

The New Toxic Environment: A Perspective Beyond Dr. Oz

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Children's Mercy
KANSAS CITY

No Disclosures

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POISON
Help
1-800-222-1222



Poison Control Centers



NPDS 2013 data

- 3,060,122 total encounters
 - 2,188,013 human exposures
 - 59,496 animal exposures
 - 806,347 information calls
 - 6,116 human confirmed non-exposures
 - 150 animal confirmed nonexposures



Substance Exposure (Pediatrics ≤ 5 years of age)

Table 17C. Substance Categories Most Frequently Involved in Pediatric (≤5 years) Exposures (Top 25)^a.

Substance (major generic category)	All substances	% ^b	Single substance exposures	% ^c
Cosmetics/personal care products	151,154	13.82	148,040	14.52
Cleaning substances (household)	113,872	10.41	109,548	10.75
Analgesics	106,639	9.75	97,388	9.55
Foreign bodies/toys/miscellaneous	75,184	6.88	73,366	7.20
Topical preparations	66,893	6.12	65,756	6.45
Vitamins	47,816	4.37	43,355	4.25
Antihistamines	45,250	4.14	40,983	4.02
Pesticides	35,254	3.22	34,246	3.36
Plants	29,346	2.68	28,296	2.78
Gastrointestinal preparations	28,481	2.60	25,883	2.54
Antimicrobials	27,928	2.55	26,294	2.58
Cold and cough preparations	25,708	2.35	23,647	2.32
Dietary supplements/herbals/homeopathic	24,638	2.25	22,550	2.21
Cardiovascular drugs	23,124	2.11	14,645	1.44
Arts/crafts/office supplies	20,736	1.90	20,126	1.97
Hormones and hormone antagonists	20,522	1.88	15,869	1.56
Electrolytes and minerals	20,071	1.84	18,293	1.79
Deodorizers	17,555	1.61	17,354	1.70
Other/unknown nondrug substances	13,261	1.21	12,627	1.24
Sedative/hypnotics/antipsychotics	12,676	1.16	9,844	0.97
Antidepressants	11,526	1.05	8,343	0.82
Alcohols	11,026	1.01	10,756	1.06
Information Calls	9,984	0.91	9,389	0.92
Hydrocarbons	9,947	0.91	9,622	0.94
Asthma therapies	9,923	0.91	9,112	0.89

Fatalities called to PCCs

Table 4. Distribution of Age^a and Gender for Fatalities^b.

Age (y)	Male	Female	Unknown	Total (%)	Cumulative total (%)
< 1 year	4	0	0	4 (0.3%)	4 (0.3%)
1 year	7	5	0	12 (1.0%)	16 (1.3%)
2 years	2	1	0	3 (0.3%)	19 (1.6%)
3 years	3	2	0	5 (0.4%)	24 (2.0%)
4 years	2	1	0	3 (0.3%)	27 (2.2%)
5 years	1	1	0	2 (0.2%)	29 (2.4%)
Child 6–12 years	3	3	0	6 (0.5%)	35 (2.9%)
Teen 13–19 years	37	26	1	64 (5.3%)	99 (8.1%)
20–29 years	103	88	0	191 (15.7%)	290 (23.8%)
30–39 years	93	101	0	194 (15.9%)	484 (39.7%)
40–49 years	98	109	0	207 (17.0%)	691 (56.7%)
50–59 years	111	115	0	226 (18.6%)	917 (75.3%)
60–69 years	72	66	0	138 (11.3%)	1,055 (86.6%)
70–79 years	35	41	0	76 (6.2%)	1,131 (92.9%)
80–89 years	23	45	0	68 (5.6%)	1,199 (98.4%)
> = 90 years	5	5	0	10 (0.8%)	1,209 (99.3%)
Unknown adult	2	3	0	5 (0.4%)	1,214 (99.7%)
Unknown age	0	2	2	4 (0.3%)	1,218 (100.0%)
Total	601	614	3	1,218 (100.0%)	1,218 (100.0%)



Electronic Cigarettes

Electronic cigarettes: miracle or menace?

How an electronic cigarette works

The electronic cigarette contains a battery that activates a heating device, atomizing liquid nicotine inside a cartridge and producing a vapor that is inhaled.



Liquid nicotine cartridge

Inhaler

Atomizer/heating device

Lithium battery

Tip lights up



Source: allhookah.net

Tim Summers / The Detroit News

Case presentation

- 10 month old with vomiting, tachycardia, grunting respirations and truncal ataxia after ingesting “small” amount of e-liquid nicotine
- Vape shop states it contained 1.8% nicotine (18 mg per milliliter) and unknown concentrations of wintergreen (methyl salicylate), glycerin and propylene glycol.

NEJM 2014, DOI: 10.1056/NEJMc1403843



OTC liquid nicotine products



NEJM 2014, DOI: 10.1056/NEJMc1403843

Nicotine toxicity

- Low dose – stimulant effects (e.g., tachycardia)
- CNS toxicity – ataxia, seizures
- Increasing dose – muscarinic toxicity of extreme secretions and GI disturbance
- High dose – neuromuscular blockade, respiratory failure, and death.
- Lethal dose – 1-13 mg/kg of body weight (1 teaspoon (5 ml) of 1.8% could be lethal in 90 kg person.



Nicotine Exposure

- Liquid nicotine products often express the concentration (mg/mL) as “mg”
- Products marked “0 mg/mL” nicotine may contain significant amounts of nicotine, up to 10 mg per cartridge
- Nicotine toxicity is strongly influenced by history of nicotine use/tolerance



Table 1 Replicate and mean nicotine concentration analyses for e-cigarette nicotine solutions

Sample ID	Brand*	Expected concentration level	Nicotine (mg/ml)			
			Replicate analyses			Mean (\pm S.D.)
			1	2	3	
A	Vapour liquid (high)	24 mg/ml (marked)	19.8	21.2	16.3	19.1 (\pm 2.52)
B	No brand, hand-labelled liquid (high)	25–36 mg/ml (est.)	12.4	12.1	12.4	12.3 (\pm 0.17)
C	Smart smoke liquid (high)	25–36 mg/ml (est.)	13.2	13.5	12.7	13.1 (\pm 0.40)
D	Smart smoke liquid (med)	10–18 mg/ml (est.)	12.7	11.2	11.9	11.9 (\pm 0.75)
E	Smart smoke liquid (low)	6–14 mg/ml (est.)	8.3	8.6	8.5	8.5 (\pm 0.16)
F	BE112 prefilled cartridge (super high)	25–36 mg/ml (est.)	19.8	20.4	19.5	19.9 (\pm 0.46)
G	Vapour prefilled cartridge (high)	24 mg/ml (marked)	22.4	22.7	21.5	22.2 (\pm 0.62)

Precision and accuracy of the LC-MS analyses for the quality control test solutions were as follows: Low: target concentration=20 ng/ml, measured nicotine mean (SD)=18.5 (\pm 0.95); Medium: target concentration=300 ng/ml, measured nicotine mean=301.4 (\pm 6.05); High: target concentration=1300 ng/ml, measured nicotine mean=1314 (\pm 42.5).

*Nicotine solutions were obtained from local vendors in Spokane, Washington, USA. All labelled brands (Vapour, Smart Smoke, BE112) were also found available for purchase on the internet. Information on country of manufacture was only found for Vapour (USA).





