Electronic Cigarettes

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Disclosure

- I have no relevant financial relationships with the manufacturers(s) of any commercial products(s) and/or provider of commercial services discussed in this CME activity
- I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.

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Objectives

- Provide background information on the evolution of e-cigarettes
- Describe various types of Electronic Nicotine Delivery Systems
- Review the prevalence and trends of e-cigarettes use among youth in the US and in Kansas
- Describe why e-cigarettes are gaining popularity among youth
- Review what is currently known about their contents and health risks
- Review current e-cigarettes control policies in the US and Kansas

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From Whence Cometh E-Cigarettes

- 2003: Chinese pharmacist, Hon Lik, is credited with conceptualizing and producing the first modern Electronic Cigarette

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Types of Electronic Nicotine Delivery System (ENDS)

- **1st Generation:**
  - » Cig-a-likes
  - » Most Toxins Emitted in the Aerosol Lower than Regular Cigarettes
  - » Aerosolizing Temperature 104 – 149 degrees Fahrenheit
- **2nd Generation**
  - » Tank Systems; refillables
  - » Some Toxins Emitted Approaching Levels found in Regular Cigarettes
  - » Aerosolizing Temperatures >149 degrees Fahrenheit

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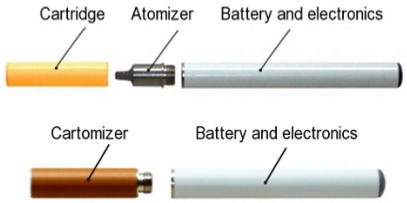
Component Parts Cig-a-Likes



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Modifications: Tank Systems

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E-Pens/E-Hookah Pens

- Flavors: Cherry, Chocolate, Vanilla, Bubblegum

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Electronic Nicotine Delivery Systems (ENDS)

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Varieties of ENDS

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Bluetooth E-Cigarette: "Vape" and Receive Calls or Listen to Music

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Prevalence of Tobacco Use among U.S. Youth, 2013/2014

Category	Any Tobacco	Cigarettes	E-Cigarettes
Youth Ever	21.8 (20.8-22.8)	13.4 (12.6-14.3)	10.7 (10.0-11.4)
Youth Last 30 days	8.9 (8.3-9.6)	4.6 (4.2-5.0)	3.1 (2.8-3.5)

Kasza et al, 2017, 32,320 adult participants (≥18 years of age) and 13,651 youth participants (12 to 17 years of age).

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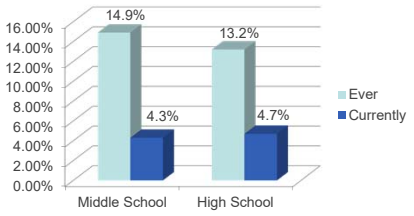
E-Cigarette Use Among Kansas Youth*

Ever and Current Electronic Cigarette Use among Kansas Youth



*Unweighted 2013/2014 Kansas Youth Tobacco Survey Christensen, Welsh and Faseru, 2014

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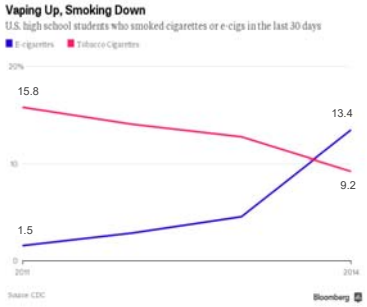
Trends in Youth: E-Cigarettes vs. Conventional Cigarettes



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Youth & E-Cigarettes

16% in 2015

- More than 3 million middle and high school students were current users of e-cigarettes in 2015, up from an estimated 2.46 million in 2014.

(NYTS, 2015)

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Why the Appeal?

- No bans on marketing
  - » Thousands of flavors
  - » Appealing to youth
- Conflicting messages about safety
  - » Headline from KC Star
  - » Everyone's doing it
- Lack of policy
  - » Not covered by KS Clean Indoor Air Act
  - » Majority of municipalities, workplaces, and schools don't have policies that encompass e-cigs
  - » Enforcement difficult

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E-Cigarette Advertising

- "Overall, e-cigarette advertising expenditures across media channels have increased from $6.4 million in 2011, to $18.3 million in 2012, to $59.3 million in 2013.
  - » 80 unique brands
  - » blu e-cigarettes (most popular among youth) dominated ad spending, comprising about 75% of all e-cigarette advertising.
  - » Highest in Magazines and TV; Lowest in Newspapers

(Kim et al., 2014)

