Pediatric Ingestions: What’s new that’s killing kids?

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Objectives

• Discuss the risk of pediatric toxic ingestions
• Evaluate which pediatric population is at highest risk
• Discuss intoxications caused by newly emerging products
• Discuss tools that can help prevent pediatric intoxications
Pediatric ingestions

• Poisoning represents one of the most common medical emergencies in the pediatric population
• Estimates of poisoning episodes annually in the US range in the millions
• Unintentional poisonings makes up to 85% of the reports
• Intentional poisonings comprise 10 to 15% of the reports
Pediatric ingestions

• Among children 5 years or younger, poisoning is related to exploratory behavior
• Those at increase risk include
  – Peak age 1 to 4 years
  – Male gender
  – Hyperactivity behavior
  – Increase finger to mouth activity
Pediatric ingestions

- Some agents are more culpable because of
  - Ease of access
  - Palatability/attractiveness and
  - Toxic potential
- Typical environmental factors include
  - Recent move or acute stressors
  - Parental illness or disability
Pediatric ingestions

• In 2012, Poison centers received 2.3 million calls concerning human exposures, 2,937 people died
• A leading cause of death was exposure to opioid exposure
• The number of opioid exposures among children under 6 years more than doubled annually
Pediatric ingestions

• Even though opioid poisoning continue to occur among young children, new threats to the pediatric population are emerging

• These threats include
  – Laundry detergent pods
  – Cannabinoid drugs
  – E-cigarette liquid nicotine
  – Energy drinks
  – Hand sanitizers
Laundry detergent pods

- Dishwasher and laundry detergents are common household products that used to be found in both liquid and powder form.
- Laundry detergent packets or pods were introduced in Europe in 2001 and in US in 2012.
Laundry detergent pods

- In 2013 and 2014, 62,254 exposures to laundry and dishwasher detergents were reported to US Poison Centers
- Almost 60% of those exposures involved detergent pods
- As of January 2013, the number of monthly laundry detergents pods exposures surpassed that of traditional detergents products
Laundry detergent pods

• This rapid increase in laundry detergent pod exposures is in part associated to its increase presence and use in the market

• Children younger than 3 years of age accounted for the majority of the exposures

• Children exposed to laundry detergent packets have 4 to 8 times more risk of developing clinical effects compared to those exposed to other detergents
Laundry detergent pods

- Children with these exposures have higher odds of being admitted and having serious medical outcomes than those exposed to other types of detergents.
- When compared to other detergent exposures, children exposed to laundry detergent pods required intubation, CPR and cardioversion more often.
## Laundry detergent pods

**Predominant Clinical Effects of Laundry Detergent Pods**

<table>
<thead>
<tr>
<th>All routes of exposure</th>
<th>Vomiting/nausea (48%)</th>
<th>Coughing/choking (13.3%)</th>
<th>Ocular Pain (10.9%)</th>
<th>Lethargy (7%)</th>
<th>Conjunctivitis (6.7%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingestion</td>
<td>Vomiting/nausea (60.9%)</td>
<td>Coughing/choking (14.6%)</td>
<td></td>
<td>Lethargy (7.8%)</td>
<td></td>
</tr>
<tr>
<td>Ocular exposure</td>
<td>Ocular burns (2.7%)</td>
<td>Ocular pain (50.6%)</td>
<td></td>
<td></td>
<td>Conjunctivitis (11.7%)</td>
</tr>
</tbody>
</table>
Laundry detergent pods

• Serious clinical effects include:
  • Coma
  • Respiratory arrest
  • Pulmonary edema
  • Cardiac arrest
  • Death
Laundry detergent pods

- It's unknown why more severe clinical effects and medical outcomes are noted with laundry detergent pod exposures compared to traditional detergent or even dishwasher pods.
- Differences in composition and concentration may account for the higher toxicity.
Laundry detergent pods

- Management after exposure is supportive
- Remove clothing and rinse exposed body parts to avoid further exposure
- Inducing vomiting is not recommended
- Goal directed symptomatic treatment is the best approach
Laundry detergent pods