Cameron et al. *Tob Control* 2014; 23: 77-78



Adult Toxicity

Exposure Quantity (mL)	Nicotine Concentration (mg/mL) in Common Products				
	0 mg/mL*	6	12	18	24
0.5	0	3	6	9	12
1	0	6	12	18	24
2	0	12	24	36	48
5	0	30	60	90	120
10	0	60	120	180	240
20	0	120	240	360	480
30	0	180	360	540	720
50	0	300	600	900	1200
100	0	600	1200	1800	2400

For an adult

-  Unlikely to cause symptoms
-  Low exposure: GI symptoms possible
-  Potentially lethal exposure
-  Multiple times potentially lethal dose

*Label may not accurately reflect nicotine quantity

Child Toxicity

Exposure Quantity (mL)	Nicotine Concentration (mg/mL) in Common Products				
	0 mg/mL*	6	12	18	24
0.1	0	0.6	1.2	1.8	2.4
0.25	0	1.5	3	4.5	6
0.4	0	2.4	4.8	7.2	9.6
0.5	0	3	6	9	12
1	0	6	12	18	24
2	0	12	24	36	48
5	0	30	60	90	120
10	0	60	120	180	240
20	0	120	240	360	480

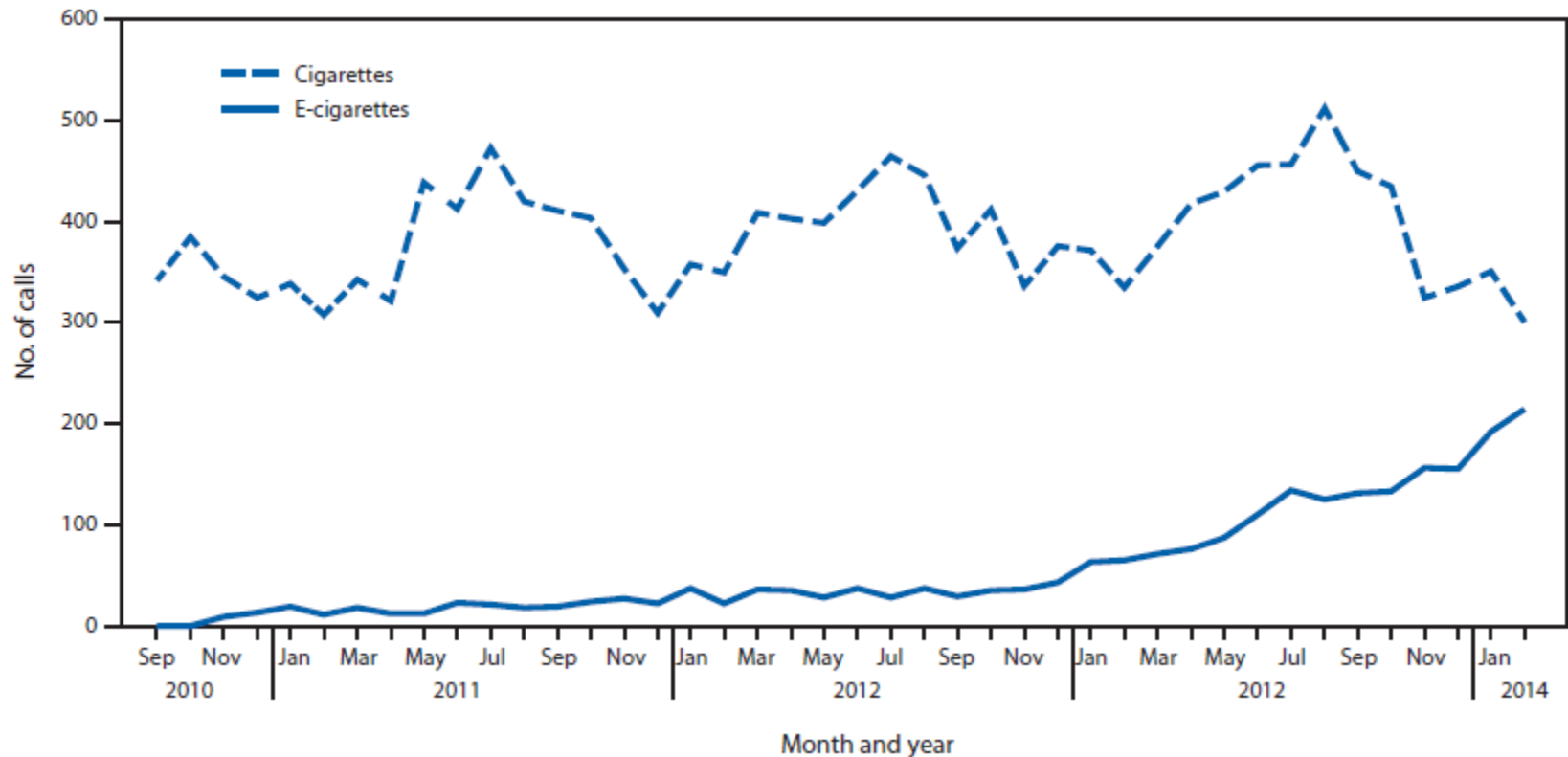
For a 10 kg child

- Unlikely to cause symptoms
- Low exposure: GI symptoms possible
- Potentially lethal exposure
- Multiple times potentially lethal dose

*Label may not accurately reflect nicotine quantity



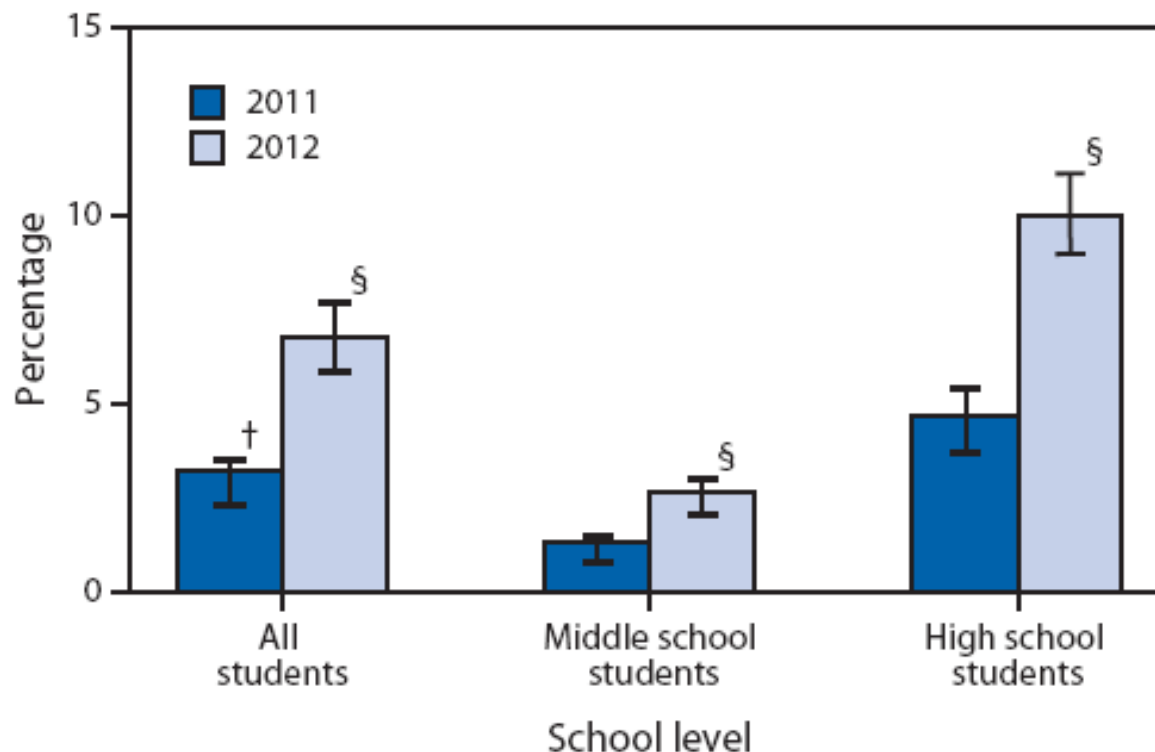
Number of calls to poison centers for cigarette or e-cigarette exposures, by month — United States, September 2010–February 2014



MMWR 04/04/2014



FIGURE. Ever electronic cigarette use* among middle and high school students, by year — National Youth Tobacco Survey, United States, 2011–2012



* Ever electronic cigarette use defined as having ever used electronic cigarettes, even just one time.

† 95% confidence interval.

§ Statistically significant difference between 2011 and 2012 (chi-square, $p < 0.05$).

