Toxicology
“New Kids on the Block”

John F Ashbourne MD, FRCP(C)
“New Kids on the Block”
“New Kids on the Block”
Internet Search
New Stuff

Statistics
Stats: New and Concerning Drug Overdose Deaths in the US are Increasing
Opioid Related Deaths and Sales

The graph shows the trends in OPR deaths per 100,000, treatment admissions per 10,000, and OPR sales kg per 10,000 from 1999 to 2009. The rates for all three metrics have increased significantly over this period.
# Canadian Stats

## Leading Causes of Injury Death, Canada, 2008

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>ALL AGES</th>
<th>MALES</th>
<th>FEMALES</th>
<th>MF</th>
<th>&lt;1</th>
<th>1–9</th>
<th>10–14</th>
<th>15–19</th>
<th>20–39</th>
<th>40–64</th>
<th>65–79</th>
<th>80+</th>
</tr>
</thead>
<tbody>
<tr>
<td>All injuries</td>
<td>9,807 (59.4)</td>
<td>5,414 (32.2)</td>
<td>15,221 (45.7)</td>
<td>43</td>
<td>141</td>
<td>119</td>
<td>676</td>
<td>3,312</td>
<td>5,230</td>
<td>1,869</td>
<td>3,731</td>
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<tr>
<td>Unintentional injuries</td>
<td>6,106 (37.0)</td>
<td>4,129 (24.6)</td>
<td>10,234 (30.7)</td>
<td>32</td>
<td>125</td>
<td>80</td>
<td>397</td>
<td>1,729</td>
<td>2,759</td>
<td>1,536</td>
<td>3,576</td>
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<tr>
<td>Motor vehicle traffic crashes</td>
<td>1,681 (10.2)</td>
<td>736 (4.4)</td>
<td>2,417 (7.3)</td>
<td>35</td>
<td>26</td>
<td>266</td>
<td>850</td>
<td>792</td>
<td>277</td>
<td>169</td>
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<tr>
<td>Falls</td>
<td>1,488 (9.0)</td>
<td>1,610 (9.8)</td>
<td>3,098 (9.3)</td>
<td>11</td>
<td>58</td>
<td>330</td>
<td>626</td>
<td>2,065</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Poisonings</td>
<td>939 (5.7)</td>
<td>502 (3.0)</td>
<td>1,441 (4.3)</td>
<td>6</td>
<td>39</td>
<td>415</td>
<td>832</td>
<td>97</td>
<td>51</td>
<td></td>
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<tr>
<td>Suffocations</td>
<td>260 (1.6)</td>
<td>186 (1.1)</td>
<td>446 (1.3)</td>
<td>20</td>
<td>14</td>
<td>6</td>
<td>28</td>
<td>105</td>
<td>104</td>
<td>169</td>
<td></td>
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<tr>
<td>Drownings</td>
<td>225 (1.4)</td>
<td>50 (0.3)</td>
<td>275 (0.8)</td>
<td>7</td>
<td>23</td>
<td>13</td>
<td>74</td>
<td>94</td>
<td>24</td>
<td>23</td>
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<tr>
<td>Fire and flame</td>
<td>163 (1.0)</td>
<td>112 (0.7)</td>
<td>275 (0.8)</td>
<td>25</td>
<td>7</td>
<td>8</td>
<td>44</td>
<td>101</td>
<td>59</td>
<td>29</td>
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<tr>
<td>Other unintentional injuries</td>
<td>1,349 (8.2)</td>
<td>933 (5.6)</td>
<td>2,282 (6.8)</td>
<td>28</td>
<td>21</td>
<td>54</td>
<td>260</td>
<td>505</td>
<td>349</td>
<td>1,070</td>
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<td></td>
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<tr>
<td>Suicides</td>
<td>2,777 (16.8)</td>
<td>928 (5.5)</td>
<td>3,705 (11.1)</td>
<td>25</td>
<td>208</td>
<td>1,084</td>
<td>1,899</td>
<td>359</td>
<td>130</td>
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<tr>
<td>Homicides</td>
<td>452 (2.7)</td>
<td>123 (0.7)</td>
<td>575 (1.7)</td>
<td>8</td>
<td>13</td>
<td>8</td>
<td>58</td>
<td>275</td>
<td>177</td>
<td>27</td>
<td>9</td>
<td></td>
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<tr>
<td>Undetermined intent</td>
<td>457 (2.8)</td>
<td>233 (1.4)</td>
<td>690 (2.1)</td>
<td>10</td>
<td>218</td>
<td>389</td>
<td>47</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Legal intervention / war</td>
<td>16 (0.1)</td>
<td>17 (0.1)</td>
<td>6 (0.1)</td>
<td></td>
<td></td>
<td></td>
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1. All records where the external cause of injury is classified to the International Classification of Diseases, 10th Revision (ICD-10) (Chapter 20), except adverse effects due to drugs or medical care.
2. Includes drownings in water transport events.
3. Suppressed due to small number of cases or value of zero.