- The Consumers Union has recommended that this product not be used.
- In 2013 Procter & Gamble (Maker of Tide Pods) introduced opaque product packaging, added a warning label and latches to the container.
- Coincidentally there has been a decrease in exposure since 2013.
Laundry detergent pods

• The American Standard of Materials (ASTM) adopted a safety standard for these products
• This standard has a number of weaknesses:
  – It does not require the packets to be individually wrapped
  – Also the standard does not address the possibility that the design, color, or fragrance may be attractive to young children
Laundry detergent pods

• House Bill 1139, the Detergent Poisoning and Child Safety Act of 2015, was introduced to Congress in February 2015.

• This Bill will allow the US Consumer Product Safety Commission to create mandatory standards if voluntary standards does not adequately address the safety issues.
Laundry detergent pods

• One of the postulated standards would be to change the chemical composition of the detergent pods

• Research is needed to determine the ingredients or its concentrations that are most responsible for the observed toxic effects

• Some of the possible culprits include ethoxylated alcohols and propylene glycol, which are also found in liquid detergents
Laundry detergent pods

- In addition to changing the packaging and chemical composition of the pod, educational efforts and public awareness may help prevent exposures.
- Detergents should be stored up and out of sight of children and in a locked cabinet.
Laundry detergent pods

- Health care providers should counsel parents about appropriate storage of pods
- Households with children younger than 6 y/o should be encouraged to use traditional detergents
Cannabinoids

• Since 1996, 23 states in the US and DC have legalized medicinal use of marijuana

• Four states have also decriminalized the recreational use of marijuana

• In all states were marijuana is legal, the possession or consumption of marijuana by a minor, younger than 21 y/o, is still illegal
Cannabinoids

- The National Poison Data System reported an increase in unintentional pediatric marijuana exposure from 2005 to 2011 in states that passed marijuana decriminalization legislation.
- In 2010 US Poison Centers reported over one million of exposures in children younger than 5 y/o.
- Of these 9.1% were evaluated and discharged and 1.3% required admission.
Cannabinoids

• In comparison, 92.8% of the recent pediatric exposures in Colorado required admission or observation in the ED
• This suggests more significant clinical effects than typically reported for exposures in young children
• The increase in pediatric exposures are more likely associated to increase availability of marijuana after decriminalization
Cannabinoids

- Since decriminalization of marijuana there has been an explosion of medical marijuana dispensaries
- In 2011, the marijuana industry made 1.5 billion in sales, in 2015 the sales increased to 3.3 billion
- Part of this growth has included expansion in the available forms of marijuana to include edible products, concentrated tinctures and e-cigarettes
Cannabinoids

• These edible products included soft candies, cookies, hard candies, popsicles, and beverages
• These products are often indistinguishable from non-marijuana-containing products
• Edible are highly attractive and palatable for children
Cannabinoids

- Marijuana edibles can contain very high amounts of tetrahydrocannabinol (THC) (100 to 500 mg)
- Studies have shown that the majority of the pediatric marijuana exposures are from edibles
- Historically, because of the poor palatability of the marijuana plant, pediatric marijuana exposures were of low consequence
- Because of the increase palatability and THC concentration, more severe symptoms have been reported after ingestion
Cannabinoids

• The primary cannabinoids in Marijuana are delta 9-Tetrahydrocannabinol (THC) and cannabidiol (CBD)

• THC is primarily responsible for the psychoactive properties of Marijuana
Cannabinoids

• Cannabinoids are thought to exert their pharmacological activity via several mechanisms
• The most studied is a receptor mediated mechanism that includes two receptors CB1 and CB2
• CB1 receptors are located mainly throughout the central nervous system
• CB2 receptors are only found in peripheral tissues
Cannabinoids

- Stimulation of the receptors in the central nervous system produces
  - Hallucinations
  - Illusions
  - Memory loss
  - Dyskinesia
  - Sedation
- Toxic reactions are usually mild after accidental ingestion but it can cause significant sedation in children
Cannabinoids

