

Household Hazards

**When Poison Proofing
Really Matters.....**

S. Rutherford Rose
Virginia Poison Center
Division of Clinical Toxicology
Department of Emergency Medicine
VCU Health System



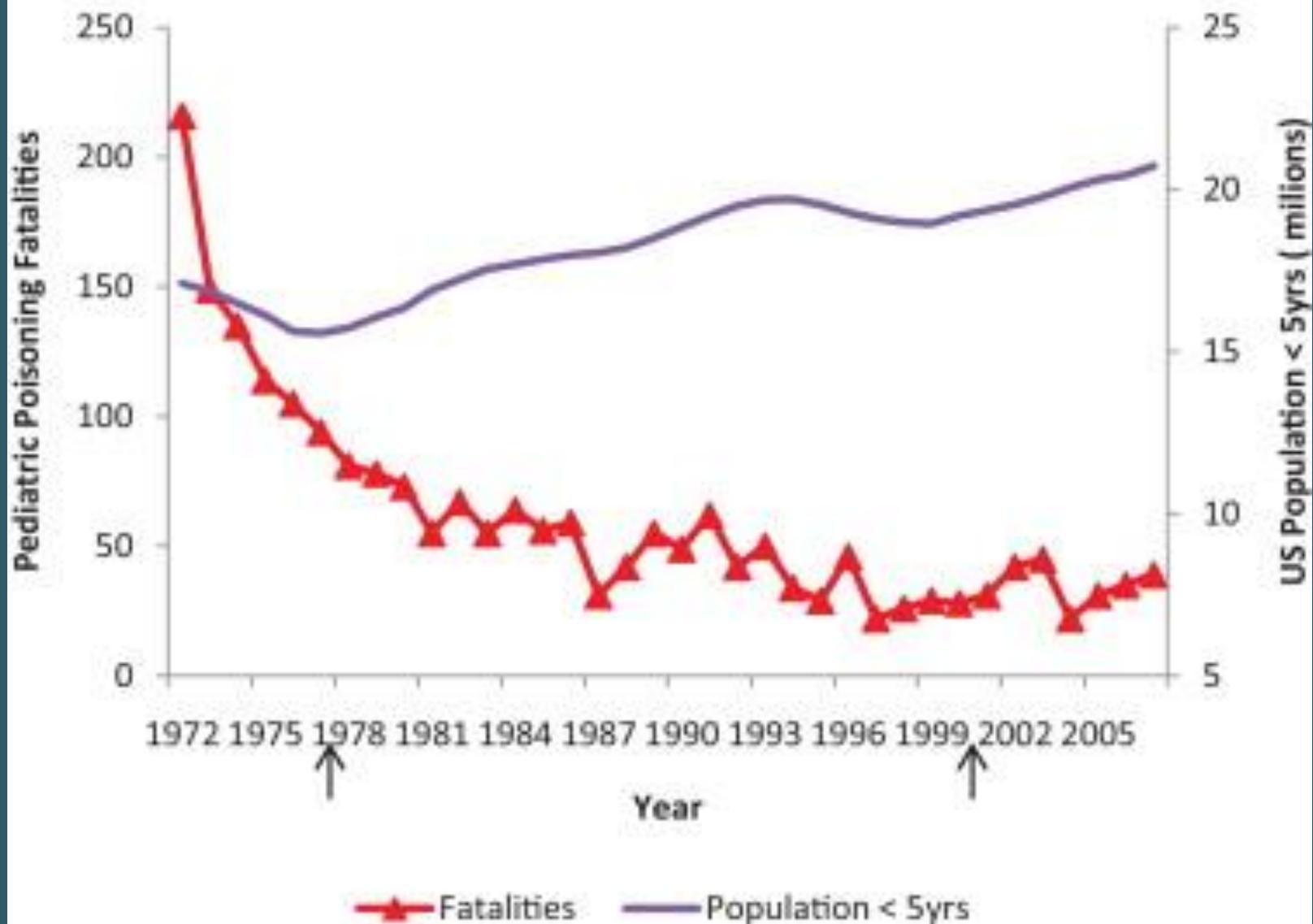
EPIDEMIOLOGY



- **US Poison Centers receive 1.5 million calls a year regarding pediatric ingestions.**
- **79% of these calls involve children younger than age six.**
- **56% of pediatric exposures are from products around the house including medicines, cleaning agents, pesticides, plants and cosmetics.**



Pediatric Poisoning from 1972 to 2007



Most Frequent Poisonings

<u>Pediatric (Age < 6)</u>	<u>Adults (Age > 20 y)</u>	<u>Pediatric Fatalities</u>
Personal care products	Analgesics	Fumes/gases/vapors
Cleaning products (home)	Sedatives/hypnotics	Analgesics
Analgesics	Antidepressants	Unknown drugs
Foreign bodies	Cardiovascular drugs	Batteries
Topical preparations	Cleaning products (home)	Alcohols
Vitamins	Alcohols	Antidepressants
Antihistamines	Pesticides	Antihistamines
Pesticides	Bites & envenomations	Sedatives/hypnotics
Plants	Anticonvulsants	Cleaning products (home)
GI preparations	Antihistamines	Hydrocarbons

Objective



When to be concerned about unintentional exposures to household products, even in small amounts, and especially in curious toddlers



Coming soon from
the makers of



Look for money
saving coupons inside!

Going to send your kids out to the street to sell something they made themselves at home?
Forget the lemonade stand.
Now they can learn the fun of science while saving up for a college education.
Maybe a new car...
Or just some kick ass bling bling.



MY FIRST METH LAB

Every kid needs a hobby.

*Worth*1000.com







Outline

- Corrosives
- Hydrofluoric acid
- Button batteries
- Laundry pods
- Hydrocarbons
- Camphor
- Mothballs
- Methanol
- Local anesthetics
- Ethylene glycol
- Methyl salicylate
- Methemoglobinemia
- Inhalants
- Nicotine liquid

Case



- A 9-month-old infant is inadvertently fed 2-3 teaspoonfuls of crystals from a Drano container. What steps should be taken to decontaminate the child?

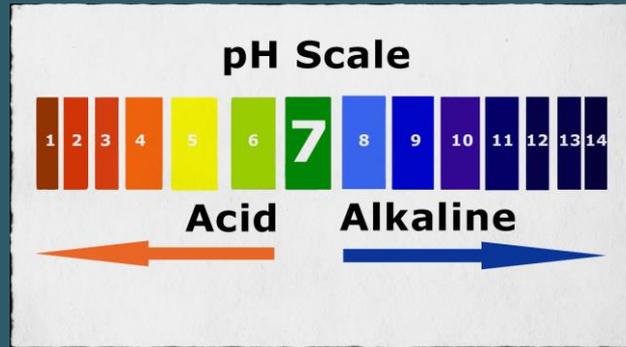
Oven Cleaner Ingestion

- A 3 y/o boy ingested an unknown amount of oven cleaner that his mom brought from work
- He was given milk, vomited, taken to ED
- Drooling, swollen lips and tongue, oral erythema
- No stridor or wheezing
- Endoscopy: oral blisters, severe esophageal inflammation, necrotic tissue in stomach

Corrosive Ingestion

- Immediate airway concern
- Liquid or solid product?
- Lack of oral burns can be misleading
- Vomiting, drooling, stridor
- Supportive care
- **NO ipecac or gastric lavage**
- **NO neutralization**





- Acetic acid
- Boric acid
- Hydrochloric acid
- Oxalic acid
- Nitric acid
- Phosphoric acid
- Sulfuric acid
- Sodium hydroxide (NaOH)
- Potassium hydroxide (KOH)
- Sodium carbonate
- Phosphate
- Silicate
- Ammonia

Household Corrosive Products

ALKALI

- Oven cleaners
- Drain cleaners
- Toilet cleaners
- Lime (cement)
- Clinitest tablets
- Automatic DD

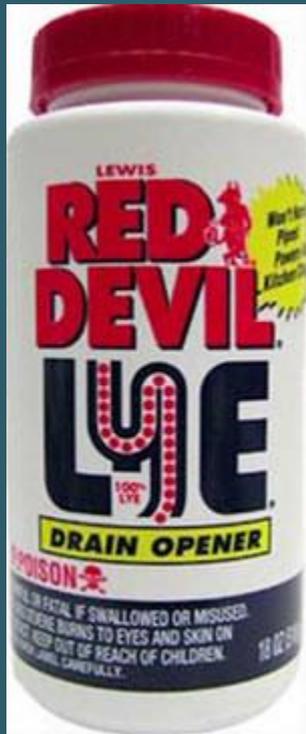
ACIDS

- Concrete cleaners
- Drain cleaners
- Toilet cleaners
- Rust removers
- Permanent wave relaxers