MMWR 09/06/2013



Environmental Exposure

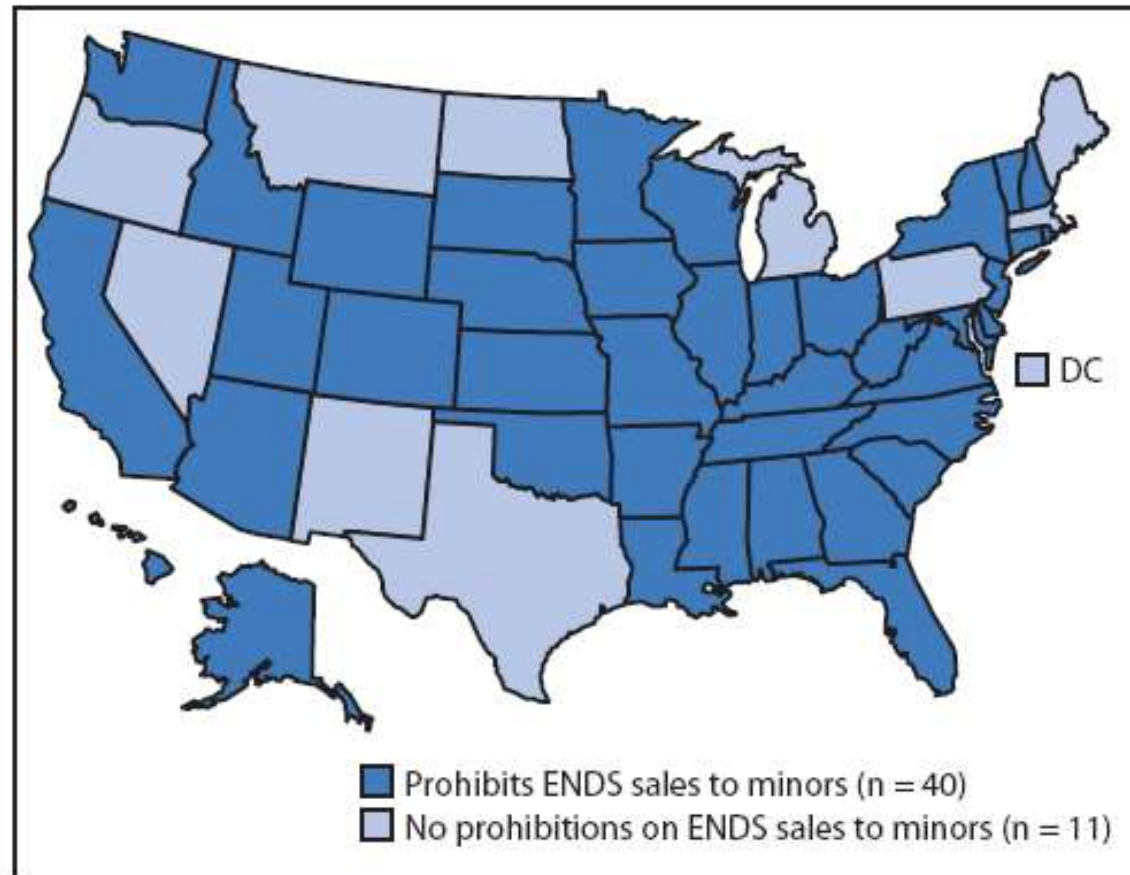
- Measured airborne markers of secondhand exposures (nicotine, PM2.5, CO, and VOCs)
- Secondhand exposure to nicotine but not to combustion toxicants.
- Nicotine exposure 10X in regular cigarettes.



Czogala et al. Nic and Tob Res. 2013

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FIGURE 1. States with and without laws prohibiting sales of electronic nicotine delivery systems (ENDS) to minors* — United States, November 30, 2014

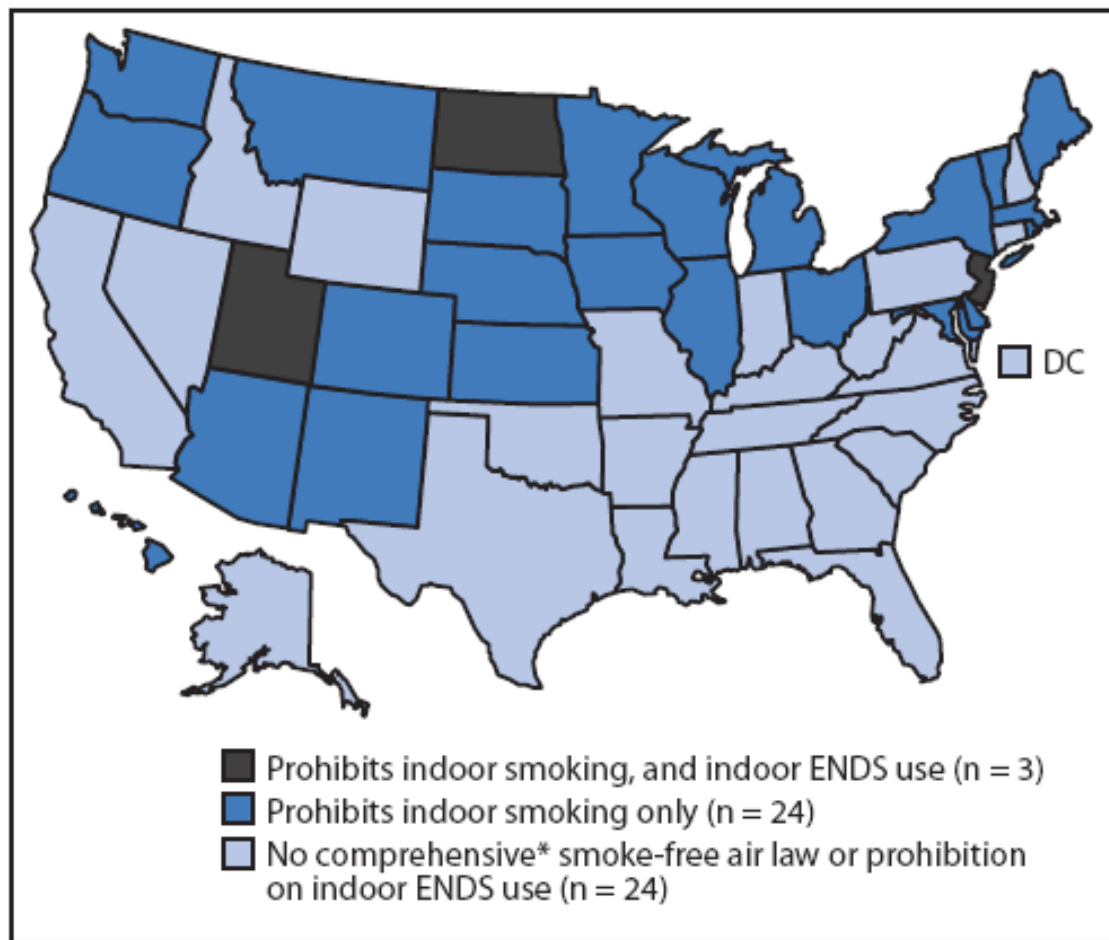


* Minors are defined by statute as persons aged <18 years, except in four states where they are defined as persons aged <19 years (Alabama, Alaska, New Jersey, and Utah).

MMWR. 63: December 12, 2014



FIGURE 2. States with and without laws prohibiting smoking and use of electronic nicotine delivery systems (ENDS) in indoor areas of private worksites, restaurants, and bars — United States, November 30, 2014



* CDC defines a state smoke-free air law as comprehensive if it prohibits smoking in indoor areas of private worksites, restaurants, and bars.

Arsenic

Arsenic in Food

- Recent reports have described arsenic levels in a variety of foods including:
 - (1) rice products such as brown or white rice, rice cakes, and rice milk,
 - (2) foods sweetened with organic brown rice syrup such as cereal and energy bars, and
 - (3) non-rice products such as apple juice



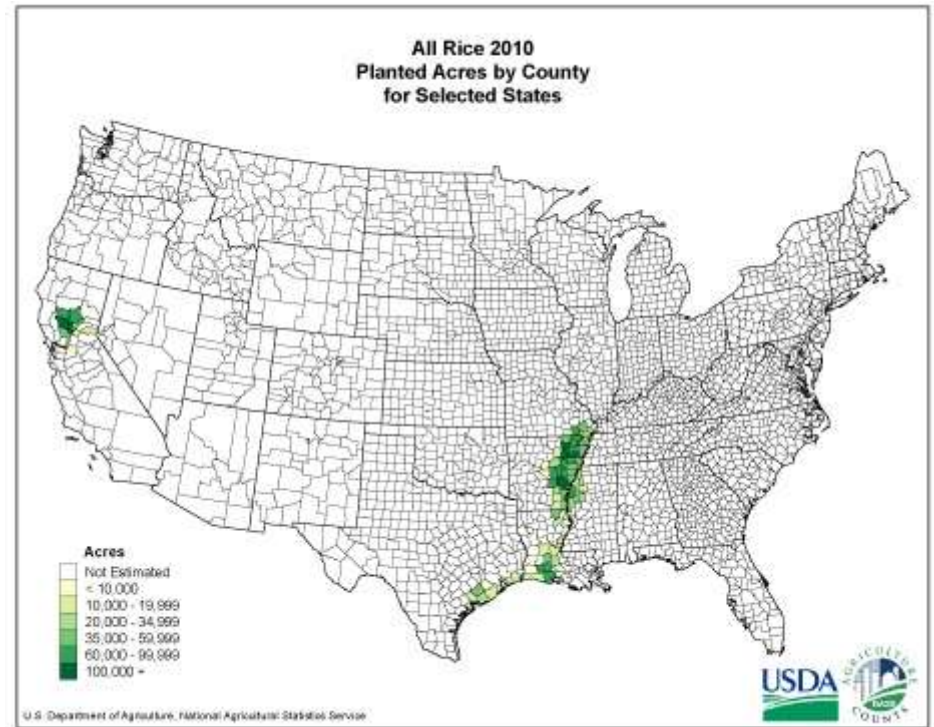
What is Arsenic?

