfully Managed With Digoxin-Specific Fab Antibody Fragment

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Background: Nerium oleander is a poisonous plant that contains the cardiac glycoside toxin oleandrin. Hyperkalemia is a poor prognostic factor associated with increased mortality in acute cardiac glycoside poisoning. We present a case of N. oleander poisoning with severe hyperkalemia successfully treated with digoxin-specific immune Fab.
Hypothesis: N. Oleander toxicity associated with severe hyperkalemia can be successfully managed with digoxin-specific Fab antibody fragments.
Methods: This is a single patient chart review. A 49-year-old man with unknown medical history presented to regional community hospital stating he consumed whiskey with an unknown amount of crushed oleander seeds with suicidal intent. The referring hospital consulted our poison center for assistance.
Results: The patient presented in atrial fibrillation with normotension on initially documented vital signs. He reported nausea and vomiting. His initial blood work showed potassium of 5.4 mEq/L, serum digoxin level of 0.2 mcg/L, and blood ethanol of 29 mg/dL. Initial ECG, per description, showed slow atrial fibrillation with normal QRS and QTc intervals. Patient was initially treated with furosemide and crystalloid fluids with four-hour repeat potassium of 7.0 mEq/L. The poison information specialist recommended 20 vials of digoxin specific fab antibody fragment, though only five vials were administered due to pharmacy availability. He subsequently received additional furosemide and IV fluids. Over the ensuing eight hours, his potassium improved to 5.5 mEq/L. By the morning of hospital day two, his potassium normalized, he remained hemodynamically stable with normal vital signs, and was medically cleared for psychiatric disposition.

Conclusion: Concern exists for reduced efficacy of digoxin-specific immune Fab in non-digoxin cardiac glycoside toxicity. However, we observed improvement in N. oleander poisoning associated with severe hyperkalemia after treatment with digoxin-specific Fab antibody fragments.

205. Pediatric *Convallaria majalis* Exposures Reported to the National Poison Data System

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Background: *Convallaria majalis* contains convallotoxin, a cardiac glycoside that can cause heart block, bradycardia, hyperkalemia, and dysrhythmias depending on the amount of the plant ingested, which is difficult to assess in children. The American Association of Poison Control Centers reported 2,008 exposures to plant cardiac glycosides in 2020, of which 70% occurred in children, and although most pediatric plant ingestions are benign, it is challenging to determine whether patients are safe for home management.
Research Question: How often do pediatric *Convallaria majalis* ingestions reported to US poison centers cause major outcomes?
Methods: This is a retrospective review of pediatric cases with confirmed or suspected exposure to *Convallaria majalis* reported to the National Poison Data System from 1/1/2000 to 1/1/2023. We included patients 0-19 years old with single-substance exposures. Variables collected included demographic data, medical outcomes, and sites of medical management. Patient characteristics were summarized using descriptive statistics.
Results: In total, 2,636 patients with exposures to *Convallaria majalis* were identified; median age was two years. Eighty-six percent were home managed, and nine percent were referred to healthcare facilities. There were 66 minor and seven moderate effect cases. There was one major effect case. Documented effects related to exposure were rare, but included bradycardia (n = 3), CNS depression (n = 2), abdominal pain (n = 13), vomiting (n = 28), and nausea (n = 12). There were no cases of high degree heart block, dysrhythmia, electrolyte abnormality, or death related to exposure. Therapies provided included dilution (n = 1,163) and activated charcoal (n = 125). No patient required digoxin specific immune fragments, antiarrhythmic, or cardioversion. One required vasopressors and intubation coded as unknown relation to exposure.
Conclusion: Pediatric ingestions of *Convallaria majalis* rarely cause problems warranting medical attention. Poison centers may safely recommend home management of asymptomatic patients to optimize resource utilization, decrease health care costs, and relieve burden to families.