Determinants of Toxicity

- Concentration
- Volume
- pH, pKa
- TAR value
- Solid or liquid
- Viscosity
- Contact time
- Premorbid condition of the GI tract

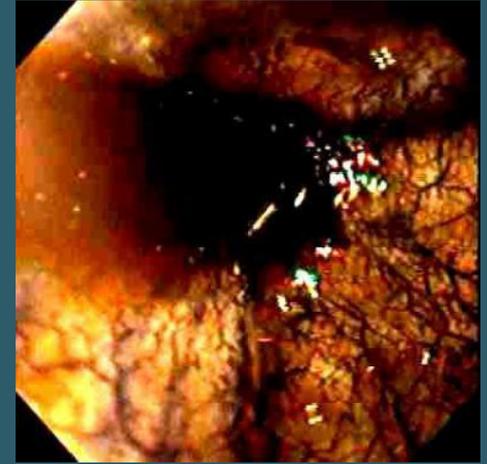
Alkaline Corrosives



- Liquefaction necrosis
- Squamous epithelium of the esophagus
- Vulnerable to perforation days 3-14
- Stricture formation
- Squamous cell CA 20-40 times greater

Acid Corrosive Injury

- Coagulation necrosis
- Esophagus and the stomach, palatible
- Magenstrasse flow along the lesser curvature
- Pylorospasm



Signs and Symptoms of Caustic Ingestions

- Stridor
- Drooling
- Vomiting
- Respiratory Distress
- Oropharyngeal Pain
- Odynophagia
- Dysphagia
- Chest, abdominal, epigastric pain
- Oropharyngeal burns
- Hypotension
- Metabolic acidosis
- DIC

Do initial signs and symptoms
predict caustic injury?

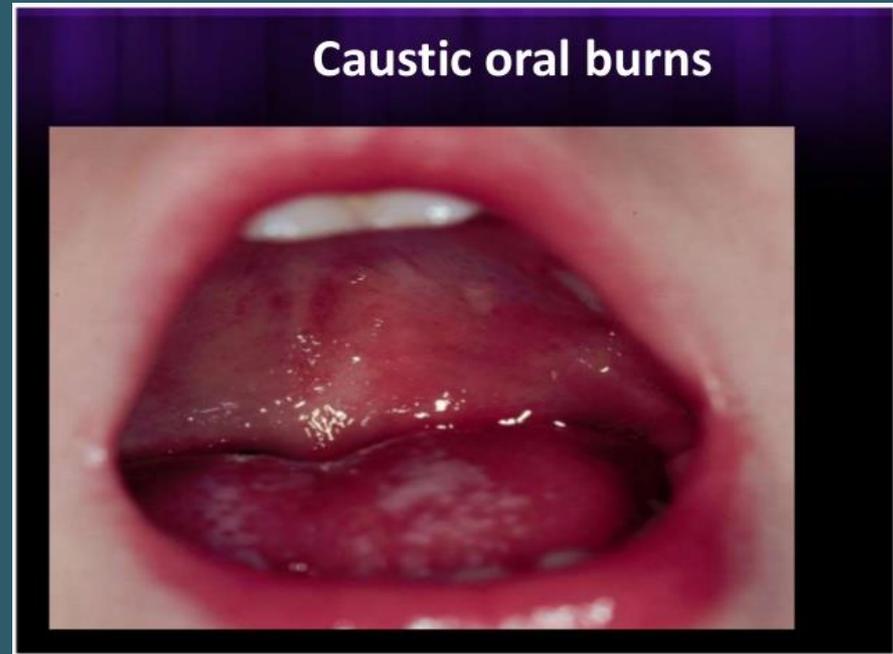
NO

Studies

- Gaudreault et al, 1982: 80 children 9 months to 13 years, w/o symptoms, 12% had grade II lesions, 1.2% of the asymptomatic patients had a stricture
- Vomiting 33%, dysphagia 25%, salivation 24%, abdominal pain 24% were most frequently associated with grade II-III lesions

What about dilutional therapy?

- Dilutes the concentration of the caustic
- Animal studies show little increase in heat or pressure when given in alkali ingestions
- Limited to the first few minutes after exposure



Household Hydrofluoride Products

- Glass Etching Creams
 - Ammonium bifluoride 60%
- Rust Removers / Wheel Cleaners
 - Hydrofluoric acid 10-12 %



Hydrofluoric Acid

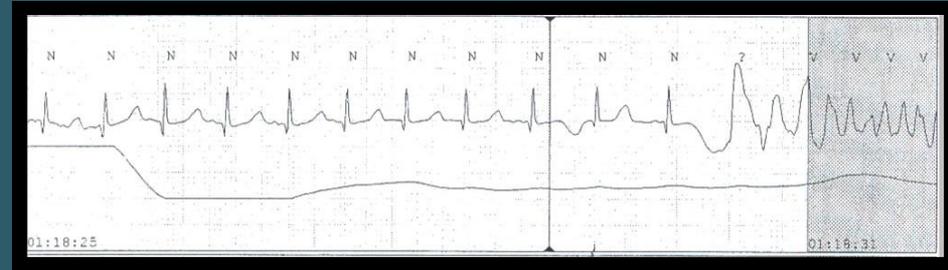
- A healthy 12-month-old girl was playing in her walker when a bottle of glass etching cream fell onto the walker tray
- Mother noticed the product on the child's hands and placing her hands in her mouth
- Vomiting was induced and the child became sleepy
- The child arrived at MCV 2 hrs later



Hydrofluoric Acid

- On ED arrival: child was in no distress and acting appropriate for her age
- P/E: crying, tachycardic (188), no lesions
- Dermal decontamination and PO calcium given
- Serum Ca = 6.8 mmol/L (9.1-10.9)
- Ca(i) = 0.96 mmol/L (1.16 – 1.32)
- CO₂ = 15 mmol/L (21-33)
- EKG: sinus tach (175), PR 94, QRS 54, QTc 436
- IV calcium 1g infusion

Hydrofluoric Acid



- ED: noted to playful and alert – fell asleep during calcium infusion
- Sudden onset of jerking movements
- Unresponsive, torsades de pointe on monitor
- CPR, Mg, Ca, Epi, defibrillation
- Child died about 4.5 hours after exposure
- Autopsy – normal, no oral or dermal lesions

Foreign Body Ingestion

- 13 mo boy to ED after witnessed FB
- Stridorous
- No PMhx, No Meds, No Soc Hx



Button Batteries



- May contain silver oxide, mercuric oxide, lithium, MnO_2 , zinc
- Most patients are asx and battery passes within 4d; may take 1 or more weeks
- Lithium and larger size (20mm) had worse outcomes
- Esophageal perforation can occur in 6 hrs

Management

- Airway, AP, lat neck, CXR, abdominal XR
- In airway = bronchoscopy
- In esophagus = nitrates, CCA, glucagon, ipecac, balloon catheter, ENDOSCOPY
- In stomach, < 6 y/o and batt > 15 mm, repeat Xray in 4 d, possibly WBI
- In intestine 99% will pass in 7 days