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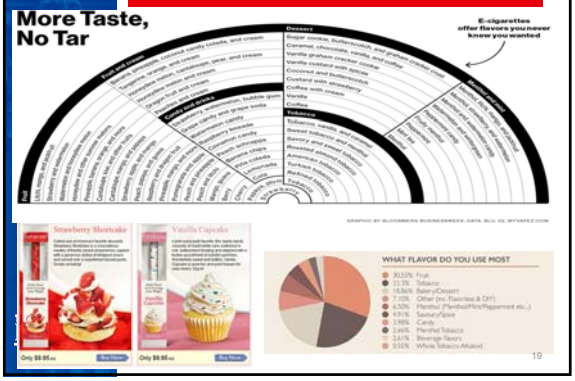
Flavorful and Fun



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Local Messaging

"I can tell you that it is 99 percent better for you than smoking." FORMER HARD-CORE SMOKING CANDI MCCANN, WHO NOW VAPES

THE KANSAS CITY STAR, SATURDAY, MAY 16, 2015

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Freedom and A 'Safer' Alternative

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Past cigarette and present e-cigarette advertising

Cigarettes, 1958

E-Cigarettes, 2013

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Renormalization

Cigarettes, 1930

E-Cigarettes, 2012

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Renormalization

Cigarettes, 1964

E-Cigarettes, 2013

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E-Cigarettes: A Cause for Concern?

NICOTINE EXPOSURE IN YOUTH MAY:

1. Promote addiction
2. Lead to sustained tobacco use
3. Cause lasting harm to brain development

Nicotine interferes with maturation of the prefrontal cortex

- Neuroplasticity
  - Intracellular signaling
  - Gene expression
  - Structural changes
- Synaptic pruning
- Myelination of axons
- Nicotine acutely activates but chronically desensitizes the areas in the brain responsible for attention and memory
  - Long-term impairment in impulse control, memory, and attention
  - Adolescent smoking associated with later life behavioral disturbances, including substance abuse and mental health problems

Dwyer, J.B., S.C. McQuown, and F.M. Leslie, *The dynamic effects of nicotine on the developing brain.* Pharmacol Ther, 2009. **122**(2): p. 125-39.

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E-Cigs as Gateway to Regular Tobacco

- National Youth Tobacco Survey (2011/2013):
  - 263,000 youth who had never smoked used e-cigarettes
  - 44% of youth who had ever used e-cigarettes said they intended to smoke conventional cigarettes within the year

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Polytobacco use Among Youth, 2013/2014

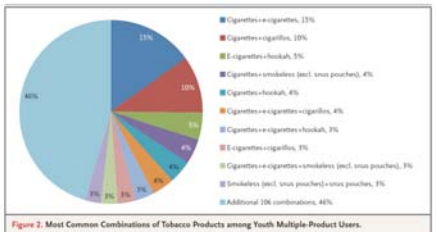

Figure 2. Most Common Combinations of Tobacco Products among Youth Multiple-Product Users.

Kasza et al, 2017, 32,320 adult participants (≥18 years of age) and 13,651 youth participants (12 to 17 years of age).

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Aerosol: Its not just Water "Vapor"

- Concentrations of pollutants less than in cigarettes
- Carcinogens, less than in cigarettes
- Wide variation in contents across products, no product standards
- Intermediate and long-term health effects unknown.
- Maybe safer than cigarettes, but this doesn't mean safe

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Composition of Aerosol

- Propylene glycol
- glycerin
- Flavorings (many)
- **Nicotine**
- **NNN and NNK Nitrosamines***
- NAB
- NAT
- **Ethylbenzene**
- **Benzene***
- xylene
- **Toluene**
- **Acetaldehyde***
- **Formaldehyde***
- **Naphthalene**
- **Styrene**
- **Benzo(b)fluoranthene**
- Acenapthene
- Chlorobenzene
- **Crotonaldehyde**
- **Propionaldehyde**
- Benzaldehyde
- Valeric acid
- Hexanal
- Fluorine
- Anthracene
- Pyrene
- Acenaphthylene
- Fluoranthene
- **Benz(a)anthracene**
- **Chrysene**
- Retene
- **Benzo(a)pyrene***
- **Indeno(1,2,3-cd)pyrene**
- Benzo(ghi)perylene
- **Acetone**
- **Acrolein**
- Silver
- **Nickel***
- Tin
- Sodium
- Strontium
- Barium
- Aluminum
- **Chromium (+6*)**
- Boron
- Copper
- **Selenium**
- **Arsenic (inorganic)***
- **Cadmium***
- Silicon
- Lithium
- **Lead**
- Magnesium
- Manganese
- Potassium
- Titanium
- Zinc
- Zirconium
- Calcium
- Iron
- Sulfur
- Vanadium
- **Cobalt**
- Rhubidium

Compounds in red are from FDA 2012, **Harmful and Potentially Harmful Substances – Established List**
*** = Carcinogenic to humans (IARC). N = 9.**

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Toxic Chemicals in E-Cigs

- Tobacco-specific nitrosamines
- Aldehydes
  - » Formaldehyde, acetaldehyde, acrolein, acetone
- Metals
  - » Nickel, lead, chromium
- Polycyclic aromatics
  - » Cresol, anthracene, pyrene
- Volatile organics
  - » Propylene glycol, glycerin

Tob Control 2014;**23**:ii11-ii17 doi:10.1136/tobaccocontrol-2013-051482

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Health Effects

Lead: impaired mental development in young children

Nickel: lung and nasal cancer

Propylene Glycol: eye, throat, and airway irritation, and asthma

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Flavoring

Common flavors: menthol, candy, bubblegum, strawberry, fruit, tobacco, mix your own, etc.