206. Necrosis and Amputation Following Black Locust Tree (*Robinia Pseudoacacia*) Dermal Penetration

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Background: Black locust trees (Robinia pseudoacacia) contain the toxalbumins phasin and robin, which are known to cause cell death by inhibition of protein synthesis. The early clinical course of dermal exposures is not well documented.
Methods: This is a case report involving a single patient followed by a regional poison control center.
Results: A 48-year-old male presented to the emergency department with swelling of his left second digit after he was stuck by two thorns of a black locust tree several hours prior. The thorns were immediately removed by the patient. His exam was notable for fusiform swelling along the length of the left pointer finger with distal ecchymosis. Radiography of the digit showed diffuse swelling without fracture or foreign body. Hand surgery was consulted and performed irrigation and debridement the next day in the operating room. Subsequent wound and blood cultures were positive for methicillin sensitive staphylococcus aureus. On the third day after exposure, the distal digit became more necrotic. The patient underwent amputation of the digit proximal to the PIP joint due to the presence of necrotic tissue on the fourth day after exposure. After a transthoracic echocardiogram showed no evidence of endocarditis, the patient was discharged on hospital day eight with a peripherally inserted central catheter for two weeks of continued antibiotics.
Conclusion: The toxalbumins present in the black locust tree can cause significant tissue damage that may then serve as a nidus for subsequent infection. Necrosis and limb-threatening infection can rapidly result, and operative debridement may be necessary. Our case highlights the importance of aggressive wound care including tetanus immunization and the early involvement of surgical specialists following dermal black locust tree exposures.

207. Learning by Leaves and Bounds: An Active Learning Approach to Poisonous Plants

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Background: Plant toxicology is typically presented in lecture format to emergency medicine (EM) residents as part of their weekly didactic sessions. Multiple studies have shown that active learning leads to better understanding and knowledge retention. Our goal was to assess whether an active learning activity was able to improve resident understanding of plant toxicology.
Hypothesis: Active learning is an effective way to teach plant toxicology to EM residents.
Methods: This is a descriptive study. Residents were introduced to a toxic plant garden where 19 frequently tested plants were grouped by their mechanism of action listed with their scientific and common names. Groups of residents from multiple class years were tasked with pairing cards that contained a representative plant picture and a clue, either toxic effects or treatments. Authors acted as facilitators of the activity. They were given 30 minutes to complete the task followed by a content review with open discussion. Participants completed a five question pre and post assessment. Feedback was gathered by surveys on a five-point Likert scale.
Results: Assessment scores improved for all participants following the activity (0.625 pre vs. 2.125 post $p < 0.05$). On a five-point Likert scale, participants rated themselves as better able to study plant toxicology on their own (1.38 pre to 3.69 post $p < 0.05$) and better able to identify plants on their toxidromes (1.44 pre vs. 2.75 post $p < 0.05$). Residents found the activity to be engaging (4.1 +/- SD 0.23) and promoted interactive communication (4.1 +/- SD 1.1).
Conclusion: We herein present a novel approach to teaching residents plant toxicology. The module taught the subject material in an engaging and interactive manner. This method of teaching plant identification is flexible, adaptable, and easily expandable. Future work will include the addition of other common toxic plants, fungi, and commonly misidentified nontoxic plants.

208. Escape the Classroom - Preferred Learning Styles of Medical Students After a Toxicology Escape Room Experience

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Background: Medical education has long utilized classroom didactics to deliver information to medical students and trainees. However, there have been shifts towards simulation techniques over the years, more recently including escape room simulations as escape room entertainment increased in popularity.
Hypothesis: We sought to evaluate the effectiveness of an escape room style learning environment for over 50 medical students at a national medical education conference, as we believe this type of activity is preferred over traditional didactics.
Methods: This is a convenience sample survey in which participants were queried before and after the escape room, answering questions about their level of training, their learning inclination, and if the escape room changed their preference of lecture style. Participants were given a table-top scenario in which they had to escape a toxin by going through a series of toxicology puzzles and rhymes to pick the correct antidote. Afterwards, they were given a debrief of the toxin, the antidote, and the puzzles they solved.
Results: Almost three-quarters of respondents were first or second year medical students. Prior to the event, 71% of respondents preferred simulation-based learning, but 89% had never participated in an escape room style event. Following the event, 94% of respondents noted that they preferred either simulation education only or a combination of simulation-based and classroom-based learning, with 48% of respondents noting that this particular activity had changed their preferences towards simulation education or a combination. Ninety-six percent of respondents rated this toxicology escape room a four or five out of five on the Likert scale of satisfaction.
Conclusion: With these results, we believe that medical schools, residencies, conferences, and other places of medical education may consider utilizing escape room activities to teach their learners relevant toxicology topics.

