POISONING OF A PEDIATRIC PATIENT

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I have no financial interests or relationships to disclose
Objectives

1. To be able to identify signs and symptoms of common toxins
2. To know when and how to treat “poisoned” patients
3. To be able to identify prescription medications that can be deadly to children

Case 1

- 2 yo F drinking unknown substance from a plastic bottle. Within a day, she was lethargic, and became unresponsive. Parents took child in via private vehicle
- PE: cardiac arrest, pupils fixed and dilated
- Labs:
  - Glu 35
  - ABG – pH 6.5, lactate 17, AG 28
  - CT – anoxic brain injury
  - UDS - pending
Case 1 cont

- UDS was positive for methadone
- Head CT done and positive for anoxic brain injury.
- In the ED: intubated, CPR, epinephrine, dextrose, calcium and sodium bicarbonate with ROSC.
- Parents later disclosed that the plastic container was full of methadone
- Pt found to be brain dead, and life support taken

Case 2

- 3 yo M with Upper respiratory infection, with alternating doses of ibuprofen and acetaminophen q 4 hours x 5 days, presented to the ED with nausea, vomiting and diarrhea.
- PMH: Meds: Cough medicine (chlorpheniramine, dextromethorphan, phenylephrine, and acetaminophen), ibuprofen
- PE: VS: BP 106/66, HR 123, RR 54, T 36.8 C
  - Tachypneic, respiratory distress, abdominal tenderness
  - Became lethargic and unresponsive
Case 2 cont

Labs:
- ABG – pH 7.35/pCO2 41, pO2 67
- Na 137/ K 4.2 / Cl 103 / CO2 10/ BUN 7/ Cr 0.8/ Glu 168
- AG 14
- AST 4869 / ALT 3887, Bilirubin 4.2, ammonia 62
- INR 6/7
- Serum acetaminophen 29.8
- CXR – multilobar right pneumonia
- Abdominal CT - hepatomegaly

Case 2 cont

- Admitted and treated with antibiotics
- Later tests – liver failure and elevated APAO level
- Eventually died secondary to liver failure and pneumonia
Case 3

- 12 yo F presents unresponsive after chewing fentanyl patches on a dare. Police initiated CPR prior to ED transport
- PE: BP 130/80, HR 160s, GCS 3,
  - Pupils fixed and dilated
  - Bradycardic, then lost pulses
  - Intubated, CPR, Epinephrine and naloxone
- Labs:
  - VBG: pH 7.14, AG 17, lactate 6.6

Case 3 cont

- In the ED, she was bradycardic, lost pulses
- She was intubated, received CPR, epinephrine and nalaxone with ROSC
- BP 130/80, HR 15-170, GCS 3, pupils fixed and dilated

Day 2 – remained unresponsive, developed a fever, day 4 brain dead and life saving measures removed.
Case 4

- 8 mo/o M found cyanotic by his babysitter while in a bouncy seat. EMS was called and found him to have muscular rigidity consistent with rigor. Pt was brought to the ED altered and rigid. Resuscitation maneuvers were continued from EMS, but were unsuccessful. There was no ROSC.

Case 4 cont

- Eventually the babysitter admitted to giving the child 50 mg of diphenhydramine for his “fussiness”.
- Autopsy: Vitreous fluid: Na 136/ K 27 / Cl 130 / BUN 14 / Cr 0.8 / Glu 102, Mg 1.2, lactate 36.
Case 5

- 14 yo M presents via ambulance and police after parents found him unresponsive in his bedroom. Police state they found brownish substance in his room. Pt has a GCS of 8, is sleepy, but has bouts of hallucinations, nervousness, and aggression. Parents have never seen the patient in this manner before.

Case 5 cont

- Police disclosed to the ED physician, that the substance found may have been “Kratom”
- Pt was mostly obtunded during the ED stay, with occasional bouts of aggressive behavior. Pt admitted to the PICU and given Ativan and Haldol with minimal change.
- Pt had improvement of his symptoms 48 hours after admission
Pediatric patients

- Unintentional
  - General
  - Therapeutic error
  - Misuse
  - Environmental
  - Bite/sting
  - Occupational
  - Food poisoning
  - unknown

- Intentional
  - Suspected suicide
  - Misuse
  - Abuse
  - unknown

Epidemiology

- Past several decades
  - Fatalities associated with pediatric poisoning have fallen steadily
    - 450 – 1960
    - 42 – 2011
  - Interventions:
    - Child-resistant packages
    - Poison-education programs
    - Improved interventions
Epidemiology