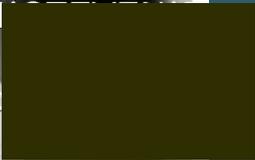
fcr2N

MCV ER #2



1
ABDOMEN, GENERAL

MORGAN

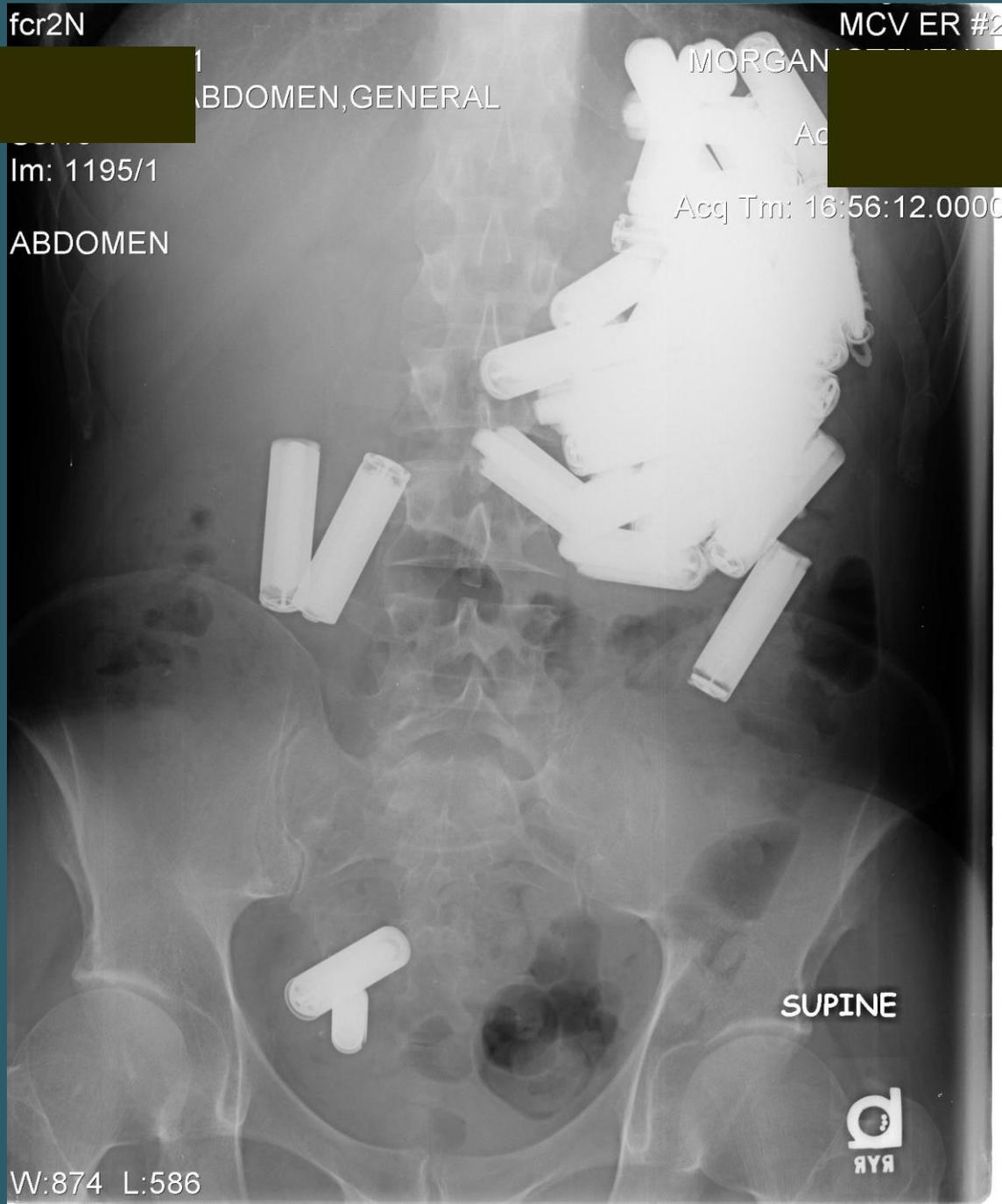


Ac

Im: 1195/1

Acq Tm: 16:56:12.0000

ABDOMEN



SUPINE



W:874 L:586





Laundry Pods





AIRWAY COMPROMISE IN CHILDREN EXPOSED TO SINGLE USE DETERGENT PODS



PE Stromberg, MH Burt, SR Rose, KL Cumpston, MM Troendle, BK Wills

Virginia Poison Center, Division of Clinical Toxicology, Department of Emergency Medicine
Virginia Commonwealth University School of Medicine - Richmond, Virginia, USA

Background

- Single-use laundry detergent pods were introduced to the United States in 2010 but have been available in Europe as early as 2001.
- Pods are a concentrated liquid detergent in a water-soluble polyvinyl alcohol membrane.
- Case reports have noted vomiting, eye injuries, respiratory and central nervous system depression.
- We summarize clinical effects from unintentional detergent pod exposures reported to a single poison center over 15 months.

Methods

- Electronic poison center records were searched from January, 2012 through April 9, 2013
- Charts were abstracted onto a database including: patient demographics, recorded clinical signs/symptoms, vital signs, clinical course, and outcome

Results

- We identified 131 cases between March 2012 and April 2013
- Average age was 3.6 years with four adult cases; all were coded as unintentional
- The most common route was ingestion (120) followed by ocular (14) and dermal (6)
- Of ingestion exposures 79 (66%) were managed at home and 41 (34%) were evaluated in a hospital, of which 9 (8%) were admitted
- The average age of admitted patients was 16 months (range, 8-24 months).

Relevant findings in the nine admitted children included:

- Emesis (78%)
- CNS depression (22%)
- Upper airway effects (56%)
- Lower respiratory symptoms (33%)
- Seizure (n=1)
- Intubation (67%).

- One child with emesis initially managed at home was subsequently intubated for respiratory distress



Conclusions

- Exposure to single use detergent pods can cause significant toxicity, particularly in infants and toddlers.
- Compared to traditional detergents, clinicians should be aware of the potential for airway compromise following exposure to detergent pods.

All Mighty Pac Ingestion



- A 17 m/o boy bit into an All Mighty Pac. By 45 min after exposure, he had vomited twice and was lethargic.
- ED: HR 120, RR 26, T 38.1, pOx 96% ra; became listless and unresponsive → intubated for > 24 hrs

LOADS OF TEMPTATION

Single-load liquid laundry packets look like candy, toys and teething rings...

*...but they're
POISON!*



Preventing poisoning is simple.



+



=



Avoid temptation:

Store laundry packets locked up and out of sight.

**Call Poison Help at
1-800-222-1222**



NSN 13-9

Petroleum Distillates

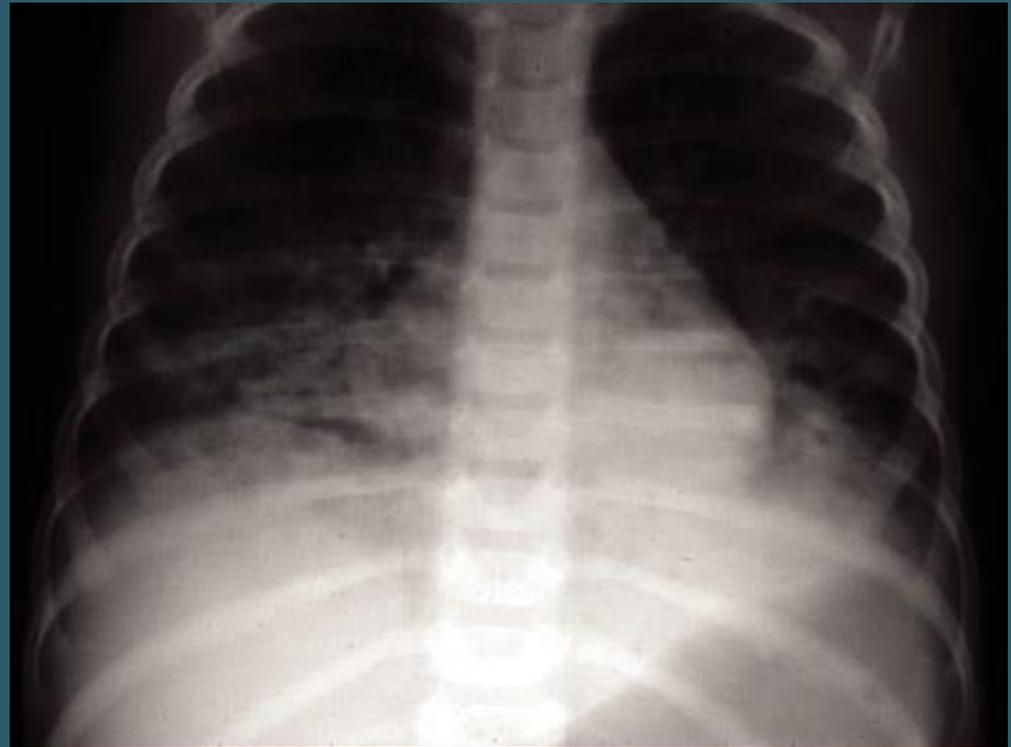
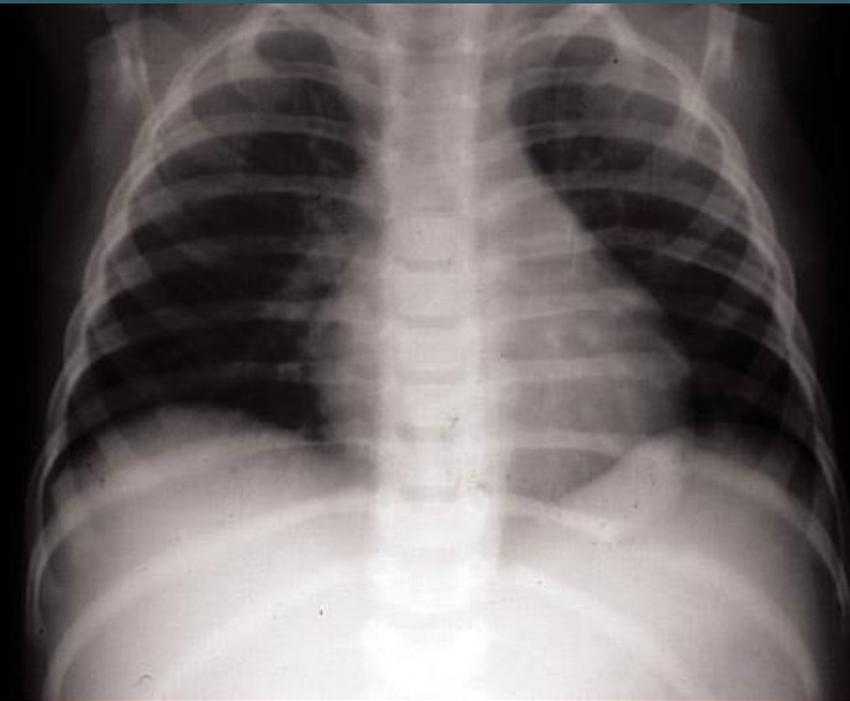
- Gasoline
- Kerosene
- Lamp oil
- Lighter fluid
- Liquid polish