- Arsenic is a naturally occurring element, found widely in the environment.
- It is present in some types of rock and soil.
- It is used in a number of industrial processes.
- It is found in measurable amounts in most seafood and in many grains and vegetables.



Reports in Rice

- Recent reports have targeted rice, rice products and apple juice, because rice fields and apple orchards are sited on fields where for decades arsenic-containing pesticides were used (either on cotton fields where rice is now grown, or in orchards which remain in use).



Rice cereal for infants

- The American Academy of Pediatrics notes that single grain cereals like rice cereal are commonly the first solid foods introduced into an infant's diet.
- However, the specific order in which solid foods are started in an infant's diet has not been shown to be important.
- Each new food should be started one at a time, and additional foods can be added every three days.



What can I do?

- Until we know more, concerned families can:
 - Choose rice products lower in arsenic.
 - Rinse rice before cooking.
 - Limit the serving size and frequency of foods noted to be higher in their inorganic arsenic content. See Consumer Reports' November 2014 article for their recommendations.
 - Avoid the frequent use of rice milk in children less than 54 months of age.
 - Limit the use of foods with large amounts of brown rice syrup.
 - Make sure your water has been tested



Lead

Lead Back Story

- CDC's Healthy Homes and Lead Poisoning Prevention Program for FY12 provides for only \$2 million - down from \$29 million in FY11.
- Impact
 - HH/CLPP funds 35 state health departments (and local partners) to monitor blood lead screening and respond to every child who has EBL with home inspection and referrals for medical intervention and lead remediation
 - Without the program, health departments will be unable to help lead-poisoned children obtain medical care and housing repairs
 - HUD's lead hazard control grantees depend on CDC surveillance to identify those children at highest risk.



Kansas

- Kansas eliminated program
 - Lead results reported to Epidemiology as Lead Poisoning Prevention Program no longer exists
 - No home investigations performed
 - Local health departments “accept” lead patients and provide “education”
- In past year, over 40 referrals to Center for Environmental Health (CEH) for elevated blood leads and need for home assessments
- Limited resources at CEH resulting in tiered approach for response using PEHSU lead document as a guide



Case: What a mess!!!

- PEHSU is called by PCPs office regarding 2 year old child with an EBL of 21.2 mcg/L. Three months prior it was 14.6 mcg/L.
- PCP had called state health department and was told that they couldn't do anything due to funding. Referral made to PEHSU.



REGION 7

Mid-America Pediatric Environmental Health Specialty Unit
Children's Mercy Hospital
Kansas City, MO

Canada

Child Health Clinic
Misericordia Community Hospital
and Health Centre, Edmonton,
Alberta

REGION 8

Rocky Mountain Regional Pediatric
Environmental Health Specialty Unit
Denver Health – University of
Colorado, Denver, CO

REGION 9

University of California San Francisco Pediatric
Environmental Health Specialty Unit
University of California San Francisco- Division
of Occupational & Environmental Medicine,
San Francisco, CA

University of California Irvine Pediatric
Environmental Health Specialty Unit
University of California Irvine - Center for
Occupational & Environmental Health, Irvine, CA

REGION 10

Northwest Pediatric Environmental Health
Specialty Unit
Occupational & Environmental Medicine Program
– University of Washington, Seattle, WA

Mexico

Unidad Pediátrica Ambiental – Mexico
Pediatric Environmental Health Specialty Unit
The National Institute for Public Health and
The Children's Hospital of Morelos,
Cuernavaca, Morelos

REGION 1

New England Pediatric Environ. Health Spec. Unit
Children Hospital/ Occupational &
Environmental Health Center –
Cambridge Hospital, Boston, MA

REGION 2

Mount Sinai Pediatric Environmental Health
Specialty Unit
Mount Sinai School of Medicine,
New York, NY

REGION 3

Mid-Atlantic Center for Children's
Health & The Environment
George Washington University School
of Public Health & Health Services –
Dept. of Environmental & Occupational
Health, Washington, D.C.

REGION 4

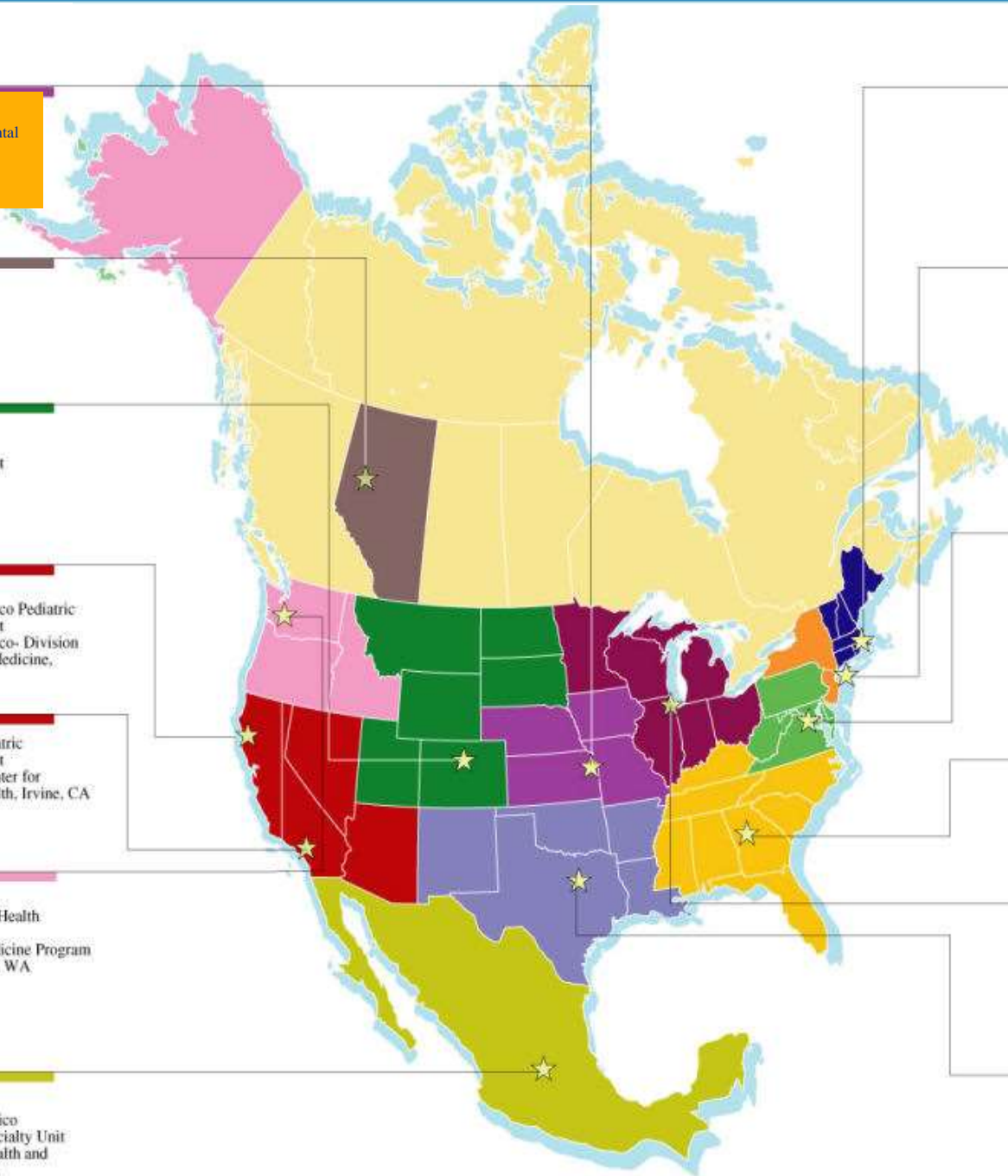
Southeast Pediatric Environmental
Health Specialty Unit
Emory University, Atlanta, GA

REGION 5

Great Lakes Center for Children's
Environmental Health
University of Illinois – Chicago &
John H. Stroger, Jr. Hospital of Cook
County, Chicago, IL

REGION 6

Southwest Center for Pediatric
Environmental Health
The University of Texas Health
Center at Tyler, Tyler, TX



Case continues.....