- 2/3 of all poisonings – pediatric exposures
- 80% of all pediatric exposures – pts < 5 yo
  - Most unintentional with minimal toxicity
- Most adolescent exposures
  - Purposeful
  - Larger doses therefore greater morbidity and mortality

Pediatric fatality case review

- Cases reviewed for patients < 20 yo
  - Bimodal age distribution
    - Death ≤ 5 years → “unintentional – general”
    - Death > 13 years → “intentional”

Table 7. Distribution of reason for exposure by age.
Route of exposure

<table>
<thead>
<tr>
<th>Route</th>
<th>Human exposures</th>
<th>Fatal exposures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>% of all routes</td>
</tr>
<tr>
<td>Ingestion</td>
<td>1,810,020</td>
<td>76.63</td>
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<tr>
<td>Dermal</td>
<td>152,020</td>
<td>6.69</td>
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<tr>
<td>Inhalation/nasal</td>
<td>133,761</td>
<td>5.88</td>
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<tr>
<td>Occlus</td>
<td>91,207</td>
<td>4.07</td>
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<tr>
<td>Bite/teeth</td>
<td>63,735</td>
<td>2.78</td>
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<tr>
<td>Parenteral</td>
<td>20,667</td>
<td>0.91</td>
</tr>
<tr>
<td>Unknown</td>
<td>14,274</td>
<td>0.63</td>
</tr>
<tr>
<td>Other</td>
<td>2517</td>
<td>0.11</td>
</tr>
<tr>
<td>Other</td>
<td>1764</td>
<td>0.08</td>
</tr>
<tr>
<td>Total number of routes</td>
<td>2,272,976</td>
<td>100.00</td>
</tr>
</tbody>
</table>

*Includes cases with RCF of 1 – undoubtedly responsible, 2 – probably responsible, or 3 – contributory. This excludes reports with outcome of Death INDIRECT.

| Substance categories |

<table>
<thead>
<tr>
<th>Substance (major generic category)</th>
<th>All substances</th>
<th>%</th>
<th>Single substance exposures</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analgesics</td>
<td>290,561</td>
<td>11.19</td>
<td>184,255</td>
<td>9.67</td>
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<tr>
<td>Cleaning substances (household)</td>
<td>195,715</td>
<td>7.54</td>
<td>176,828</td>
<td>9.38</td>
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<td>Cosmetics/personal care products</td>
<td>186,970</td>
<td>7.20</td>
<td>180,065</td>
<td>9.45</td>
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<tr>
<td>Sedative/hypnotics/antipsychotics</td>
<td>151,620</td>
<td>5.84</td>
<td>55,314</td>
<td>2.90</td>
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<tr>
<td>Antidepressants</td>
<td>122,975</td>
<td>4.74</td>
<td>51,509</td>
<td>2.70</td>
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<tr>
<td>Antihistamines</td>
<td>108,777</td>
<td>4.19</td>
<td>75,833</td>
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<td>Cardiovascular drugs</td>
<td>107,493</td>
<td>4.14</td>
<td>46,890</td>
<td>2.46</td>
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<tr>
<td>Foreign bodies/imals/miscellaneous</td>
<td>93,911</td>
<td>3.62</td>
<td>90,667</td>
<td>4.76</td>
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<td>Pesticides</td>
<td>83,659</td>
<td>3.22</td>
<td>77,573</td>
<td>4.07</td>
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<tr>
<td>Topical preparations</td>
<td>72,134</td>
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<td>70,352</td>
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<td>Alcohol</td>
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<td>2.78</td>
<td>22,289</td>
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<td>Stimulants and street drugs</td>
<td>66,132</td>
<td>2.55</td>
<td>36,486</td>
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<td>Vitamins</td>
<td>63,931</td>
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<td>Anticonvulsants</td>
<td>63,488</td>
<td>2.45</td>
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<td>Hormones and hormone antagonists</td>
<td>57,316</td>
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<td>38,090</td>
<td>2.00</td>
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<td>Cold and cough preparations</td>
<td>56,720</td>
<td>2.19</td>
<td>39,432</td>
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<td>Antimicrobials</td>
<td>55,654</td>
<td>2.14</td>
<td>45,100</td>
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<tr>
<td>Dietary supplements/herbal/homeopathic</td>
<td>51,272</td>
<td>1.98</td>
<td>42,523</td>
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<tr>
<td>Gastrointestinal preparations</td>
<td>49,443</td>
<td>1.90</td>
<td>36,158</td>
<td>1.90</td>
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<tr>
<td>Bites and envenomations</td>
<td>48,423</td>
<td>1.87</td>
<td>46,989</td>
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<tr>
<td>Plants</td>
<td>47,793</td>
<td>1.84</td>
<td>45,150</td>
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<td>Chemicals</td>
<td>39,807</td>
<td>1.53</td>
<td>33,910</td>
<td>1.78</td>
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<tr>
<td>Fumes/gases/vapors</td>
<td>34,345</td>
<td>1.32</td>
<td>31,337</td>
<td>1.64</td>
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<tr>
<td>Other/unknown non-drug substances</td>
<td>29,968</td>
<td>1.15</td>
<td>27,350</td>
<td>1.44</td>
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<tr>
<td>Hydrocarbons</td>
<td>29,796</td>
<td>1.15</td>
<td>27,807</td>
<td>1.46</td>
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</table>