Tiki Torch Fuel Ingestion

- A 17 m/o girl may have ingested a mouthful of torch fuel. Spilled on her shirt and the floor.
- Child has a “minor” cough; playing
- Plan?
- Decontaminate?





Chemical Pneumonitis

Tiki Torch Fuel Ingestion

- 1630: ingestion & aspiration
- 7 hrs: mild tachypnea
- 13 hrs: in ED: T 103, b/l infiltrates
- 29 hrs: RR in 80s
- Tx: ECMO for 48-72 hours in ICU
- In hospital > 7 days

Petroleum Distillates

- Risk for aspiration – related to viscosity
- Chemical pneumonitis
- Symptoms within 6 hours
- Supportive pulmonary toilet
- No role for steroids or antibiotics
- DO NOT induce emesis (ipecac)!



Camphorated
Oil

KEEP THIS AND ALL OTHERS
OUT OF REACH OF CHILDREN
IN CASE OF ACCIDENT
OR IN CASE OF
IN ASSISTANCE
- PHARMACY
- PHARMACY

Products with Camphor

- **Camphorated oil** **23%**
- **Campho-Phenique** **10.8%**
- **Camphor spirits NF** **10%**
- **Soltice Quick Rub** **5%**
- **Soltice Quick Rub Childrens** **3.75%**
- **Vicks Vaporub** **4.8%**
- **Ben-gay ultra strength** **4%**

Camphor Toxicity

- **Lipophilic cyclic terpene with CNS stimulant properties**
- **Antipruritic, rubefacient, antiseptic**
- **Oral and throat irritation**
- **Nausea and vomiting**
- **Confusion, restlessness, seizures**
- **Onset 5-15 minutes**



Camphor Toxicity

- **1 g has caused death in a child**
- **2 g causes significant adult toxicity**
- **Clinically significant toxicity does not occur with < 30 mg/kg and is rare with doses < 50 mg/kg (Geller et al, 1984)**
- **Refer to HCF for ingestions > 500 mg**
- **Avoid milk or fatty foods**

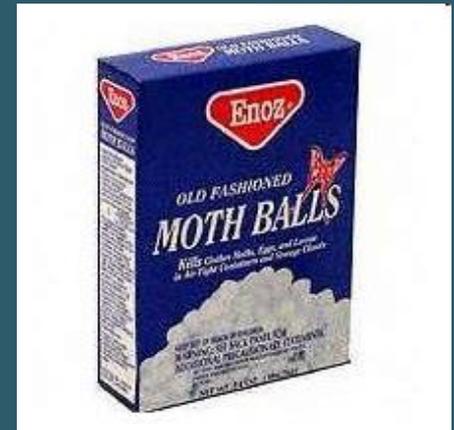
Mothballs

- Naphthalene
- Paradichlorobenzene
- Camphor

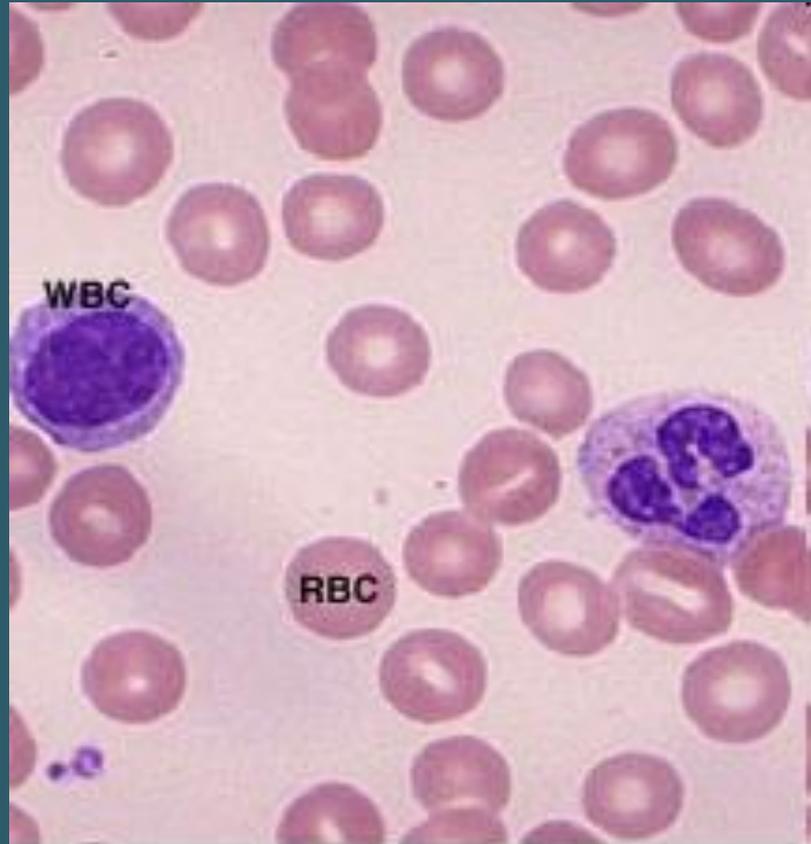


- Also found in cake deodorizers (diaper pail, toilet bowl)
- Toxicity: seizures, hemolysis, methemoglobinemia