• Other signs and symptoms can include
  • Anxiety
  • Panic episodes
  • Dyspnea
  • Chest pain
  • Nausea and vomiting
  • Dizziness
  • Somnolence
  • CNS depression
  • Respiratory depression
  • Coma
Cannabinoids

• In contrast to adults, the pediatric patient typically presents CNS depression
• Pediatric patient has an increased risk of airway compromise and aspiration
Cannabinoids

• More severe clinical effects have been noted in pediatric exposures with the majority of these exposures being from edibles
• Edibles carry a higher concentration of THC and because of its palatability a larger exposure
• The onset of action from ingestion is 2 to 4 hrs compared to 3 to 10 min from inhalation
Cannabinoids

• Management
  – The management of acute marijuana intoxication consists primarily of supportive care
  – Symptoms like agitation, anxiety and psychosis are well managed with benzodiazepines
  – Gastrointestinal symptoms can be managed with ondasetron and metoclopramide
Cannabinoids

• Management
  – Tachycardia and hypertension respond well to benzodiazepines and IV fluids
  – Diagnostic confirmation adds little value to the acute intoxication management
  – Synthetic Cannabinoids (Spice, K2) will not show in a routine urine drug screen
Cannabinoids

• Management
  – Pediatric patients younger than 6 year of age presenting with CNS depression should be observed until symptoms resolve either inpatient or in the ED
  – For patients 6 years or older, disposition should be determined according to the provider assessment of symptoms severity, patient co-morbidities, and caregiver reliability
Cannabinoids

• Management
  – Patients without AMS may be discharged if they remain asymptomatic after 4 hrs of ingestion
Cannabinoids

• Prevention
  – Medical Marijuana should be treated like any other medication and be kept away from children in a locked cabinet
  – Medical Marijuana, specially edibles, are often packaged on attractive food packaging
  – Given the success of child resistant packaging, the marijuana industry should adopt the Poison Prevention Packaging Act standards
Energy Drinks

• Energy drinks may contain caffeine, taurine, sugars and sweeteners, herbal supplements and other ingredients

• Caffeine is the main ingredient in energy drinks and may contain 70 to 80 mg/8-oz serving

• Energy drinks often contain additional amounts of caffeine thru additives like guarana, kola nut, yerba mate and cocoa
Energy Drinks

- Each gram of guarana can contain 40 to 80 mg of caffeine and has a longer half-life
- Manufacturers are not required to list the caffeine content from these ingredients
- The actual content of caffeine in a single serving may exceed that listed
- In the US, adolescent caffeine intake averages 60 to 70 mg/day and ranges up to 800mg
Energy Drinks

• Most of the caffeine intake in the young comes from soda, however, energy drinks are becoming increasingly popular

• One study found that 31% of 12 to 17 year old reported regular consumption of energy drinks

• It wasn't until 2010 that US Poison Centers started tracking energy drink overdoses
Energy Drinks

• Since 2010 40% of the calls to the US Poisons Centers associated to energy drinks overdoses involved children younger than 6 years of age
• Moderate to major outcomes have been reported in 42% of cases involving energy drinks that were mixed with alcohol and 19% in those that did not contain alcohol
• Among all cases with major outcomes, cardiovascular effects were reported in 57% of cases and neurologic effects in 55%
Energy Drinks

• Other outcomes include
  • Liver damage
  • Kidney failure,
  • Respiratory disorders,
  • Seizures,
  • Agitation,
  • Psychotic conditions,
  • Rhabdomyolysis,
  • Dysrhythmias,
  • Heart failure
  • Death
• Management is goal-directed and symptomatic
Energy Drinks

• The FDA imposes a limit of 71 mg of caffeine per 12 oz of soda
• Energy manufacturers may circumvent this limit by claiming that their drinks are a natural dietary supplements
• Thus safety determinations of energy drinks are made solely by manufacturers and there are no requirements for testing, warning labels, or restrictions against sales to minors
Energy Drinks