*Percentages are based on the total number of substances reported in all exposures (N = 2,595,526).

*Percentages are based on the total number of single substance exposures (N = 1,905,846).
### Substance categories ≤ 5 years

<table>
<thead>
<tr>
<th>Substance (major generic category)</th>
<th>All substances</th>
<th>%</th>
<th>Single substance exposures</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cosmetics/personal care products</td>
<td>138,904</td>
<td>13.29</td>
<td>136,004</td>
<td>13.06</td>
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<tr>
<td>Cleaning substances (household)</td>
<td>115,701</td>
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<td>111,445</td>
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<tr>
<td>Analgesics</td>
<td>96,312</td>
<td>9.21</td>
<td>87,710</td>
<td>8.77</td>
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<tr>
<td>Foreign bodies/trim/miscellaneous</td>
<td>67,771</td>
<td>6.48</td>
<td>65,864</td>
<td>6.77</td>
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<tr>
<td>Topical preparations</td>
<td>52,984</td>
<td>5.07</td>
<td>52,030</td>
<td>5.37</td>
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<tr>
<td>Antihistamines</td>
<td>47,476</td>
<td>4.54</td>
<td>42,143</td>
<td>4.33</td>
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<tr>
<td>Vitamins</td>
<td>46,306</td>
<td>4.31</td>
<td>41,912</td>
<td>4.19</td>
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<tr>
<td>Pesticides</td>
<td>34,608</td>
<td>3.11</td>
<td>33,458</td>
<td>3.45</td>
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<tr>
<td>Dietary supplements/herbs/homeopathic</td>
<td>34,443</td>
<td>3.29</td>
<td>32,059</td>
<td>3.30</td>
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<tr>
<td>Plants</td>
<td>28,856</td>
<td>2.74</td>
<td>27,565</td>
<td>2.83</td>
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<tr>
<td>Gastrointestinal preparations</td>
<td>27,417</td>
<td>2.64</td>
<td>24,933</td>
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<tr>
<td>Antimicrobials</td>
<td>24,710</td>
<td>2.36</td>
<td>23,274</td>
<td>2.39</td>
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<tr>
<td>Cardiovascular drugs</td>
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<td>13,824</td>
<td>1.42</td>
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<tr>
<td>Cold and cough preparations</td>
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<td>2.02</td>
<td>19,267</td>
<td>1.98</td>
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<tr>
<td>Art/crafts/office supplies</td>
<td>20,723</td>
<td>1.98</td>
<td>20,096</td>
<td>2.07</td>
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<tr>
<td>Electrolytes and minerals</td>
<td>18,420</td>
<td>1.76</td>
<td>16,700</td>
<td>1.72</td>
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<tr>
<td>Hormones and hormone antagonists</td>
<td>18,416</td>
<td>1.76</td>
<td>14,346</td>
<td>1.47</td>
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<tr>
<td>Deodorizers</td>
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<td>1.68</td>
<td>17,398</td>
<td>1.79</td>
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<tr>
<td>Essential oils</td>
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<td>1.34</td>
<td>13,264</td>
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<tr>
<td>Other/unknown non-drug substances</td>
<td>12,907</td>
<td>1.23</td>
<td>12,118</td>
<td>1.25</td>
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<tr>
<td>Tobacco/cigarette products</td>
<td>11,462</td>
<td>1.10</td>
<td>11,358</td>
<td>1.17</td>
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<td>Antidepressants</td>
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<tr>
<td>Sedative/hypnotics/antipsychotics</td>
<td>10,498</td>
<td>1.00</td>
<td>8,119</td>
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<tr>
<td>Chemicals</td>
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<td>0.97</td>
<td>9,286</td>
<td>0.96</td>
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<td>Alcohols</td>
<td>8,938</td>
<td>0.94</td>
<td>9,562</td>
<td>0.98</td>
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</tbody>
</table>

*Includes all children with actual or estimated ages ≤ 5 years old. Results do not include "unknown child" or "unknown age".