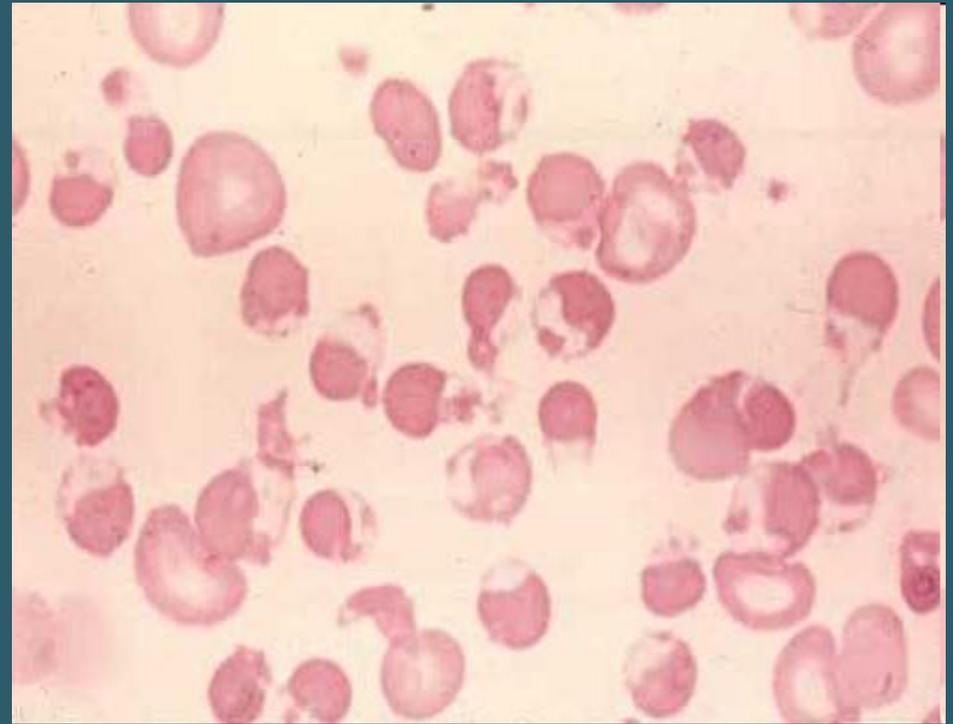
Mothball Ingestion



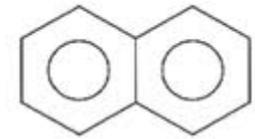
- A 7 year-old girl bit into 2 mothballs thinking they were candy – only small amount believed swallowed
- PMH of developmental delay, CVA
- 3 days later presented to ED with dark urine and scleral icterus
 - Acute hemolysis: Hgb 7 (nl 12)
 - Methemoglobinemia: 4.4%
 - Total bilirubin 7.8



Normal Blood Smear

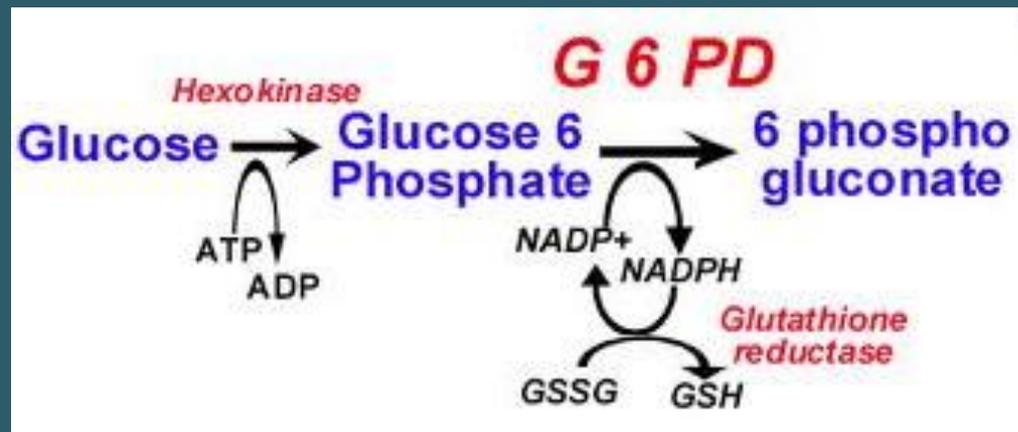


Naphthalene-Induced Hemolysis



Naphthalene
 $C_{10}H_8$

- Naphthalene epoxide metabolite causes oxidative stress
- RBC glutathione is reduced in pts with G-6-PD deficiency



Mechanism of G6PD-Deficiency anemia

- Reduced glutathione
 - Acts as a scavenger for dangerous oxidative metabolites in the cell.
 - Converts harmful hydrogen peroxide to water.
 - Source of NADPH that protects the cells against oxidative stresses.
 - Individuals deficient in G-6-PD are not prescribed oxidative drugs because their red blood cells undergo rapid hemolysis under this stress.



READY TO USE ALL-SEASON

Wiper Blue

WINDSHIELD WASHER

Antifreeze & Summer Cleaner
Protects to -20° F

DANGER POISON

COMBUSTIBLE - VAPOR HARMFUL
MAY BE FATAL OR CAUSE BLINDNESS
IF SWALLOWED.

DIRECTIONS: POUR INTO WASHER TANK. In freezing temperatures, operate defrosters before use.

CONTAINS METHANOL. Cannot be made non-poisonous. Use with adequate ventilation. FIRST AID: If swallowed, induce vomiting by medically approved means. CALL A PHYSICIAN. If splashed in eyes, immediately flush with water for at least 15 minutes.

KEEP AWAY FROM OPEN FLAME.
KEEP OUT OF REACH OF CHILDREN.
DOUGLAS PRODUCTS AND PACKAGING
Liberty, Missouri 64066

1 U.S. GAL. (3.785L)



0 51223 00311 8

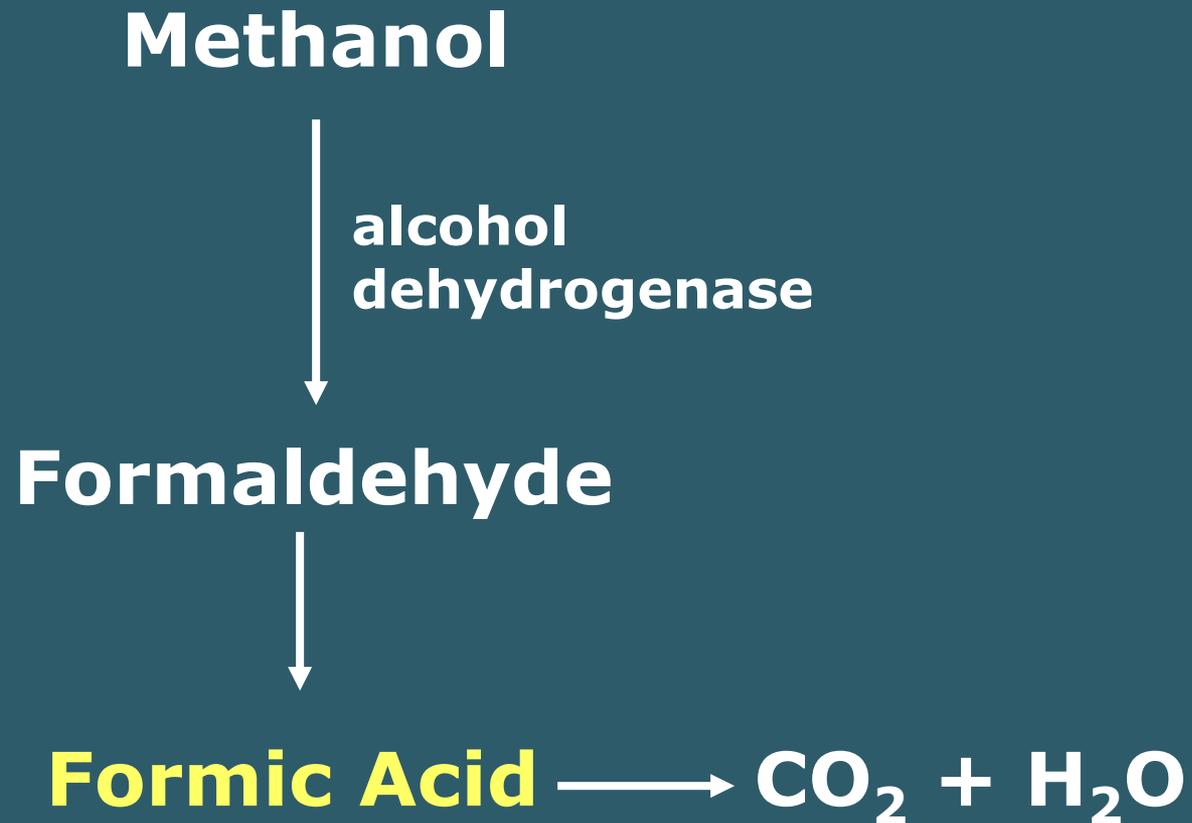


Methanol

- Sources: gasoline antifreeze, windshield washer fluid, sterno
- Inebriation, lethargy, coma
- Blurred vision → blindness; retinal edema, hyperemia
- Metabolic acidosis
(delayed: 18-24 h)



Methanol Metabolism



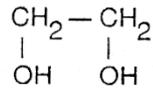
Methanol

- **Rapid decontamination**
- **Check methanol blood level, serum osmolality**
- **Folic acid / leucovorin**
- **Inhibit MEOH metabolism:**
 - **Ethyl alcohol – intravenous**
 - **4-methylpyrazole (Antizol®)**
- **Hemodialysis**
 - **Based on symptoms, acidosis, level**