209. The Evaluation of Clinical Skill Levels of Emergency Medicine Residents in Medical Toxicology With Simulation

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Background: The purpose of the study was to design and apply simulation-based Objective Structured Clinical Examinations (OSCE) to evaluate the clinical skill levels of emergency medicine residents in medical toxicology, clinical decision-making, and medical management process, and to determine the existing deficiencies.
Method: Five OSCE stations were created to test residents in medical toxicology. These included two simulated case videos, one standardized patient scenario, and two high-technology realistic models, and applied to the participants within two days. The clinical skill levels of the participants were evaluated at each station with a standardized form by the assessors. All the data were analyzed by transferring to the SPSS 22.0 statistical program.
Results: A total of 51 emergency medicine residents were included in the study. The number of people who were successful at a minimum of one station was found to be 19 (37.3%), and the number of people who were not successful at any station was 32 (62.7%). Statistically significant factors between those who were successful at a minimum of one station and those who were unsuccessful at any station were: participation in the simulation study, working in an institution with a medical toxicology unit, and working as a resident for > 24 months ($p < 0.05$).
Conclusion: This is the first study that was conducted in the field of medical toxicology with this measurement and evaluation method. The results highlight the importance of having a standard medical toxicology training curriculum and rotation for emergency medicine residents for the care of poisoned patients.

210. Investigation of Clinical Skill Levels of Emergency Medicine Residents on Toxic Terrorism Medical Management

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Background: The aim was to measure the clinical skill levels of emergency medicine residents by developing a simulation-based clinical exam to measure toxic terrorism readiness and emergency medical management skills.
Method: The study was developed by medical toxicologists for five case scenarios that were simulation-based, and a clinical skills exam on toxic terrorism readiness and emergency medical management. For the exam, a total of five stations were created (two simulated case videos, two standardized patient scenarios, and one case scenario) by using a reality-like model (containing technology). Evaluators assessed the residents by using standardized forms at each station. Each station was evaluated as successful, improvable, or unsuccessful according to diagnostic interventions and treatment management.
Results: A total of 48 emergency medicine residents participated in this study. The highest success rate of emergency medicine residents was demonstrated at the third station (botulism case scenario) in the study with 16 participants (33.3%). All residents were unsuccessful at the second station and no resident was successful at all five stations. When evaluating the descriptive and educational information of emergency medicine residents and their success in at least one station, statistically higher achievement rates were detected among women, those who worked in the residency for more than 24 months, those who received CBRN training, and those who received simulation-based training.
Conclusion: This study is a standardized and simulation-based measurement and evaluation method developed to measure the clinical skills and knowledge of emergency medicine residents about toxic terrorism. This study emphasizes the necessity of developing the existing core education curricula on toxic terrorism and the need for a measurable assessment process to ensure emergency medicine residents are competent with the medical management of this rare but high-risk scenario.

211. Addressing Polysubstance Overdose With an Agnostic Pharmacological Strategy

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Background: The opioid overdose crisis has evolved into a polysubstance overdose crisis, posing challenges to existing treatments for respiratory depression. Xylazine has become increasingly prevalent in polysubstance overdoses. Xylazine releases neurotransmitters in the central nervous system resulting in sedation, analgesia and euphoria as well as decreases in peripheral vascular resistance, heart rate and blood pressure. When fentanyl is adulterated or associated with xylazine (FAAX), patients experience enhanced euphoria as well as life threatening effects on breathing. As a result, traditional opioid-receptor antagonists like naloxone are less effective against FAAX-induced respiratory sequelae.
Hypothesis: To address the current polysubstance overdose challenge, a new approach is needed, focusing on a respiratory stimulant that works independently (i.e., be 'agnostic') of the cause, does not reverse opioid pain relief, is effective against both hypoxia (low O_2) and hypercapnia (high CO_2), has a rapid onset of action, and has a good safety profile including minimal central nervous system activity.
Method: Review of preclinical and clinical study data to demonstrate the effects of an agnostic respiratory stimulant, ENA-001.
Results: ENA-001, a novel respiratory stimulant, works by inhibiting the large-conductance Ca^{2+}/voltage-activated big K^+ (BK) channels located in chemosensory glomus cells of the carotid bodies, a peripheral site of action. ENA-001 works in contradistinction to receptor blockade by an antagonist, which is hampered by ever-more-potent opioid agonists and polysubstance-induced respiratory depression and is 'agnostic' to the cause and therefore ideally universally effective. Studies demonstrate its ability to safely increase ventilation in a dose-dependent manner and reverse respiratory depression induced by opioids, benzodiazepines, isoflurane, and propofol in both animal models and recent human trials.
Conclusion: In conclusion, targeting BK channels in the carotid bodies may offer a safe and effective approach to address the complexities of polysubstance overdoses.