### Substances most frequently involved in pediatric deaths ≤ 5 years

<table>
<thead>
<tr>
<th>Substance (major generic category)</th>
<th>All substances</th>
<th>%</th>
<th>Single substance exposures</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humans/gases/vapors</td>
<td>12</td>
<td>18.18</td>
<td>6</td>
<td>21.62</td>
</tr>
<tr>
<td>Analgesics</td>
<td>11</td>
<td>16.67</td>
<td>9</td>
<td>24.32</td>
</tr>
<tr>
<td>Cardiovascular drugs</td>
<td>7</td>
<td>10.61</td>
<td>1</td>
<td>2.70</td>
</tr>
<tr>
<td>Antidepressants</td>
<td>6</td>
<td>9.09</td>
<td>1</td>
<td>2.70</td>
</tr>
<tr>
<td>Anti-inflammatories</td>
<td>5</td>
<td>7.58</td>
<td>3</td>
<td>8.11</td>
</tr>
<tr>
<td>Batteries</td>
<td>4</td>
<td>6.06</td>
<td>4</td>
<td>10.81</td>
</tr>
<tr>
<td>Unknown drug</td>
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<td>6.06</td>
<td>4</td>
<td>10.81</td>
</tr>
<tr>
<td>Stimulants and street drugs</td>
<td>3</td>
<td>4.55</td>
<td>1</td>
<td>2.70</td>
</tr>
<tr>
<td>Chemicals</td>
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<td>Pesticides</td>
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<td>2.70</td>
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<tr>
<td>Plants</td>
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<td>Sedative/hypnotics/antipsychotics</td>
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<td>3.03</td>
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<td>0.00</td>
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<tr>
<td>Alcohols</td>
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<td>1.52</td>
<td>1</td>
<td>2.70</td>
</tr>
<tr>
<td>Antimicrobials</td>
<td>1</td>
<td>1.52</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Cosmetics/personal care products</td>
<td>1</td>
<td>1.52</td>
<td>1</td>
<td>2.70</td>
</tr>
<tr>
<td>Dietary supplements/herbs/homeopathic</td>
<td>1</td>
<td>1.52</td>
<td>1</td>
<td>2.70</td>
</tr>
<tr>
<td>Diuretics</td>
<td>1</td>
<td>1.52</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Hormones and hormone antagonists</td>
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<td>0.00</td>
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<tr>
<td>Total</td>
<td>56</td>
<td>100.00</td>
<td>37</td>
<td>100.00</td>
</tr>
</tbody>
</table>

*Includes all children with actual or estimated ages ≤ 5 years old. Results do not include "unknown child" or "unknown age". Includes death and death, indirect regardless of RCF.

*Percentages are based on the total number of substances reported in pediatric exposures (N = 1,045,339).

*Percentages are based on the total number of single substance pediatric deaths (N = 97,914).
Commonly abused drugs

- Alcohol
- Ayahuasca
- CNS Depressants
- Cocaine
- DMT
- GHB
- Hallucinogens
- Heroin
- Inhalants
- Ketamine
- Khat
- Kratom
- LSD
- Marijuana
- MDMA (Ecstasy/Molly)
- Mescaline (peyote)
- Methamphetamine
- OTC – Dextromethorphan
- OTC – Loperamide
- PCP
- Rx Opioids

Commonly abused drugs

- Rx Stimulants
- Psilocybin
- Rohypnol (Flunitrazepam)
- Salvia
- Steroids (anabolic)
- Synthetic Cannabinoids
- Synthetic Cathinones (Bath salts)
- Tobacco
History

- Difficult
  - Age
  - Altered
- If able, obtain:
  - Identification of substance
  - Time of ingestion
  - Amount of ingestion
  - Other medications in the home
“one pill can kill”... important History to obtain for infants / toddlers

- Oral hypoglycemics
- β-blockers
- Calcium channel blockers
- α-2-adrenergic agonists
- Cyclic antidepressants
- Opioids
- Buprenorphine

- Loperamide & diphenoxylate
- Salicylates
- Quinine & quinidine
- Camphor
- Podophyllin & colchicine
- Acetylcholinesterase inhibitors

“one pill can kill”...