- Case reviewed with Dr. Lowry, KCMO HD, and CEH staff.
- Based on environmental risk factors, information learned during initial contact with family, and EBL level, decision was made to provide courtesy visit.



Case continues....

- Exterior concerns:
 - Suspect lead paint in bare soil near foundation
 - Qualitative test showed presence of lead on front porch columns
 - Living room window sill tested positive for lead
 - Sidewalk chalk tested positive for lead
- Interior of home:
 - Home built between 1905 & 1915
 - Chipping paint on interior of windows & kitchen door
 - Possible remodeling dust lingering on floors
 - Living room window sill tested positive for lead



Case continues....

- Occupational concerns:
 - Dad working at manufacturing plant
 - Clothes not washed separately
 - Dad walks into home and plays with children prior to bathing
- Involve OSHA?
 - Agency to Agency referral challenges
 - Extraordinarily sensitive situation
 - Pros and cons



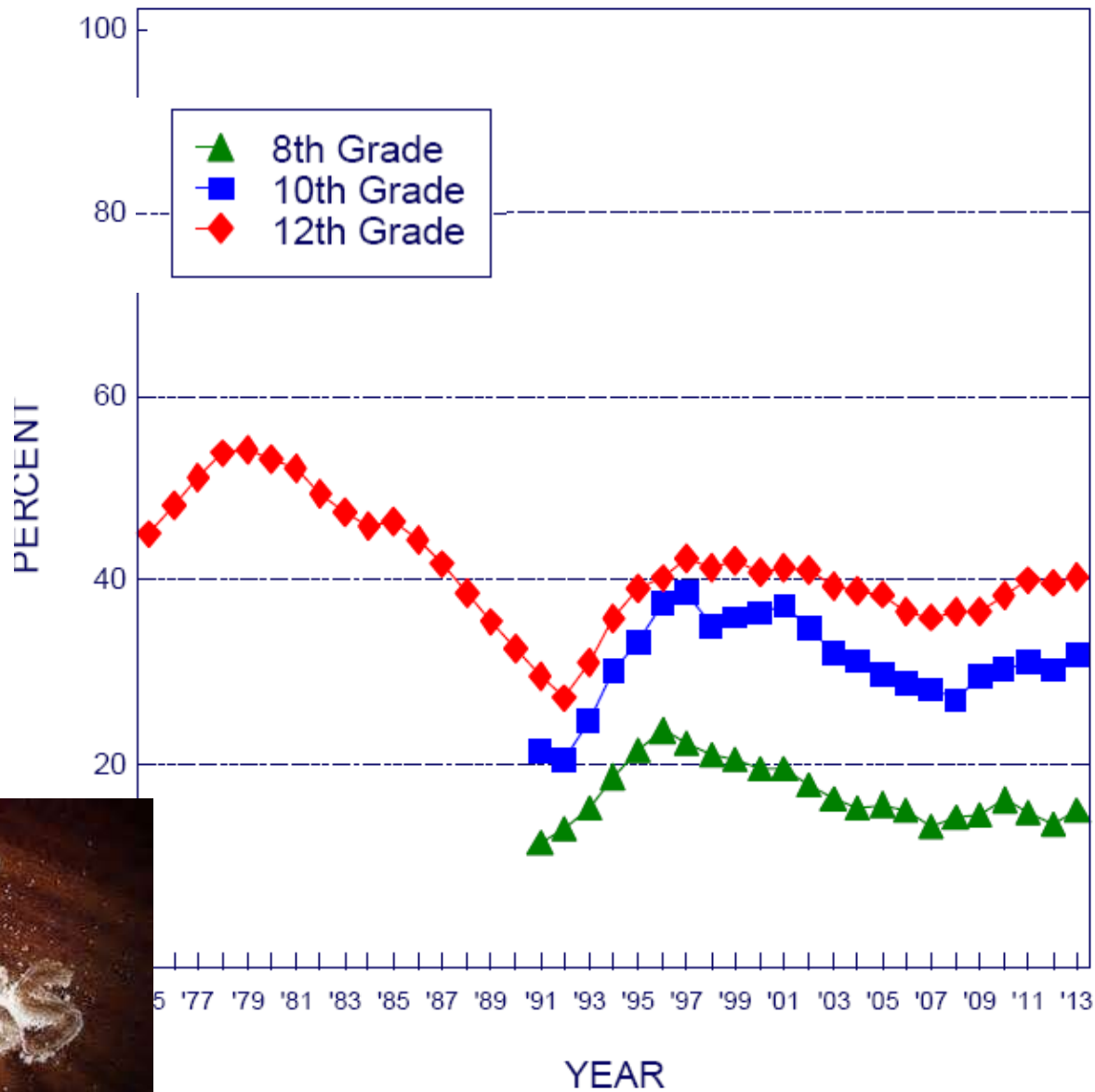
How is the family doing?

- Family cleaned contaminated areas
- Stopped renovation
- Painted hazards
- Removed product hazards
- Dust wipe follow-up
- Child's lead level improved

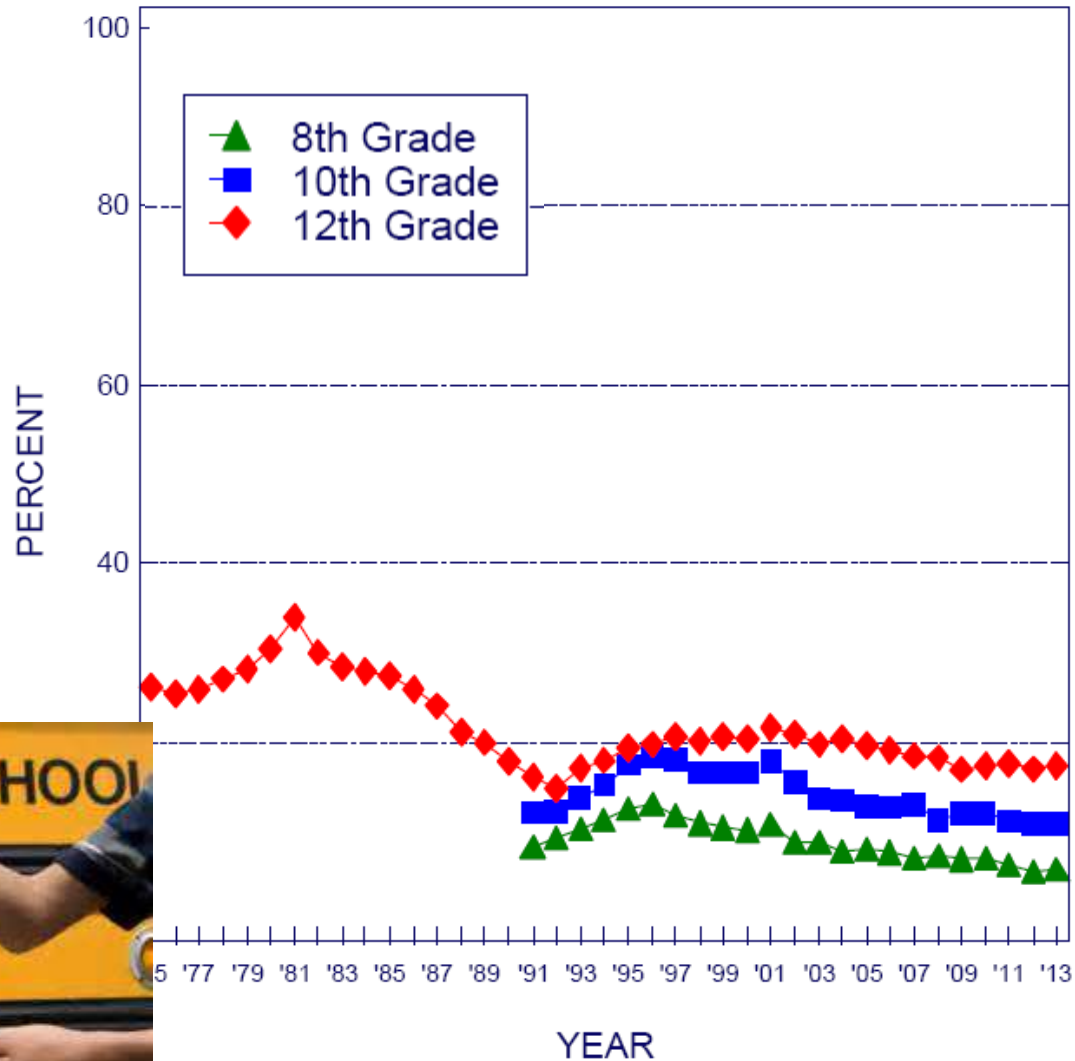


Adolescent Intentional Exposures

% who used any illicit drug in last 12 months



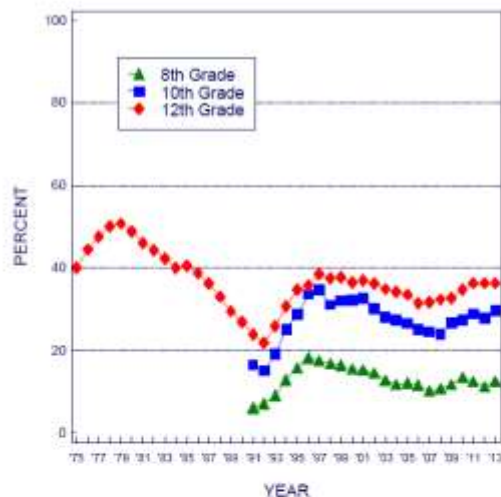
% who used **any illicit drug other than marijuana** in last 12 months*