Source: Injury Section analysis of mortality data from Statistics Canada.
Prescription Drug Abuse: A Public Health Epidemic

• 4-fold increase in opioid OD deaths parallels the increase in sales

• More than 16500 deaths per year from prescription opioid-related drug overdose

• Direct health care costs > $70 billion annually
Canadian Stats

Trends in drug toxicity – Figure 3

Figure 3: % distribution of drug toxicity deaths based on type of drugs (n=47), all age groups combined. The majority of deaths occurred due to prescription drug overdose.
Solutions

• Pain control education and opioid prescribing guidelines
• Evidence-based with applied research eg effects of PDMP (prescription drug monitoring programs)
• Effective drug laws
• ?Altered Formulations
OxyNeo The Answer?

• Same or similar to OxyContin-OP in US
• Released in Canada early 2012
• Coincided with expiration of patent
• Extra-hard coating; gels when dissolved
• No different than previous formulation when taken orally
• Numerous sites on-line proposing techniques to abuse by by-passing the extended release properties
Hmmm, wrong bottle. I guess THIS one must have been the Elixir of DEATH...
Management of Poisoning

- Very little is “New”
- Organized approach
- Good supportive care
Poisoning Treatment Algorithm

1. Stabilize vital functions: Airway, breathing, circulation
   Appropriate monitoring

2. If mental status depressed administer oxygen, glucose, thiamine and naloxone

3. Obtain history and perform physical examination
   Identify agent(s) and/or toxidromes
Apply methods to **decrease absorption** of toxin

Obtain general labs and **specific drug identification or levels** as indicated
Use ancillary tests as needed

Continuous reevaluation
Administer symptomatic and supportive care

Perform **enhanced elimination and institute antidotes**
Disposition
When in Doubt.....
Antidotes- Do we really need them?

• Most poisoned patients are successfully managed with good supportive care

• Antidotes can be critical component of care in some poisoned patients and in some cases may be potentially live saving

• In this situation the antidote must be immediately available
Antidote Stocking Issues

• Despite published guidelines many studies have shown antidote stocks in hospitals are often **inadequate**
  
  – Wiens et al CJEM 2006;8(6):409-16
  

• Expert **guidelines** have been published
  
  
  – “Expert Consensus Guidelines for Stocking of Antidotes in Hospitals That Provide Emergency Care”
Expert Panel

Selected 24 antidotes for stocking

12 antidotes recommended for immediate administration on patient arrival

9 antidotes to be available within 1 hour and could be stocked in pharmacy

Others could be shared between regional centres
Dart et al – Antidotes to be available immediately

- Atropine
- Calcium chloride
- Calcium gluconate
- Hydroxocobalamin
- Digoxin Immune Fab
- Flumazenil
- Glucagon
- Methylene Blue
- Naloxone
- Physostigmine
- Pyridoxine
- Sodium bicarbonate
Available within 1 Hour

- Acetylcysteine
- Deferoxamine
- Dimercaprol
- Ethanol
- Fomepizole
- Octreotide
- Potassium Iodide
- (Antivenin)
Antidotes

• Review your hospital formulary
• Review hospital needs
• Consider maintaining stocks of critical antidotes if not currently the case
“New” Antidotes

• Hydroxocobalamin (Cyanokit)
• Intralipid
• HIE (High dose insulin euglycemic therapy)
Case 1

- 54 yo F extricated from apartment fire by FD
- Covered in soot, no thermal burns
- Decreased LOC – GCS E2 V1 M5
- Vitals: 120 107/75 36 93% 12 L
In ED

- Intubation
- Hypotension following sedation – fluids
- Labs:
  - CBC N
  - Lytes: Na 142 K 3.6 Cl 97 HCO2 13
  - COHb: 29.2 %
  - Lactate: 12.8
- Diagnosis?
- Management?
UPDATE:
HYDROXOCOBALAMIN
What is it?