- α-2 adrenergic agonist
  - Bradycardia and hypotension, decreased level of consciousness, miosis and respiratory depression
  - Common agents:
    - Clonidine, brimonidine tetrahydrozoline (Visine) and oxymetazoline (Afrin)

- Oral hypoglycemics
  - Meds for T2DM
  - Hypoglycemia may occur 18-24 post ingestion
  - Requires admission with q1-2 hr glucose checks
“one pill can kill”...

- **CCBs (calcium channel blockers)**
  - Decreased cardiac inotropy
  - Increase vasodilation
  - Blocks insulin secretion
  - Effects may appear 18-24 hours post ingestion (long-acting CCB’s)
  - Common CCBs
    - Amlodipine, nicaripine
    - Verapamil, diltiazem

“one pill can kill”...

- **β-blocker**
  - Decrease heart rate, hypoclycemia (blocks glycogenolysis), mental status depression
  - Propanolol >> atenolol

- **Cyclic antidepressants**
  - Block fast sodium channels $\rightarrow$ intraventricular conduction delay
    - Wide QRS $\rightarrow$ prolonged QTc
  - Common meds: imipramine, desipramine, amitriptyline
“one pill can kill”...

- **Buprenorphine** – opioid agonist / antagonist
  - Eg. Subutex / Suboxone (to treat opioid addiction)
  - Significant respiratory depression in children after only 1 lick

- **Loperamide & Diphenoxylate**
  - Active ingredients in antidiarrheals (lomotil, Imodium).
  - Depressed mental status and severe respiratory depression

“one pill can kill”

- **Quinine & quinidine**
  - Na-channel block
    - QRS widening and arrhythmias, hypokalemia-related QTc prolongation and torsades de pointes
  - Cause cinchonism (blurred vision, hearing impairment, and flushing – minor; deafness, blindness and cardiac arrhythmias – severe)

- **Oral Acetylcholinesterase inhibitors**
  - Cholinergic poisoning
Physical examination

- Key factors in helping identifying toxidrome / toxicity:
  - Vital signs
  - Level of consciousness
  - Pupil size
  - Coma / seizures
  - Skin exam
  - Odor

Common Toxidrome - CHOLINERGIC

- E.g. organophosphates, carbamates, psilocarpine

- DUMBELLS
  - Diarrhea, diaphoresis
  - Urination
  - Miosis
  - Bradycardia, bronchosecretions
  - Emesis
  - Lacrimation
  - Lethargic
  - Salivation
Common Toxidrome – **Nicotinic**
- MTWTFSS
  - Mydriasis
  - Tachycardia
  - Weakness
  - Tremors
  - Fasciculations
  - Seizures
  - Somnolent

Common Toxidrome - **Opioid**
- Eg. Heroin, morphine, codeine, methadone, fentanyl, oxycodone, hydrocodone
- Everything slows down
  - Miosis
  - Bradycardia
  - Hypotension
  - Hypoventilation
  - Coma
Common Toxidrome – Anticholinergic

- Eg. Antihistamines, cyclic antidepressants, atropine, benztropine, phenothiazine, scopolamine
  - Hyperthermia (HOT as a hare)
  -Flushed (RED as a beet)
  -Dry skin (DRY as a bone)
  -Dilated pupils (BLIND as a bat)
  -Delirium, hallucinations (MAD as a hatter)
  -Tachycardia
  -Urinary urgency and retention

Common Toxidrome - withdrawal

- Diarrhea
- Mydriasis
- Goose flesh
- Tachycardia
- Lacrimation
- Hypertension
- Yawning
- Cramps
- Hallucinations
- Seizures (with ETOH and benzodiazepine withdrawal)
Common Toxidrome - sympathomimetic
- Eg: cocaine, amphetamines, ephedrine, phencyclidine, pseudoephedrine
  - Mydriasis
  - Tachycardia
  - Hypertension
  - Hyperthermia
  - Seizures