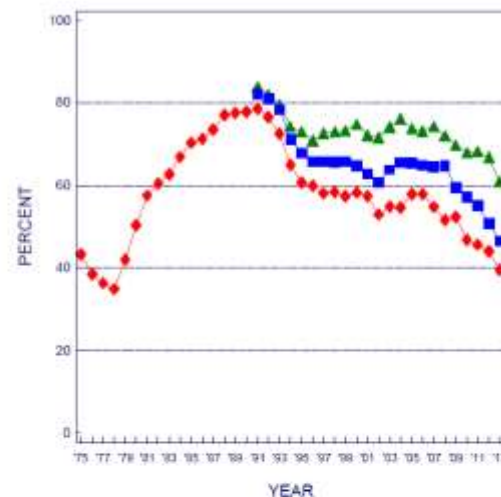
Marijuana: Trends in Annual Use, Risk, Disapproval, and Availability Grades 8, 10, and 12



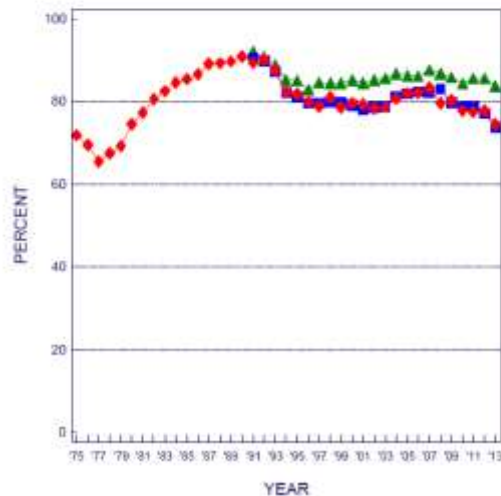
Use
% who used in last 12 months



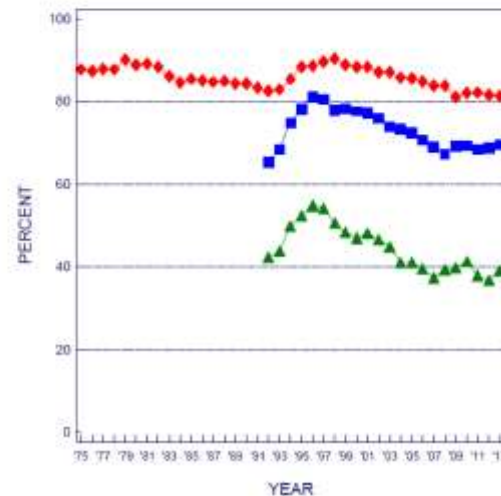
Risk
% seeing "great risk" in using regularly



Disapproval
% disapproving of using regularly



Availability
% saying "fairly easy" or "very easy" to get

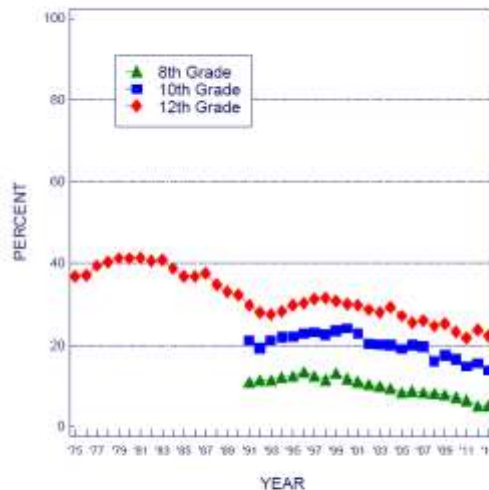


Alcohol: Trends in Binge Drinking, Risk, Disapproval, and Availability

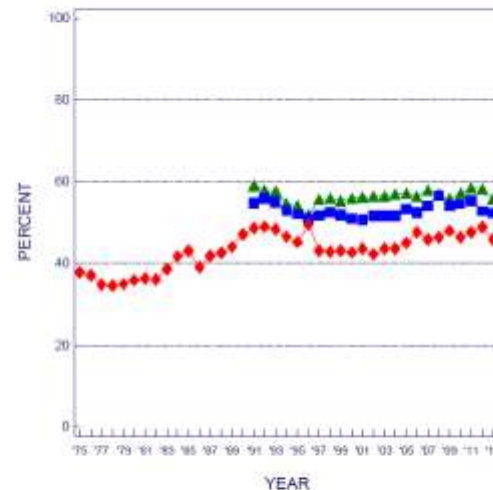
Grades 8, 10, and 12



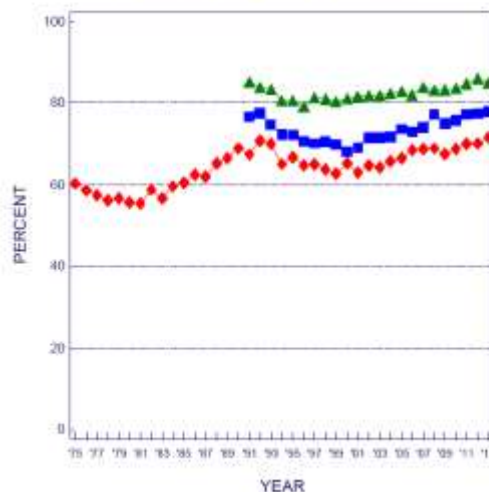
Use
% who had 5+ drinks in a row
at least once in past two weeks



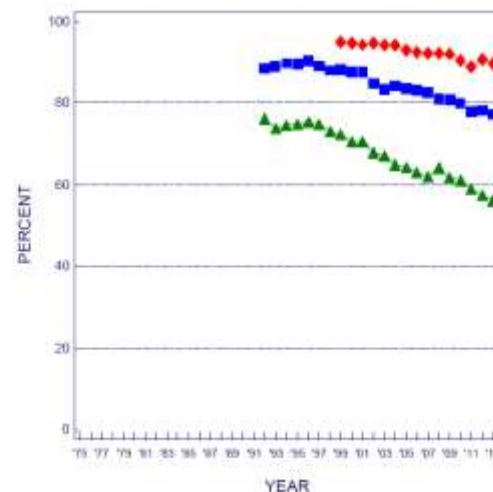
Risk
% seeing "great risk" in having 5+ drinks in a row
once or twice each weekend



Disapproval
% disapproving of having 5+ drinks in a row
once or twice each weekend



Availability
% saying "fairly easy" or "very easy" to get

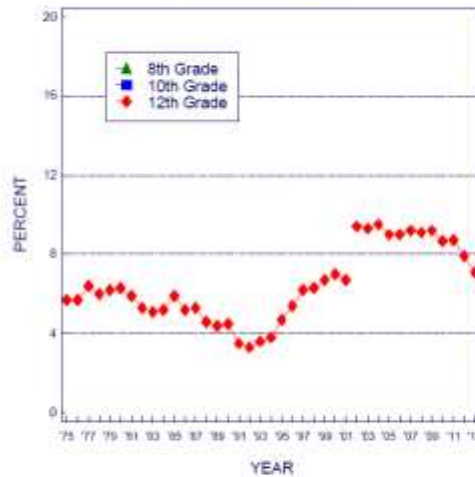


Narcotics other than Heroin: Trends in Annual Use and Availability

Grades 8, 10, and 12



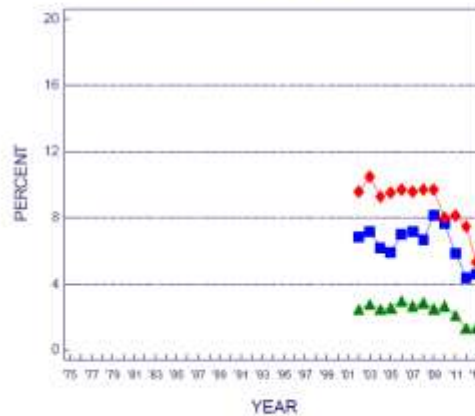
Use of Narcotics other than Heroin
% who used any narcotics other than heroin
in last 12 months*