• Vitamin B₁₂ precursor

• FDA approved in Dec 2006 in U.S. for treatment of cyanide poisoning – but earlier in Canada/Europe
When to suspect CN Toxicity

- Bitter almond odor of HCN – only 60% of population
- Fire victim with coma and acidosis – lactate > 10
- Intentional overdose with coma and lactate > 8
- Unexplained coma and acidosis
  - Lab or industry worker
  - Ingestion of artificial nail remover
  - Patients on nitroprusside
USING HYDROXOCOBALAMIN IN YOUR ED
Cyanokit®

- Hydroxocobalamin 2.5 g in each vial
- For dilution in 100 ml NS
- Starting dose: 5 g (2 vials) or 70 mg/kg kids
  - Infused over 15 min
- Additional doses 5 g each up to 15 g total
Mechanism of Action

• Hydroxocobalamin binds (chelates) cyanide
  – Forms cyanocobalamin

• Cyanocobalamin is eliminated in urine
  – Or releases the cyanide slow enough to allow for detoxification via rhodanese pathway
Side Effects and Administration Issues

Chromaturia – up to 5 weeks

Red skin discolouration

Marked hypertension in first hour

Interferes with colorimetric lab tests

– draw blood first
Literature

• Prospective series reported 71% survival using Hydroxocobalamin in 14 severe cyanide-poisoned patients whose pre-treatment CN levels were considered lethal

• Retrospective study – 42% survival rate when prehospital Hydroxocobalamin for smoke inhalation victims

• Beagle model – both doses of 150mg/kg and 75mg/kg significant mortality benefit over saline placebo
Advantages over Cyanide Kit of the past

• Standard treatment for cyanide poisoning with nitrites produces methemoglobinemia
• Carboxyhemoglobin plus methemoglobin is potentially fatal
• Hydroxocobalamin treats the undifferentiated smoke inhalation victim effectively – without the risk of hypoxia
Summary

- CyanoKit with Hydroxocobalamin only option now available in Canada for treatment of cyanide poisoning
- Cases are rare but antidote potentially lifesaving
- Consider in smoke inhalation victims with unexplained acidosis
Case 2 – “I Have a Bad Feeling”

- 27 year old female
- Brought to ED by her mother
- Under treatment for depression
- Recent break-up with fiance
- Took a mixture of her mother’s and her own pills 1 hour ago
Case 2 – 27 y.o. F

- Potential drugs ingested:
  - Bupropion SR 100 mg X 90 (Wellbutrin)
  - Aripiprazole 20 mg X 90 (Abilify)
  - Verapamil SR 180 mg X 60 (Isoptin)
Case 2 – 27 y.o. F

- Patient is sleepy but easily aroused
- Appears confused
- BP 95/50, HR 100, RR 20, O2 Sat 95%, T 37
- Sinus rhythm on monitor with QT prolongation
Case 2 – 27 y.o. F

• General Concerns?
• Specific Drug Toxicities?
• Priority of Management?
Case 2 - Bupropion

• Monocyclic antidepressant
• Structurally related to amphetamine
  – (synthetic cathinone)
• Selective serotonin reuptake inhibitor as well as norepinephrine and dopamine
• Use: depression – primary and adjunctive and smoking cessation
Case 2 - Bupropion Toxicity

• Minor
  – GI, Hypertension, Tachycardia,
  – Drowsiness, dizziness
  – Tremor, agitation

• Major
  – Seizures, Conduction abnormalities
  – Cardio toxicity described in mixed overdose
  – More toxic than most “newer” antidepressants
Case 2 - Verapamil

• Phenylalkylamine CCB (Non-dihydropyridine)

• Clinical use for angina, hypertension, migraine

• Highly cardiotoxic
  – Bradydysrhythmias, hypotension, shock, acidosis
  – Delerium, agitation, seizures
Case 2 Aripiprazole

• “Atypical” or third generation antipsychotic
• Indications – schizophrenia, bipolar depression, adjunctive therapy for major depression
• Toxic effects – Sedation, tachycardia, nausea and vomiting, dystonia
Case 2 – 27 y.o. F

- Potentially large ingestion of very toxic drugs
- Concern that patient could deteriorate quickly with CNS and CVS toxicity
- Ingestion 1 hour ago – decontamination is high priority – extended release preparations
- Best Approach? PCC recommendations?
Case 2 – 27 y.o. F

• When to control airway?