<table>
<thead>
<tr>
<th>Odor</th>
<th>Possible source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitter almonds</td>
<td>Cyanide</td>
</tr>
<tr>
<td>Carrots</td>
<td>Cicutoxin (water hemlock)</td>
</tr>
<tr>
<td>Fruity</td>
<td>DKA, isopropanol</td>
</tr>
<tr>
<td>Garlic</td>
<td>Organophosphates, arsenic, DMSO, selenium</td>
</tr>
<tr>
<td>Gasoline</td>
<td>Petroleum distillates</td>
</tr>
<tr>
<td>Mothballs</td>
<td>Naphthalene, camphor</td>
</tr>
<tr>
<td>Pears</td>
<td>Chlora hydrate</td>
</tr>
<tr>
<td>Pungent aromatic</td>
<td>Ethchlorvynol</td>
</tr>
<tr>
<td>Oil of wintergreen</td>
<td>Methyl salicylate</td>
</tr>
<tr>
<td>Rotten eggs</td>
<td>Sulfur dioxide, Hydrogen sulfide</td>
</tr>
<tr>
<td>Freshly mowed hay</td>
<td>Phosgene</td>
</tr>
</tbody>
</table>
Laboratory workup

- Guided by specific drug / poison
  - Acetaminophen – CMP (assess hepatic damage)
  - Ethylene glycol – BMP (Cr / BUN – renal damage)
- If unknown:
  - CMP, blood gas
- Calculate anion gap with metabolic acidosis
  - $[\text{Na}]-([\text{HCO}_3^-]+[\text{Cl}^-])$

Elevated anion Gap acidosis

* AG > 12 mEq/L

- METAL
  - Methanol, metformin, massive overdoses
  - Ethylene glycol
  - Toluene
  - Alcoholic ketoacidosis
  - Lactic acidosis
- ACID
  - Acetaminophen (large ingestion)
  - Cyanide, CO, colchicine
  - Isoniazid, iron, ibuprofen (lg ingestion)
  - DKA
- GAP
  - Generalized seizure-producing toxins
  - Acetylsalicylic acid or other salicylates
  - Paraldehyde, phenformin
Laboratory workup

- Concern of possible toxic alcohol ingestion – Methanol, ethylene glycol, mannitol, acetone or isopropanol → Calculate Osmol gap
  - Normal < 10
  - Serum osmolality – calculated Osmolarity
  - Calculated Osmolarity:
    - $2\cdot[\text{Na}] + [\text{glucose}] / 18 + [\text{BUN}] / 2.8$

Laboratory / Radiology workup

- Toxicology “screen” of blood / urine → rarely contribute to ED management
  - False negatives and false positives are frequent
- Abdominal X-ray
  - Important for Iron poisoning
Management

- ABC’s
  - Prior to antidote or gastric decontamination → resuscitate first and foremost.
- After resuscitation
  - AMS → glucose check
    - Hypoglycemia → IV dextrose: 2 mL/kg D25W
      - If no IV → 1 mg glucagon IM
  - Lethargy / coma with bradypnea & mitotic pupils
    - Consider Naloxone 0.1 mg/kg IV or 2 mg in pts > 20kg
Management

- Pt with hallucinogen-induced behavioral changes
  - Place in a calm and relaxed environment
  - +/- physical restraints
  - +/- chemical restraints
    - Liberal doses of benzodiazepines
    - *Haloperidol* – if benzos alone not working
      - Needs cardiac monitoring → QT prolongation / torsade de pointes
      - Lowers seizure threshold
      - Temperature dysregulation

  *Caution with Haloperidol

Management

- Hyperthermia with agitated delirium → OMINOUS and life-threatening
  - AGGRESSIVE TREATMENT
- Rapid cooling measures
  - Possible paralysis required
  - Hydration
  - Observe for rhabdomyolysis
Management

- GI decontamination
  - *Ipecac-induced emesis, gastric lavage and cathartics → NO longer considered*

- Activated Charcoal
  - Odorless / tasteless black powder
  - Adsorbs various toxins
  - Given if toxic amount of adsorbable poison was taken 1 hour prior
  - 25 g < 6 yo
  - 50 g – adolescents / adults

Management – Activated charcoal

- Substances activated charcoal will **not adsorb**:
  - PESTICIDES
  - ACIDS
  - ALKALIS
  - ALCOHOLS
  - METALS (FE, PB, LI, BORATES)
  - SOLVENTS
Management