• The US Senate is considering a Bill that would require supplement manufacturers to register annually with the FDA and allow FDA to recall supplements suspected of being unsafe
• Healthcare providers need to be aware of the energy drinks dangers
E-cigarettes

- Electronic Nicotine Delivery Systems (ENDS) also called e-cigarettes, are products that produce an aerosolized mixture containing flavored liquids and nicotine.
- ENDS can resemble tobacco products like cigarettes, cigars, pipes, or common gadgets like pens or flashlights.
- These products are exploding in popularity and are being used by adolescents.
E-cigarettes

- ENDS are now estimated to be a 1.5 billion market and are projected to increase 2%/year thru 2018
- In 2015 more teens used ENDS than regular cigarettes: 10% 8th graders, 14% 10th graders and 16% of 12th graders
- ENDS products can be easily purchased online by minors
E-cigarettes

- ENDS contain a liquid solution that is usually flavored.
- Common flavors include chocolate, bubble gum, peach, peppermint, and piña colada
- ENDS solution also include other chemicals such as anti-freeze, diethylene glycol and carcinogens
E-cigarettes

• There has been an increase in unintentional exposures and poisonings from ENDS in the US, including inhalations, eye and skin exposures and ingestions

• In 2014 Poison Centers reported 3,783 exposures to ENDS and nicotine liquid, compared to only 1,543 exposures in 2013

• In 2015, 3,073 exposures were reported

• The majority of the exposures were among children 0 to 5 years of age
E-cigarettes

- Nicotine liquid refills are available in various strengths ranging from 6 mg/ml (6%) to 36 mg/ml (3.6%)
- Severe nicotine toxicity in children has been reported with nicotine doses as low as 2 mg
- Estimated 6 mg/kg is a lethal dose of nicotine, and ingestion of the contents of 2 ml (<0.5 tsp) can be fatal to a 12 kg 20 month old
**E-cigarettes**

- Nicotine is well absorbed from the respiratory tract, mucosal surfaces, skin and intestines
- Nicotine exposure can occur from inhaling, ingesting or coming in physical contact
- Symptoms of acute nicotine toxicity are generally mild and resolve within 12 hrs without treatment, but large exposures can be fatal
E-cigarettes

- Symptoms of acute nicotine intoxication include fine tremor, nausea, tachycardia, and hypertension.
- Severe poisonings have a biphasic reaction:
  - Early symptoms occur within the first hour and are characterized by increased salivation, vomiting, diaphoresis, seizures, cardiac dysrhythmias and muscle fasciculations.
  - Late symptoms occur 0.5 to 4 hours and include hypotension, bradycardia, lethargy, and respiratory failure.
E-cigarettes

• Management
  – There is no antidote to reverse the effects on nicotine ingestion
  – Treatment should be goal directed and supportive
  – With ENDS nicotine ingestion more severe clinical effects should be expected, the child should be observed for at least 4 hrs until asymptomatic
E-cigarettes

• Prevention
  – In early 2016 a Bill was signed into law that required child resistant packaging for ENDS products
  – ENDS users should keep e-cigarettes and liquid nicotine locked up and out of children's reach
  – Internet sales of ENDS should be banned to minimize youth access to these products
E-cigarettes

• Prevention
• Liquid nicotine should be packaged in child resistant non attractive packaging
• Liquid nicotine should be flavorless
Hand Sanitizers

- Ethanol-containing hand sanitizers play an important role in reducing transmission of disease at home, hospitals and the classroom
- According to the Worldwide Cleaning Industry Associates more than 70 million worth of hand sanitizers have been sold in year
- Sales of hand sanitizers in the US have double in one year
Hand Sanitizers

• National Poison Data System (NPDS) received reports of 68,712 hand sanitizer exposures between 2005 and 2009

• A total of 80.5% of the reports occurred in children < 6 years, media age was 2 years

• There was an equal exposure between males and females
Hand Sanitizers

• In those younger than 6 years, 99.9% of the exposures were unintentional

• Those aged 6 years to 19 years, 77% of the exposures were unintentional
# Hand Sanitizers