• GI decontamination –
  ◆ NG tube?
  ◆ Activated Charcoal?
  ◆ Whole Bowel Irrigation?
Case 2 – 27 y.o. F

- Despite best efforts patient deteriorates while GI decontamination in progress
- Patient intubated prior
- Now is pulseless with slow wide complex rhythm = PEA
Case 2 - Causes of PEA

5 H’s
• Hypoxia
• Hypovolemic
• Hydrogen Ion (Acidosis)
• Hyper or Hypo kalemia
• Hypothermia

5 T’s
• Tension Pneumothorax
• Tamponade
• Thrombosis – cardiac
• Thrombosis – pulmonary
• Toxins/Tablets
Case 2 - Toxins

Short list of possible toxins

• Cardiac Drugs
• Antipsychotics and Antidepressants
• Drugs of Abuse
• Anticonvulsants
• Mixed Overdose
Case 2 - Options

• ACLS
  – continue high quality CPR
  – Vasopressors?
  – Treat the cause
    • Best airway, oxygenate, IV fluids
    • therapy directed at cardiotoxic drugs
Case 2 - Specific Therapies

- Sodium Bicarbonate
- Calcium
- Intravenous Lipid Emulsion Therapy (ILE)
- High Dose Insulin Euglycemic Therapy (HIE)
Intravenous Lipid Emulsion Therapy

• Accidentally discovered antidote
• Developed initially as therapy for local anesthetic (LA) toxicity
• Animal models show improved survival
• Case reports of recovery from CV collapse due to LA poisoning
Intravenous Lipid Emulsion Therapy

• Anecdotal case reports of use for non-LA drug cardiotoxicity

• Calcium channel blockers, Beta blockers, Antidepressants, Antipsychotics

• Common feature – lipid solubility
Intravenous Lipid Emulsion Therapy

• Mechanism
  – “Lipid sink” – sequesters lipophilic toxins
  – Augment myocardial substrates – increased ATP
  – Direct effect on calcium channels to increase cardiac myocyte calcium
Protocol

- Lipidrescue.org
- 1.5 ml / kg 20% Intralipid Emulsion bolus
- .25 ml / kg / min for 30 – 60 minutes
- Repeat bolus 1 – 2 times as needed
- Increase infusion if BP declines
Warning!!

• No standardized protocol – dose, bolus vs infusion, timing of administration
• No human studies
• Adverse effects reported eg acute lung injury, pancreatitis

BUT

• The patient is dying
Case 2 – 27 y.o. F

- What could you do now?
  - Ensure effective CPR with good airway management and compressions and limit epinephrine
  - Bolus Na Bicarb - 1 – 2 amps IV or IO
  - Bolus CaCl2 - 1 gram IV or IO (10 ml of 10%)
  - Bolus 1.5 ml/kg Intralipid
  - Bolus 1 unit / kg Regular insulin and 25 grams D50W
Case 2 - Summary

• GI Decontamination is important in highly toxic ingestions
• ACLS – guidelines only – treat the reversible causes
• Bupropion OD may lead to significant toxicity
• ILE Therapy may be life-saving for both LA and non-LA poisoning
• Call your Poison Centre when in doubt
Intralipid (NACCT)
North American Congress in Clinical Toxicology (Oct 2013)

• Adjunctive use of low dose intralipid associated with hemodynamic improvement in combined amlodipine and labetalol overdose refractory to standard therapy
  – Michelle M. Troendle ¹, Kirk L. Cumpston ¹, Amber O. Powell ², Brandon K. Wills ¹, Paul E. Stromberg ¹, S. R. Rose ¹

• One poison center's experience with lipid resuscitation therapy: frequency of recommendation and subsequent treating-physician administration during a one-year period
  – Adam C. Pomerleau, Sara J. Miller, Ziad N. Kazzi

• Prolonged lipemia and pancreatitis due to extended infusion of lipid emulsion in bupropion overdose
  – Mason H. Bucklin ², Rachel M. Gorodetsky ¹, Timothy J. Wiegand ²
So you're a toxicologist these days? You must have a lot of great antidotes up your sleeve!

Well, there was this one time in A+E...

SOME TIME LATER...

So I said, "Rectum? It damn near killed 'im!"

ANTidotes. Not anecdotes.