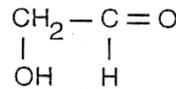
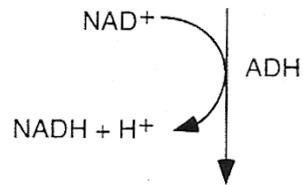
Ethylene Glycol

- Radiator antifreeze
- Estimated lethal dose = 100 ml (1.4 ml/kg)
- Clinical effects:
 - Neurologic (0.5 – 12 hrs)
 - Cardiopulmonary (12-24 hrs)
 - Renal (24-72 hrs)

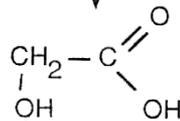




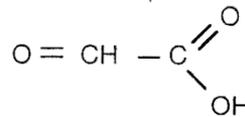
ETHYLENE GLYCOL



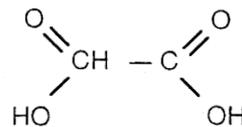
GLYCOALDEHYDE



GLYCOLIC ACID



GLYOXYLIC ACID



OXALIC ACID

Ethylene Glycol

- **Rapid decontamination**
- **Check osmolality – EG blood level**
- **Check for crystalluria**
- **Thiamine / pyridoxine**
- **Inhibit MEOH metabolism:**
 - **Ethyl alcohol – intravenous**
 - **4-methylpyrazole (Antizol®)**
- **Hemodialysis**
 - **Based on symptoms, acidosis, level**

Methyl Salicylate

- 1 cc of 98% = 1,400 mg aspirin
- One swallow (5 ml) is equivalent to 7 g of aspirin, which = 466 mg/kg in a 15 kg child.
- Ingredient in Wintergreen alcohols and topical analgesics (15-30%)
 - Ben-Gay
 - Icy Hot



Salicylate Toxicity

- **GI irritation – N/V/D, abdominal pain**
- **Tinnitus**
- **CNS stimulant – hyperventilation, agitation, seizures, coma**
- **Hypoglycemia**
- **Metabolic acidosis, hyperthermia**
- **Pulmonary edema**
- **Coagulopathy**

Salicylate Treatment

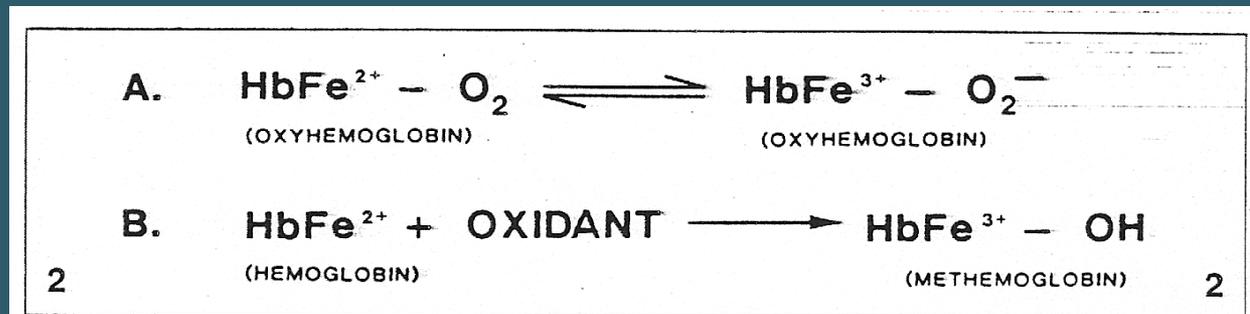
- **Activated charcoal**
- **Serial salicylate levels, BMP, ABG**
- **Urinary alkalization (pH 7.5 – 8.0)**
- **Hemodialysis**
 - **Significant altered mental status**
 - **Refractory acidosis**
 - **Renal failure**
 - **Serum level – acute or chronic?**

Methemoglobinemia

- Benzocaine, lidocaine
- Aniline dyes
- Naphthalene
- Phenazopyridine
- Nitrites, nitrates
- Chlorates

Methemoglobinemia

- Oxidized Hgb does not carry or deliver oxygen



- Dyspnea, chest pain, CNS symptoms
- Chocolate brown colored blood and cyanosis unresponsive to O_2 therapy

Methemoglobinemia

- **< 15%** **Asymptomatic**
- **15-30%** **Cyanosis**
- **30-55%** **Headache, fatigue, dizzy,
tachycardia, lethargy**
- **55-70%** **Coma, acidosis,
seizures, dysrhythmias**





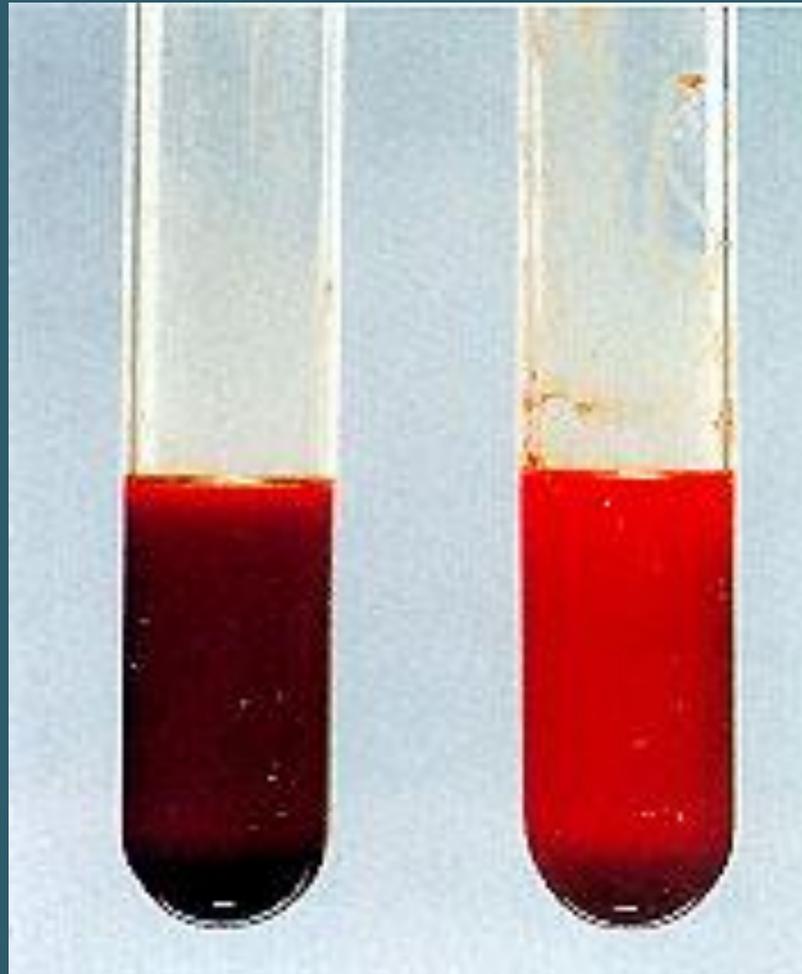
Methemoglobinemia

Occurs in poisoning by phenacetin (acetophenetidin), acetanilid, nitrate, nitrite, aniline dyes, and over 100 other compounds

Cyanosis

Chocolate-brown blood

Methemoglobinemia



Methemoglobinemia



- **Management = reduction of metHgb with methylene blue**
- **1-2 mg/kg (0.1-0.2 ml/kg) of 1%**
- **May repeat at 1 hr intervals**
- **Avoid doses > 7 mg/kg**

Sudden Sniffing Death

- Onset in minutes
- Unpredictable
- Combination of low oxygen and cardiac rhythm disturbance
- Victims usually found unresponsive (dead)
- Resuscitation unlikely



What are Inhalants?