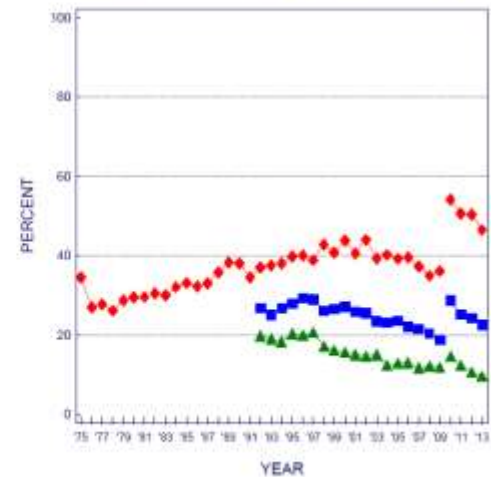
OxyContin Use
% who used OxyContin in last 12 months



Vicodin Use
% who used Vicodin in last 12 months



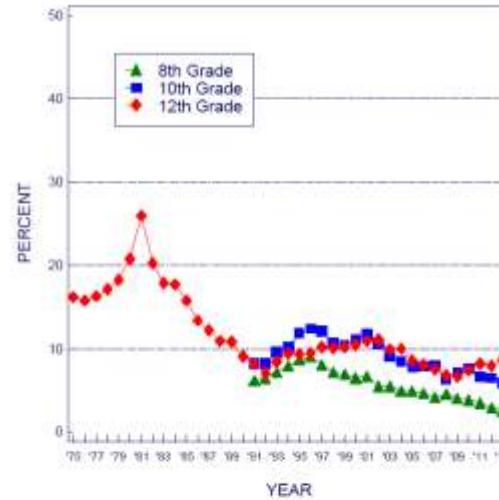
Availability of Narcotics other than Heroin**
% saying "fairly easy" or "very easy" to get



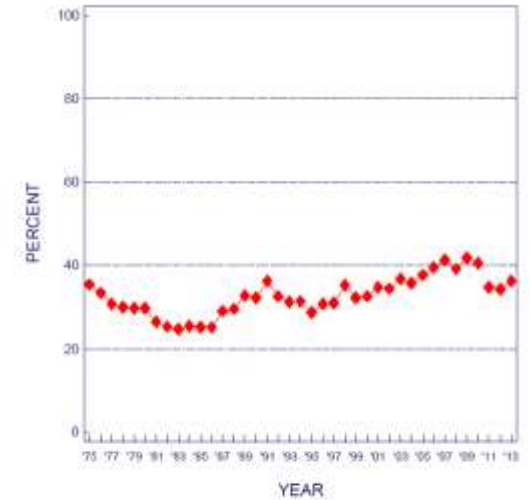
Amphetamines: Trends in Annual Use, Risk, Disapproval, and Availability Grades 8, 10, and 12



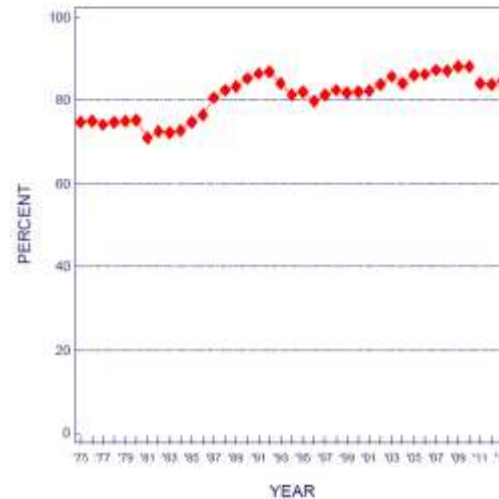
Use*
% who used in last 12 months



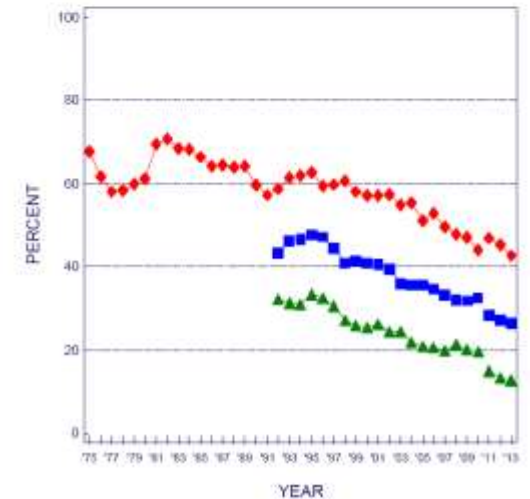
Risk**
% seeing "great risk" in using once or twice



Disapproval**
% disapproving of using once or twice



Availability**
% saying "fairly easy" or "very easy" to get



Source of Prescription Drugs^a
among Those Who Used in Last Year
Grade 12, 2007–2013

(Entries are percentages.)

Where did you get the [insert drug name here] you used without a doctor's orders during the past year? (Mark all that apply.)

	<u>Amphetamines</u>		<u>Tranquilizers</u>		<u>Narcotics other than Heroin</u>	
	<u>2007–2008</u>	<u>2009–2013</u>	<u>2007–2008</u>	<u>2009–2013</u>	<u>2007–2008</u>	<u>2009–2013</u>
Bought on Internet	4.6	6.0	2.4	4.1	2.3	1.4
Took from friend/relative without asking	19.6	9.8	21.1	19.2	24.2	19.5
Took from a friend	—	4.2	—	5.1	—	4.1
Took from a relative	—	7.9	—	17.1	—	18.0
Given for free by friend or relative	58.2	59.4	59.8	65.6	50.5	57.2
Given for free by a friend	—	56.1	—	55.1	—	50.7
Given for free by a relative	—	9.2	—	20.9	—	15.4
Bought from friend or relative	45.0	43.6	44.1	40.4	37.1	33.6
Bought from a friend	—	43.1	—	39.4	—	33.1
Bought from a relative	—	2.2	—	5.4	—	3.9
From a prescription I had	15.1	15.0	18.4	14.9	40.2	36.7
Bought from drug dealer/stranger	26.7	20.3	24.2	24.1	18.6	17.5
Other method	17.8	13.2	7.5	9.5	8.5	10.3
<i>Weighted N =</i>	261	619	226	441	361	685

Source. The Monitoring the Future study, the University of Michigan.

Note. '—' indicates data not available.

^aIn 2009, the response categories were expanded to differentiate between friends and relatives.

U.S. Children Are Safer Than Ever, But Suffocation, Poisoning Rise — CDC

- Death rates from unintentional injuries among U.S. children and teens dropped 29% from 2000 to 2009.
- The total number of deaths dropped from about 12,400 to about 9,100, CDC researchers reported.
- However, the report found that the death rate for accidental poisonings rose 91% among those age 15 to 19 due to abuse of prescription drugs, and accidental infant suffocation deaths increased 54%.