Oh. No, not really.
New Toxins

- Pediatrics – Accidental
- Adolescents and Young Adults – Intentional/abuse
- Seniors – Accidental / Adverse Effects / Interactions
• Majority of poisonings
• >95% non-toxic or no effect
• Most managed at home
Peds Case 1

- 2 yo boy presents with persistent vomiting
- Ingested liquid from small container on father’s bedside
- Lethargic, ataxic, diaphoretic, increased BS
- Unsteady gait, weak
- VS 109/69, 160, 24 afebrile
- ?Toxicidrome
Peds Case 2

• Nicotinic syndrome
  – Tachycardia, hypertension, diaphoresis, vomiting, increased peristalsis

• Father is quitting smoking

• Uses e-cigarettes, 10 ml refill of nicotine liquid

• 16 – 24 mg of nicotine, 2 mg toxic in children
E-Cigarettes (NACCT)

• Fatal intravenous injection of electronic cigarette “eLiquid” solution
  – Stephen Thornton, Lisa Oller, Tama Sawyer

• Nicotine poisoning following ingestion of e-Liquid
  – Matthew Valento

• Nicotine content of liquid for electronic cigarettes
  – Ronald I. Kirschner ¹, Roy Gerona ², Kathy L. Jacobitz ³
Peds Case 2

- 2yo child ingested laundry detergent
- Vomiting and respiratory distress
- Lethargy
- What was the product?
Liquid Laundry Detergent Pods
(SUDS – Single Use Detergent Sacs)

• Extensive experience in UK and Europe

• When introduced to North America spike in serious detergent cases

• CNS effects, vomiting, respiratory distress

• Major ocular symptoms described
SUDS (NACCT)

• All mighty pac free and clear laundry pod® ingestions with metabolic and lactic acidosis: A laboratory analysis and investigation
  — Rachel D. Levitan¹, Kimberlie Graeme², Mike Torrey¹, Will Heise¹

• Serious adverse effects from single use detergent sacs: Report from a statewide poison system
  — Jennifer Heppner¹, Serena Huntington², Rais Vohra¹, Richard J. Geller²

• Airway compromise in children exposed to single-use laundry detergent pods: confirmation of toxicity in a large case series
  — Paul E. Stromberg, Michele H. Burt, S. Rutherfoord Rose, Kirk L. Cumpston, Michelle M. Troendle, Brandon K. Wills

• First year market safety surveillance data for single-use laundry detergent packs
  — Jonathan Colvin¹, Leslie Rylander², Alysha Behrman¹, Shan Yin¹, Kersi Vasunia²
Drugs Toxic to Children

- Koren 1993 “toxic with one pill”
  - Camphor, chloroquine, TCA, phenothiazine's, quinine, methyl salicylate, theophylline
- Updated 2004
  - added oral hypoglycemics, CCB’s, opioids
- More extensive review Emerg Med Clin 2004 (1019 – 1050) – add clonidine, lomotil, toxic alcohols
Adolescents - Case 1

• 18 yo found wandering on the highway
• Had been drinking 4 Loco with friends
• Caffeinated alcohol beverage
• Case series Ann Emerg Med 2012 – usually underage, high risk behaviour, 1 case of seizures
• Increased EtOH toxicity ?masking effects of caffeine
Adolescents – Case 2

• 16 yo presents with vomiting, diarrhea and abdominal pain for 2 days
• Routine blood work reveals Cr of 140
• What product should be asked about?
Synthetic Cannabinoids

- K2 or Spice
- Developed to research cannabinoid receptors
- Affordable, sold on internet, “Not for Human Consumption”
- Sympathomimetic effects
- Recent description of renal effects
- AKI recently described? new product or contaminant
Synthetic Cannabinoids (NACCT)

- Signs of synthetic cannabinoid vs. marijuana intoxication as determined by police drug recognition experts
  - Peter B. Chase

- Seizure and acute kidney injury associated with synthetic cannabinoid use
  - Steven A. Seifert 1, Eugenia M. Brazwell 3, Chad Smeltzer 2, James Gibb 1, Barry K. Logan 4

- Haloperidol successfully treats cannabinoid hyperemesis syndrome
  - Joanne C. Witsil 1, Jami L. Hickey 1, Mark B. Mycyk 2
Adolescents - Case 3

• 19 yo male brought by EMS after insufflating an unknown compound
• Agitated, confused, had a seizure en route
• BP 160/90, HR 120, Temp 38, R 22
• Pupils dilated
• Increased muscle tone
Case - Agitated Teen

• Differential Diagnosis
  – Trauma
  – Metabolic
  – Infectious
  – Medication
  – Toxin
Case – Toxidrome?