212. Clinical Outcomes of Tirzepatide Overdose

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Background: Tirzepatide is a novel glucose-dependent insulinotropic polypeptide (GIP) receptor and glucagon-like peptide-1 (GLP-1) receptor agonist that increases glucose-dependent insulin secretion, decreases inappropriate glucagon secretion, and slows gastric emptying. Its use is becoming increasingly popular across the United States for the treatment of type II diabetes mellitus and weight loss but has no published literature in the overdose setting.
Methods: This was a retrospective cohort study conducted in patients exposed to tirzepatide across three poison centers between May 2022 and November 2023. A database search of ToxSentry® was performed using ToxSentryWeb®. Patients were excluded if they coingested any medication that may cause significant hypoglycemia. The primary outcome was clinical effects related to tirzepatide. Secondary outcomes included incidence of hospital admission, reason for exposure, and dosing range. Basic descriptive statistics were performed including mean (SD), median (IQR), and frequencies.
Results: Ten patients were exposed to tirzepatide from May 2022 to November 2023. All ten patient exposures were unintentional therapeutic errors, with nine being acute-on-chronic exposures. None of the patient exposures had coingestants reported. Four patients reported taking tirzepatide for weight loss, while six patients did not report an indication for use. Most patients were female and the average age was 45 (IQR 38-53) years. The median dose administered was 30 (IQR 20-50) mg. Six patients were asymptomatic, while four patients reported nausea and three patients reported vomiting. One patient required hospital admission, while all other patients were managed at home (n = 6) or observed in a healthcare facility (n = 3). Hypoglycemia was not reported.
Conclusion: There is a paucity of literature regarding the disposition of tirzepatide overdose. This study found that tirzepatide is well tolerated in the setting of unintentional therapeutic errors, with the majority of clinical effects being gastrointestinal-related and managed at home.

213. Critical Hypoglycemia in Isolated Metformin Overdoses

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Background: Metformin, unlike other diabetic medications, does not act via insulin-mediated mechanisms or by stimulating insulin release, so providers are not commonly concerned with hypoglycemia. However, critical hypoglycemia can occur following large metformin overdoses in the absence of co-ingestions.
Methods: This is a review of two patient cases. Case 1) A 24-year-old woman with no history of diabetes who was prescribed metformin as an off-label adjunct to psychiatric medications presented to the emergency department (ED) two hours after intentional ingestion of 120 tablets of 500

mg metformin. Family denied access to hypoglycemic or other diabetes medications at home. Initial glucose was 102 mg/dL. Aspirin, acetaminophen, and ethanol concentrations were not detected. Her lactate concentration increased from 2.2 to 9.3 mmol/L over two hours. While awaiting dialysis, her mental status declined. Her fingerstick glucose was undetectable (< 40 mg/dL) but responded to IV dextrose. Expanded drug testing was positive for benzodiazepines and cannabis. The serum metformin concentration was 100 mcg/mL (therapeutic concentration: 1-2 mcg/mL). Hypoglycemia did not recur. Case 2) A 32-year-old woman with no history of diabetes presented after ingesting 145 tablets of 500 mg metformin over 24 hours reportedly for intoxication. She was somnolent on ED arrival. The initial fingerstick glucose was 16 mg/dL. After IV dextrose, her mental status improved. Her lactate concentration was 26.4 mmol/L, arterial pH 7.02, and creatinine 6.2 mg/dL. A sodium bicarbonate infusion was started prior to transfer for dialysis. Aspirin, acetaminophen, and ethanol concentrations were not detected. Urine drug screen detected only cannabinoids. Ethylene glycol, isopropanol, methanol, and acetone were not detected. Blood samples obtained 11 hours after initial presentation revealed metformin concentration was 8.5 mcg/mL. No other hypoglycemic agents were detected. Hypoglycemia did not recur.
Conclusion: Massive metformin overdose can be associated with profound hypoglycemia in the absence of other hypoglycemic agents. Providers seeking Poison Center consultation for such cases should be aware of the risk.