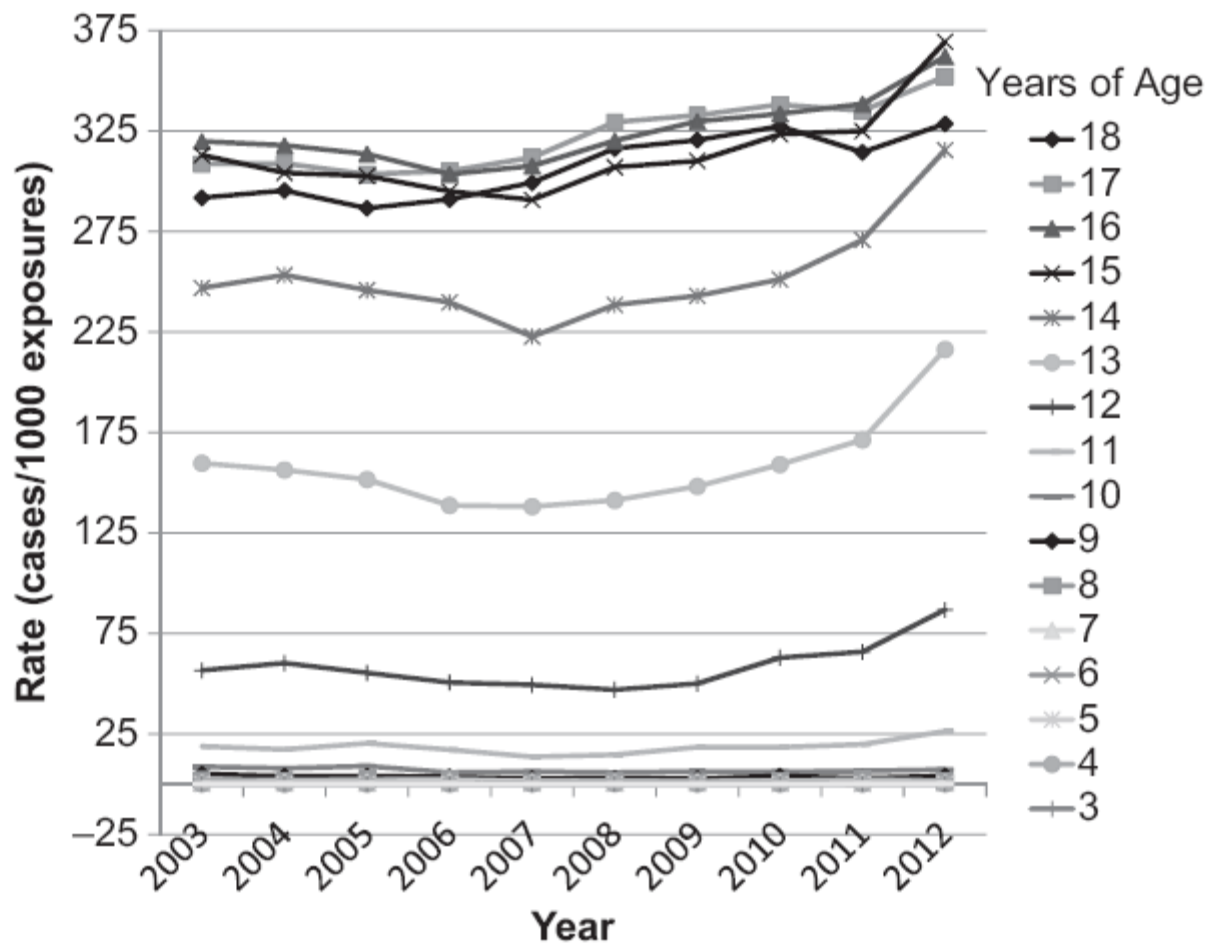


Fig. 1. Abuse/Misuse exposure trends in children at 1–18 years of age. Trends show significant increases both by calendar year ($p = 0.0001$) and by year of age ($p < 0.0001$), but the interaction between them is not significant. Lowry JA. Clin Toxicol. 2013; 51:673.

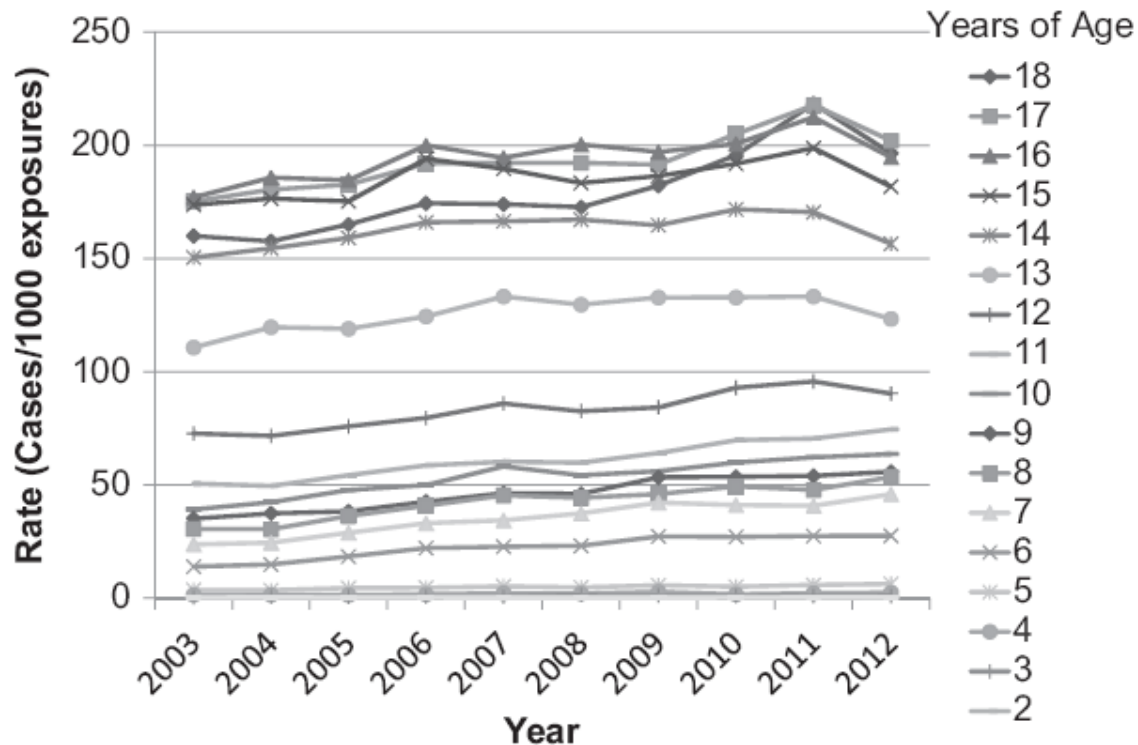


Fig. 2. Suicide exposure trends in children at 1–18 years of age. Trends show significant increases by calendar year ($p = 0.0220$) and year of age ($p = 0.0395$) as well as a significant interaction between year of age and calendar year ($p = 0.0339$). The output for the interaction indicates that for the patients over 13 years, the slope of the year line is positive (rate is increasing over time), but the slope for the younger kids (≤ 12) is close to zero or essentially flat. Lowry JA. Clin Toxicol. 2013; 51:673.

Summary

- Poison centers are underutilized but are important for the management of poison patients and public health surveillance
- Electronic cigarette use is on the rise in adolescents and is a high risk for toxicity in infants and children.
- Arsenic has been found in food products, but a well balanced diet should prevent toxic levels

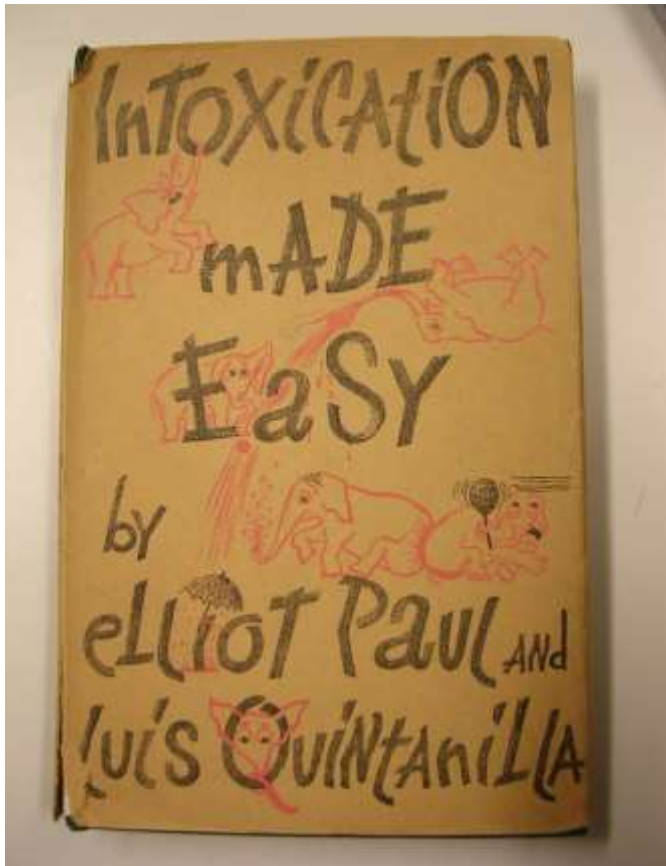


Summary

- Lead poisoning remains a problem in children. Absence of health department functions result in responsibility of primary pediatricians to manage care.
- Intentional exposures of drugs are increasing with suicide attempts responsible for the highest rate of rise.



Questions??



POISON
Help
1-800-222-1222

The logo for Poison Help features a red pill bottle with a white cap and a white skull and crossbones symbol on the front. The word "Help" is written in a large, bold, black font, with the pill bottle acting as the letter "e".