• Focused Exam
  – Vital signs
  – CNS
  – Eyes / Mouth
  – Skin
  – CV exam
  – GI
  – Muscle
Autonomic Toxidromes

• Alpha, Beta or Mixed Adrenergic
• Sympatholytic
• Nicotinic, Muscarinic or Mixed Cholinergic
• Anticholinergic
Case - ?Toxicidrome

- Tachycardia
- Hypertensive
- Febrile
- Confused
- Pupils Dilated
- Dyskinesia
- Diaphoretic

- Mixed Adrenergic Syndrome
Case - Possible Toxins?  
Mixed Adrenergic

• Cocaine
• Amphetamines or Methamphetamines
• Bath Salts – Synthetic Cathinones
  – Methylenedioxypyrovalerone (MDPV)
  – Mephedrone
• Nbomb – 25i-NBOMe – Phenylethylamine deriv
Case - Questions

• What is recommended for sedation in an agitated toxic patient given the potential toxins?

• Is a drug screen of any use in this patient?
Case - Sedation

• Benzodiazepines
• Benzodiazepines
• Benzodiazepines
• Others: Haloperidol, Droperidol, Olanzapine
  – Cardiovascular toxicity and potential drug interactions
• If anticholinergic syndrome – consider physostigmine
• For excited delerium – consider ketamine
Case – Drug Screens

• Pros
  – D of A screen may help confirm clinical suspicion
  – Might be useful in legal cases
  – Psychiatry might accept patient

• Cons
  – Detects limited drugs
  – Affects outcome in only 18% of cases when used
  – Interfering compounds and false positives and negatives
  – Qualitative
Case 2 - Summary

- Focused exam
- Look for toxidromes to guide differential Dx and treatment
- Benzodiazepines first choice for sedation with stimulants
- Tox screens have limited utility
- Call your Poison Centre
Bath Salts (NACCT)

• Prevalence of rhabdomyolysis in sympathomimetic toxicity: A comparison of stimulants
  – Michael Levine 1, Ayrn D. O’Connor 1, Angela Padilla-Jones 2, Craig W. Heise Jr 1, Stephen H. Thomas 3

• “Bath Salts” abuse: A poison center study of the clinical effects and outcomes
  – Heath A. Jolliff 2, Chad T. Holmes 1, Katherine A. Holmes 1, D. C. Clifton 1, Jamie J. Jenkins 1

• Survival despite severe hyperthermia and multi-organ system dysfunction following week-long use of an MDPV containing “stain remover”
  – Michelle M. Troendle, Paul E. Stromberg, S. Rutherland Rose

• A novel agent for agitated delirium: a case series of ketamine utilization in the emergency department (ED)

• Kathryn T. Kopec 2, Jane Lavelle 1, Kevin C. Osterhoudt 1, J. Michael Kowalski 2
Nadia discovers the benefits of performance-enhancing thugs.
Seniors

- 80 year old female with frequent falls present to ED with syncopal episode
- VS BP 110/70, HR 45, RR 16, Sat 95%
- ECG – sinus bradycardia
- Meds: Ramipril, Eltroxin, Metformin, Donepezil
- What medication may have put her at increased risk?
Donepezil and other Cholinesterase Inhibitors

• Several studies have documented:
  – Increased incidence hip fracture
  – Increased pacemaker insertion
  – Increased ED visits for syncope and bradycardia

• Questionable clinical benefit

• A Donepezil Overdose: Trending levels and symptoms (NACCT)
  – Elizabeth ter Haar, Kristen Donaldson, Allan Mottram
Seniors

- 76 yo female presents to ED with generalized weakness and malaise
- Treated last week for UTI by GP
- VSS
- ECG Chronic RBBB
- Labs – Potassium 6.9
- What antibiotic is she on?
Septra (trimethoprim)

- Structurally similar to amiloride
- Inhibits potassium clearance in distal nephron
- Up to 20% incidence of hyperkalemia in patients on Septra (hospitalized)
- Increased risk – advanced age, renal insufficiency, high trimethoprim doses, ACE, ARB, spironolactone
Scientists devise another way of delaying death.