214. Surge of Semaglutide Identified: A Case Series Reported to a Regional Poison Control Center from 2019-2023

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Background: Semaglutide is a glucagon-like peptide -1 receptor agonist approved in 2017 for type 2 diabetes. In 2021, it was approved for chronic weight management leading to an uptick in exposures reported to poison centers. Its popularity caused prefilled injectable pen shortages which led to compounding pharmacy efforts to formulate multidose vials contributing to dosing confusion among the formulations.
Research Question: What is the incidence of hypoglycemia and what are the error patterns with therapeutic semaglutide use reported to one US poison control center?
Methods: This is a retrospective chart review of a single poison center's semaglutide cases from 2019 to 2023. A Toxicall® search of semaglutide therapeutic error exposures of coded fields and the verbatim were extracted and reconciled.
Results: There were 52 semaglutide therapeutic errors during the study period. The case count rose 625% from 2019 (n = 4) to 2023 (n = 29). The majority (67%) were managed outside of a healthcare facility. Most exposures resulted in minor clinical outcomes, but two patients experienced a moderate outcome of hypoglycemia (4%, blood sugar of 68, 56 mg/dL). Most therapeutic errors (35%) were due to administration confusion in switching between formulations, followed by dosage amount errors (31%) which included two-fold, three-fold and ten-fold dosing errors. Titration errors occurred in seven cases, and five patients injected semaglutide daily instead of weekly. Other therapeutic errors included taking the wrong medication, taking someone else's medication and one iatrogenic compounding error.
Conclusion: Following the approval of semaglutide for chronic weight management therapeutic errors reported to poison control centers have increased. The majority of therapeutic errors were due to administration confusion between formulations. The incidence of hypoglycemia was low, and most patients were managed outside of a healthcare facility with minor effects.

215. Usefulness of a Toxicosurveillance Tool at the Emergency Departments to Keep an Efficient Awareness System

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Background: The surveillance of the epidemiological profile of acute poisoning cases attended in the ED is fundamental to keeping updated the diagnostic and therapeutic tools and the trend of the involved toxic products. Our Unit of Clinical Toxicology (UCT) tries to reach this goal by following all the cases that meet this profile in a prospective way. Our hospital covers a population of 300,000 people, representing a robust sample of our regional population.
Methods: UCT staff daily fill an electronic form with 46 items describing demographics, chronology, intentionality, group and specific product, analytical results, symptoms, treatment, and evolution of all acute poisonings attended in our ED. We show the data of the cases incorporated in the database in 2022.
Results: Total ED cases were 141,455. Acute poisoning cases were 949 (0.67%). The mean age was 38 ± 18-years. Distribution by sex was even: 53% men and 47% women. Patients under 15 are 49 (5%). Drug abuse cases were significantly prevalent (46%) followed by suicide gestures (32%) and accidental cases (10%). The main substances involved were abused drugs led by ethanol (54%),

and medications led by benzodiazepines (34%). Other agents, very prevalent in the world around us, such as paracetamol (5%) and opioids (2%) had a low incidence. Household, industry, and agricultural chemicals were also very infrequent (7%). The main route of entry was oral (78%). Symptomatic cases at admission were 79%, mostly neurologic (69%). Sixty-eight percent of cases received symptomatic treatment and 15% antidotes. Just in 8% of the cases, gastric decontamination was performed. Eighteen cases were admitted in the ICU. Three lethal cases were registered related to traumatic lesions under the effect of ethanol.

Conclusion: A prospectively filled database encompassing all cases of acute poisoning attended to in the ED is a highly valuable tool for identifying and addressing potential harmful changes.

216. Woof! I Ate My Dog's Medicine

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Background: Oclacitinib is a veterinary JAK1 inhibitor used for allergic symptoms in dogs that can cause gastrointestinal distress in acute overdose and increased risk of infection and cancer in chronic use that was found during animal studies. Although other JAK1 inhibitors are approved for human use, there have been few documented cases of human oclacitinib ingestion.

Methods: This is a single patient case study via chart review. A 52-year-male presented to the emergency department (ED) after accidental ingestion of 24 mg of oclacitinib one hour prior to arrival. Our service was consulted via telemedicine for further management.

Results: On presentation the vital signs were all within normal limits. Labs including complete blood count, complete metabolic panel, and troponin were within normal limits. The EKG was also normal. Documentation from the encounter reported no physical exam abnormalities. The patient denied any acute symptoms during the encounter. He was observed for six hours in the ED on telemetry without any incidence and discharged home.

Conclusion: Our case demonstrated that the acute ingestion of oclacitinib resulted in no acute physiologic derangements and is well tolerated. The typical dose in veterinary medicine is 0.4-0.6 mg/kg and our patient is 114 kg (ingested a dose of 0.2 mg/kg); therefore, further studies will need to be done on the effects when higher doses of oclacitinib are ingested.

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