Whole Bowel Irrigation

- "flushes" the toxin through the GI tract
- PEG (Polyethylene glycol electrolyte) solution
  - Does not create fluid or electrolyte disturbances
  - 500 mL/h (sm children)
  - 1-2 L/h for adolescents
- Continue irrigation until rectal effluent is clear → 4-6 hours

Management – Whole Bowel Irrigation

- No conclusive evidence that WBI improves clinical outcome of poisoned patients
- Utilized in patients who are hemodynamically stable with normal bowel function and anatomy
- Ideal for sustained release or enteric-coated drugs, iron, and packets of illicit drugs
Management – Enhancing elimination

- Removes toxin after absorption has occurred
- **Multiple-dose-activated Charcoal**
  - Repeated doses of A.C.
  - 10-25g q 2-4 hours
  - Poisoning with: carbamazepine, dapsone, phenobarbital, quinine, or theophylline
- **Urinary Alkalinization**
  - Na bicarbonate IV; enhances excretion of weak acids
  - Salicylate or phenobarbital

Management - Enhancing elimination

- **Extracorporeal elimination**
  - Hemodialysis, hemoperfusion, continuous veno-venous hemofiltration (CVVH), and continuous veno-venous hemodialysis (CVVHD)
  - Indicated in **salicylate, phenobarbital, methanol, ethylene glycol and lithium poisonings**
  - Require nephrology and critical care
## Antidotes

<table>
<thead>
<tr>
<th>Poison</th>
<th>Antidote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaminophen</td>
<td>N-Acetylcysteine</td>
</tr>
<tr>
<td>Anticholinergics</td>
<td>Physostigmine</td>
</tr>
<tr>
<td>β-blockers</td>
<td>Glucagon; Insulin / glucose</td>
</tr>
<tr>
<td>Ca-channel antagonists</td>
<td>Insulin / glucose</td>
</tr>
<tr>
<td>Carbamate insecticides</td>
<td>Atropine</td>
</tr>
<tr>
<td>Cyanide</td>
<td>Hydroxycobalamin</td>
</tr>
<tr>
<td>Digoxin; digitoxin</td>
<td>Fab antibody fragments</td>
</tr>
<tr>
<td>Ethylene glycol</td>
<td>Fomepizole</td>
</tr>
<tr>
<td>Heavy metals</td>
<td>Chelators</td>
</tr>
<tr>
<td>Isoniazid</td>
<td>Pyridoxine</td>
</tr>
<tr>
<td>Iron</td>
<td>Deferoxamine</td>
</tr>
<tr>
<td>Methanol</td>
<td>Fomepizole</td>
</tr>
<tr>
<td>Methemoglobinemia</td>
<td>Methylenear blue</td>
</tr>
<tr>
<td>Opioids</td>
<td>Naloxone</td>
</tr>
<tr>
<td>Organophosphates</td>
<td>Atropine and pralidoxime</td>
</tr>
<tr>
<td>Sulfonyleureas</td>
<td>Octreotide</td>
</tr>
<tr>
<td>Tricyclic antidepressants</td>
<td>Sodium bicarbonate</td>
</tr>
<tr>
<td>Valproic acid</td>
<td>Carnitine</td>
</tr>
<tr>
<td>Warfarin</td>
<td>Vitamin K</td>
</tr>
</tbody>
</table>
Disposition

- Critical care setting: unstable patients
- ED 6-8 hours: Stable and low concern for serious intoxication
- 24 hour observation: Intoxication of
  - Modified release pharmaceuticals
  - Sulfonylureas
  - Clonidine
  - Calcium channel antagonists
  - Lithium
  - Methadone
  - Monoamine oxidase inhibitors
- Others:
  - Variable
  - Clinical and social factors need to be assessed

What else to know about...
New drugs on the street...

- **Flakka** – aka “gravel”
- **Kratom**
  - DEA – “drug of concern”
- **Spice**
  - Marijuana alternative
  - Paranoia and panic attacks

New drugs on the street...

- **“Vitamin K” or “Special K”**
  - Ketamine
- **Smiles**
  - 251-NBOMe
  - Psychedelic drug
- **Molly**
  - DEA – “dangerous Schedule I controlled substance”
New drugs on the street...

- **Acetyl Fentanyl**
  - 5x more potent than heroin
  - CDC advisory recommends
    - Naloxone – antidote
References

- Suchard J. One pill can kill – pediatric poisonings. Program and abstracts of the American College of Emergency Physicians Scientific Assembly; September 28-October 1, 2010; Las Vegas, Nevada.
- Emedicine.com