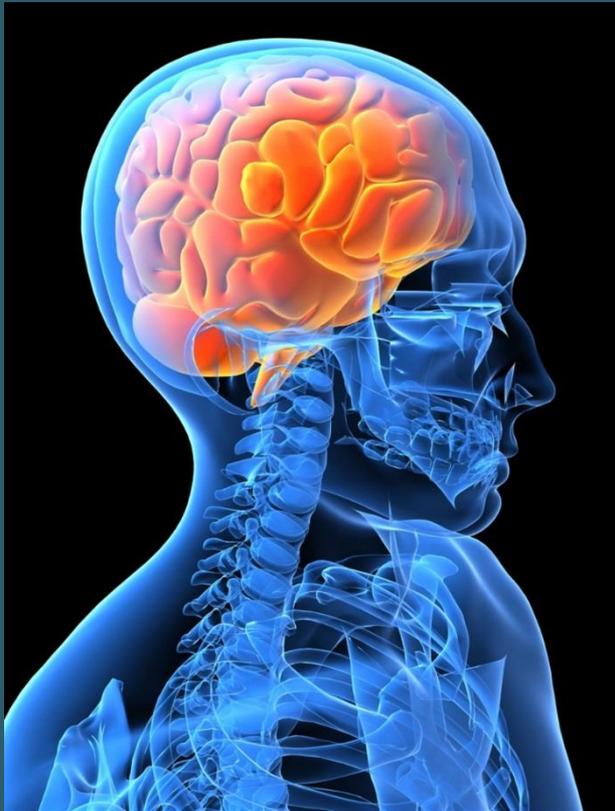
- Paint thinner and other solvents
- Nail polish remover
- Fuel vapors
- Propellants (aerosols)
- Glues
- Refrigerants
- Anesthetics (nitrous oxide)
- Nitrites (poppers, room odorizers)
- Butane (cigarette lighters)



Stages of Intoxication

Excitatory	Euphoria, excitation, dizziness, sneezing, coughing, drooling, N&V, bizarre behavior, hallucinations
Early CNS Depression	Confusion, disorientation, blurred vision, headache, pale, "buzzing"
Medium CNS Depression	Drowsiness, incoordination, slurred speech, random eye movements
Late CNS Depression	Coma, bizarre dreams, seizures

Symptoms of Inhalant Abuse: Acute Medical Problems



- Euphoria, loss of consciousness
 - Brain is not getting enough oxygen
- Irregular heart beat
 - Stress hormones are circulating at high levels
 - Affect electrical conduction in the heart
- Frostbite
- Trauma
- Suffocation

Sudden Sniffing Death

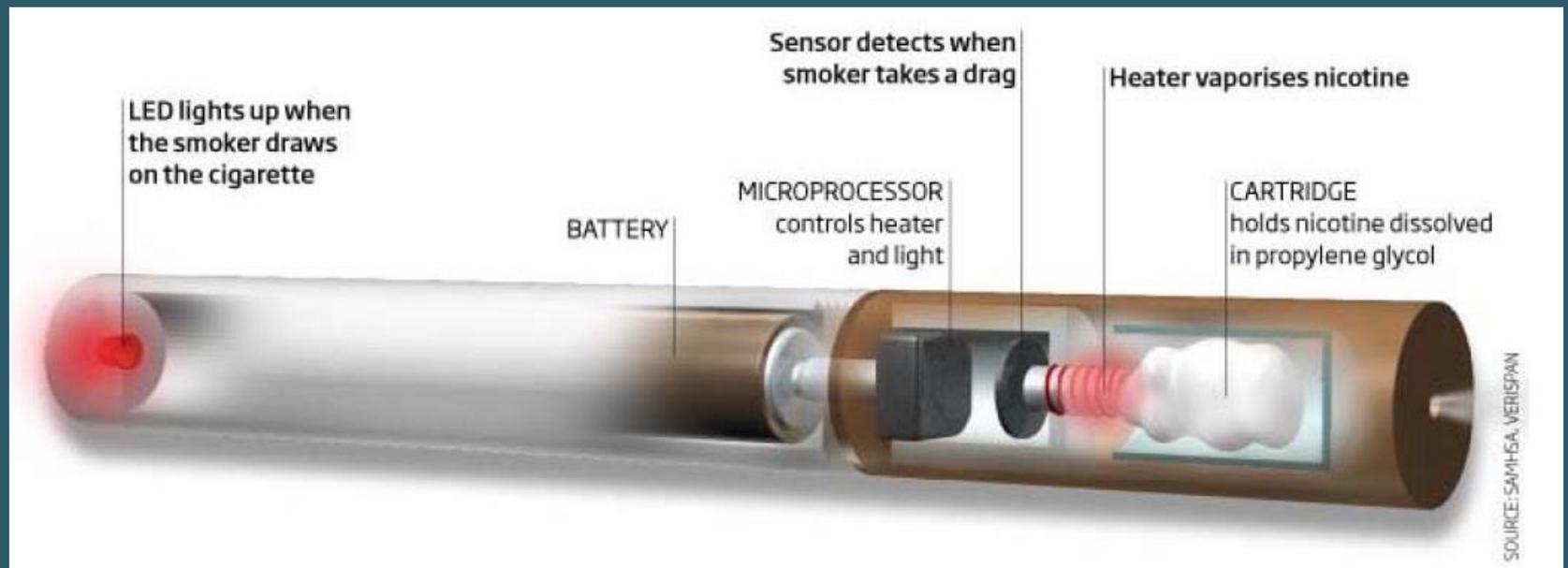
- 39 deaths reported in Virginia, 1987-1996
- Mean age: 19
- 46% involved butane or propane

- 144 deaths reported in Texas, 1988-1998
- Mean age: 24
- 35% involved refrigerants (Freon)

Liquid Nicotine & E-cigs

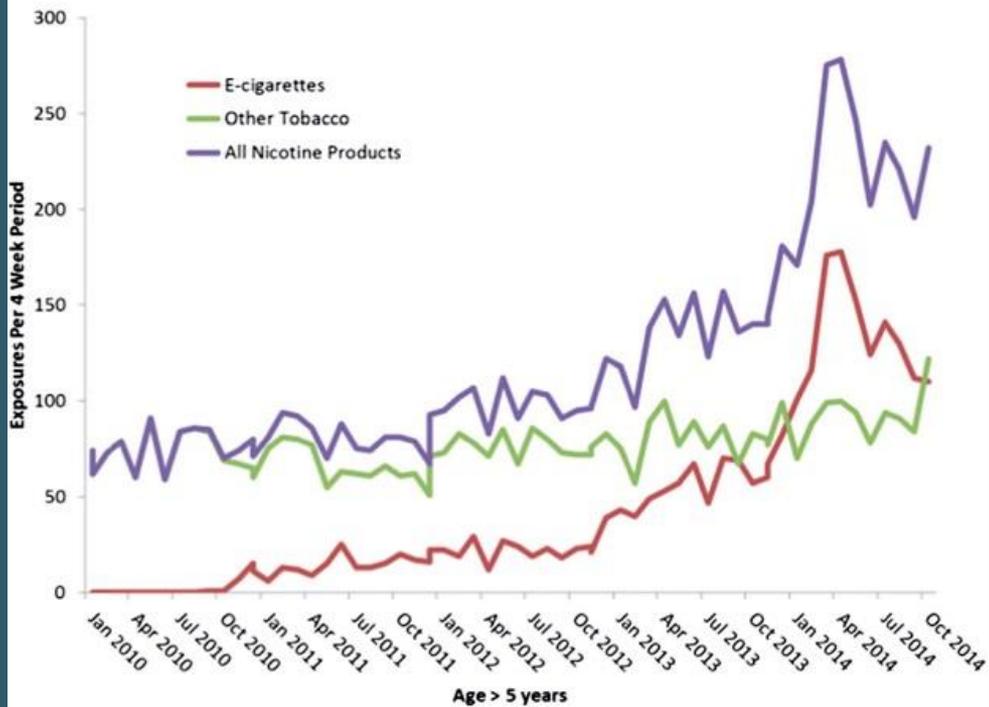
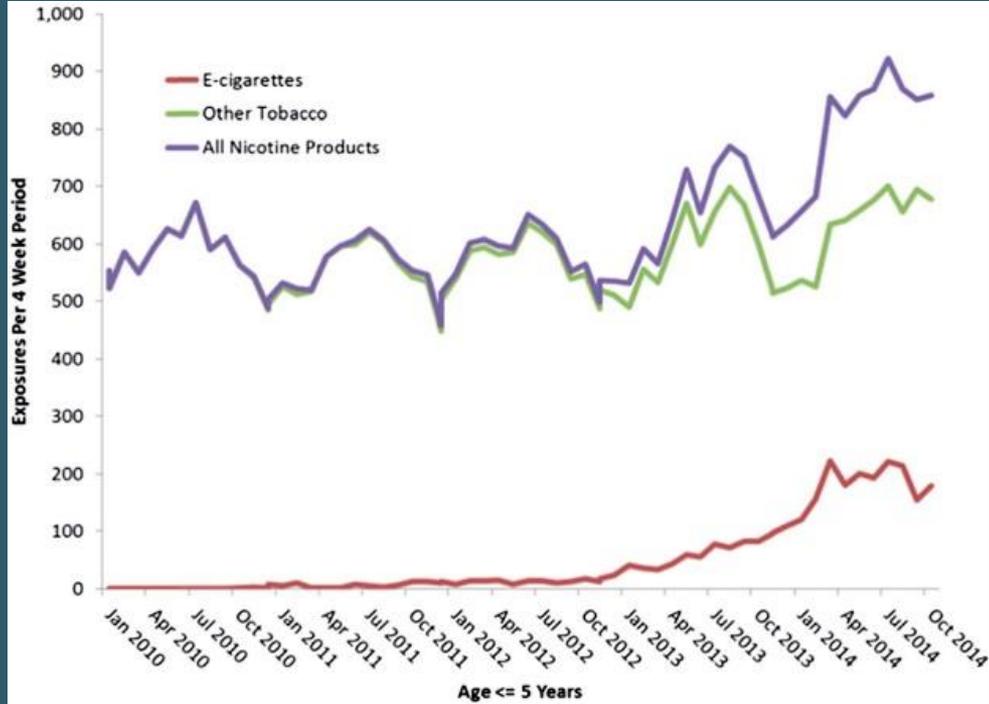
- New on the market
- Potent forms of nicotine
- Lack of child proof containers
- Lots of exposures in children