## National Poison Control Center Data: Alcohol and Non-alcohol Containing Hand Sanitizers Calls

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Hand Sanitizer Calls</th>
<th>Hand Sanitizer Calls in Children 12 years and under</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>20,014</td>
<td>17,208</td>
</tr>
<tr>
<td>2012</td>
<td>21,050</td>
<td>18,098</td>
</tr>
<tr>
<td>2013</td>
<td>20,974</td>
<td>17,972</td>
</tr>
<tr>
<td>2014</td>
<td>21,057</td>
<td>17,989</td>
</tr>
<tr>
<td>2015</td>
<td>15,882+</td>
<td>13,460+</td>
</tr>
</tbody>
</table>
# Hand Sanitizers

<table>
<thead>
<tr>
<th>Year</th>
<th>Hand Sanitizer Calls</th>
<th>Total exposures in children 12 years or under</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>587</td>
<td>562</td>
</tr>
<tr>
<td>2012</td>
<td>552</td>
<td>517</td>
</tr>
<tr>
<td>2013</td>
<td>622</td>
<td>601</td>
</tr>
<tr>
<td>2014</td>
<td>526</td>
<td>518</td>
</tr>
<tr>
<td>2015</td>
<td>462+</td>
<td>410+</td>
</tr>
</tbody>
</table>
Hand Sanitizers

• Alcohol based hand sanitizers containing ethanol or isopropanol, can have an alcohol concentration ranging from 60% to 95%
• Most hand sanitizers have an alcohol concentration of 60% to 65%
• Though a tiny amount of hand sanitizer that may have been licked from your hands can cause a child to become ill, a larger dose could be fatal
Hand Sanitizers

• The packaging, smell, flavoring and color of hand sanitizers can be very tempting for a child
Hand Sanitizers

• “Purell Shots”-Some adolescents are drinking hand sanitizers straight from the bottle to get drunk

• Instructions can be easily found on the web to use salt to separate the ethyl alcohol from the glycerin gel
Hand Sanitizers

- Acute ethanol intoxication can result in serious life-threatening clinical effects including:
  - Hypothermia
  - CNS and Respiratory depression
  - Cardiac dysrhythmias or arrest
  - Hypotension
  - Nausea and vomiting
  - Acute liver injury
  - Myoglobinuria
  - Ketoacidosis and hypoglycemia
Hand Sanitizers

- Ethanol intoxication can be fatal in a the range of ≥ 400mg/dL
- Most children are exposed to small doses which cause minor effects, but there are reports of severe symptoms and even death associated to larger doses
Hand Sanitizers

• Management
  – Therapy of severe ethanol overdose is primarily supportive by providing airway protection, respiratory support and addressing any metabolic disturbance
  – Hemodialysis is effective at removing ethanol but unnecessary if the airway is protected and there is no severe organ damage
  – Alcohol dehydrogenase inhibition with Fomipazole is contraindicated as it will prolong toxicity
Hand Sanitizers

• Young children should be supervised while using hand sanitizers
• Hand sanitizers should be stored in areas that are not easily reached by young children
Summary

• Ingestions are one of the most common pediatric medical emergencies
• Children younger than 6 years of age are at higher risk
• With the introduction of new products into the market, new hazards have also being introduced
Summary

• Laundry detergent packets are becoming one of the most common types of pediatric toxic exposures
• Laundry detergent packets exposures produce more severe effects than traditional detergent exposures
• With the decriminalization of marijuana in multiple states, an increase in marijuana intoxication has been reported
Summary

• Nicotine exposure from ENDS can be lethal with less than 1/2 tsp solution
• As health care providers we need to advocate for safer packaging for these new products
• These products need to be treated as the hazard they are and be kept away from children
Summary

• Even though hand sanitizer exposure tend present with mild symptoms, there is potential for a fall ingestions at large doses
• Hand sanitizers are becoming a substance of abuse among adolescents