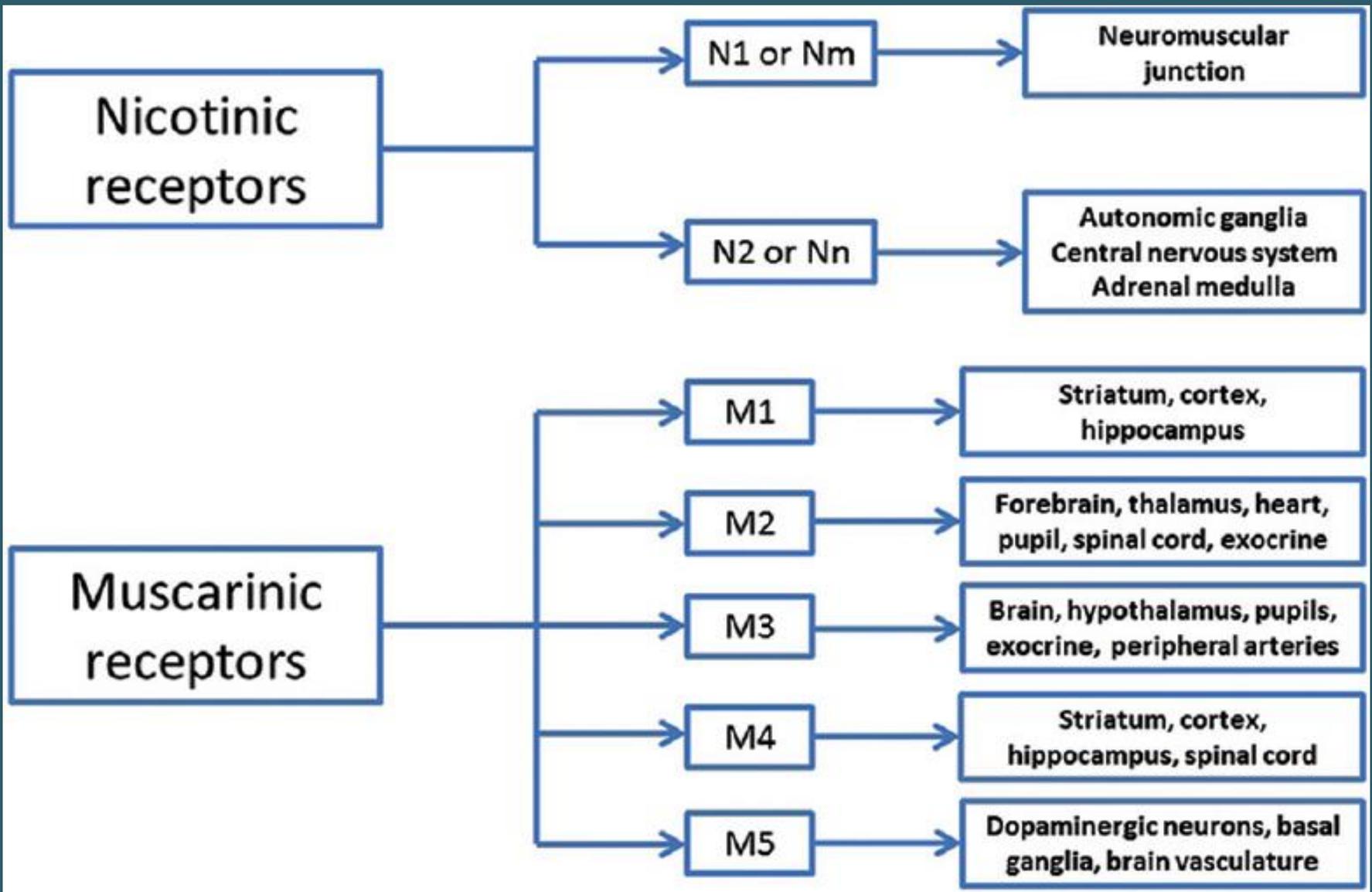




E-cig and Liquid Nicotine Calls to Poison Centers

Year	Number of Cases
2011	271
2012	460
2013	1,543
2014	3,783
2015 (thru October)	2,689





Nicotine Poisoning

- Binds and stimulates nicotinic Ach receptors – autonomic nervous system
- High doses → overstimulation
- Mild to Moderate:
 - N/V, HA, dizziness, tremor, diaphoresis, tachycardia, pallor, mild HTN
- Severe Toxicity:
 - Agitation, confusion, seizures, bradycardia, hypotension, respiratory muscle paralysis

E-LIQUID NICOTINE STRENGTH GUIDE

Regular Cigarette

E-liquid Nicotine

Unfiltered, very strong

Super High - 36mg

Full Flavored, Strong

Extra High - 24mg

Regular (most)

High - 16mg

Light

Med - 11mg

Ultra-light

Low - 8mg

Freedom from Nicotine!

No Nicotine - 0mg



Nicotine Poisoning

- 2-4 mg can cause effects in children
- Estimated adult lethal dose: 1 – 12 mg/kg
- Liquid nicotine products:
 - 0.6%: 6 mg/ml
 - 1.2%: 12 mg/ml
 - 1.8%: 18 mg/ml
 - 2.4%: 24 mg/ml
 - 3.6%: 36 mg/ml

E-cig use up among teens, national youth tobacco survey shows

By TAMMIE SMITH Richmond Times-Dispatch | Posted: Thursday, April 16, 2015 10:30 pm

Teens are trading traditional cigarettes for electronic cigarettes, according to a federal report that shows use of e-cigarettes rose sharply in middle and high school students.

Use of e-cigarettes tripled from 2013 to 2014, becoming the main tobacco product used by middle and high school students, according to the 2014 National Youth Tobacco Survey.

“There are now 2.5 million kids using e-cigarettes and 1.5 million using hookah,” Dr. Tom Frieden, director of the federal Centers for Disease Control and Prevention, said in a briefing Thursday.

“It’s important that everyone, parents and kids, understand that nicotine is dangerous for kids at any age, whether it’s an e-cigarette, hookah,



20140922_MET_COVR_2_p07

Some examples of electronic cigarettes used in the VCU study are shown on the counter at Voltage Vapin' in Chester, Thursday, Sept. 11, 2014.



Post-lecture Questions

No, you can't leave yet.....

All of the following contain methylsalicylate except

- a. Oil of wintergreen
- b. Ben Gay ointment
- c. Icy Hot ointment
- d. Campho-phenique

Answer: d

Toxicity of camphor is primarily:

- a. Hepatic injury
- b. Metabolic acidosis
- c. Seizures
- d. Cardiac arrhythmias

Answer: c

Benzocaine exposure may result in:

- a. Coma
- b. Urinary retention
- c. Hypotension
- d. Methemoglobinemia

Answer: d

Summary

- Many drugs and commercial household products can cause serious poisoning
- Sometimes in very small doses
- Symptoms and toxicity may be delayed
- Spend time to obtain a good history
- Bring containers with the patient
- The Poison Center is an excellent resource