Health effects: facilitates usage. cinnamon and several other flavors have been found to have detrimental effects on the lungs of laboratory animals

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Secondhand "Vaping"

Concentrations of both biomarkers among non-smokers exposed to conventional cigarettes and e-cigarettes' "vapor" were statistically similar (only 2 and 1.4 times higher, respectively). The levels of airborne nicotine and cotinine concentrations in the homes with e-cigarette users were higher than control homes (differences statistically significant). "**Our results show that non-smokers passively exposed to e-cigarettes absorb nicotine**"

(Fernandez et al, 2014)

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Secondhand "Vaping" (Con't.)

"Overall, the e-cigarette is a new source of Volatile Organic Compounds (VOCs) and ultrafine/fine particles in the indoor environment. Therefore, the question of "passive vaping" can be answered in the affirmative. However, with regard to a health-related evaluation of e-cigarette consumption, the impact of vapor inhalation into the human lung should be of primary concern"

(Schripp, et al., 2012).

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Other Concerns

- E-cigarette explodes in man's pant
  - http://www.cnn.com/2016/11/24/us/e-cigarette-explosion-video/
- E-cigarette explodes inside man's mouth
  - http://nypost.com/2017/01/17/an-e-cigarette-exploded-inside-this-mans-mouth/
- E-cigarette explodes in Man's pocket on bus
  - http://abc7chicago.com/news/e-cigarette-explodes-in-mans-pocket-on-bus/1668641/

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Other Concerns (con't.)

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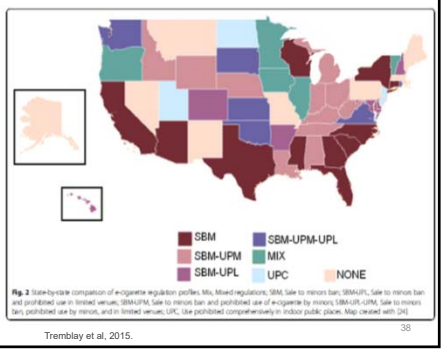
Current U.S. State Policies Regarding Minors



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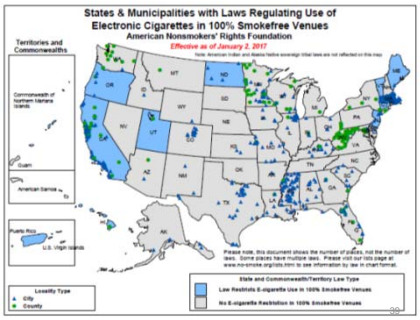
Tremblay et al, 2015.

Current U.S. State Policies – Clean Indoor Air Laws



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Current Kansas Policies

- Illegal for KS youth to purchase or possess (KS statute: 79-3321)
- E-cigarettes are NOT covered by the Kansas Indoor Clean Air Act
  - ✓ KS Attorney General ruling (2011)
- E-cigarettes are NOT covered by most city ordinances
  - ✓ Smoking regulations depend on ***specific definitions of smoking and/or tobacco***. Neither smoking nor tobacco applies to e-cigarettes which is why they are not covered.

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Existing E- Cigarette Indoor Air Policies in Kansas

- Existing State policy: Kansas correction facilities.
- Existing local policies [Covering workplaces, restaurants and bars] existing in Kansas municipalities: Kansas City (7/2015), Overland Park (8/2014), Olathe (1/2015), *McPherson – use only (9/2014), Park City (3/2015),* Topeka (8/2015), Eudora (1/2016), Hutchinson (11/2015), Lenexa (4/2016), Westwood Hills (6/2016),).
- Other targeted cities without policies: Lawrence, Manhattan, Salina, Shawnee, Wichita.

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Summary and Conclusions

- Variety of products.
- Appeals to youth. Rapid increase in use.
- Increase in use among non-smokers.
  - » Nicotine addiction
  - » Transition to cigarette smoking
  - » Anxiety disorders
  - » Susceptibility to other drugs of abuse
  - » Nicotine exposure to the developing fetus
- Health impacts (short and long-term) not currently understood.

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Summary and Conclusions (Con't.)

- Some flavors exhibit greater lung toxicity (e.g., menthol, tobacco, cinnamon, and coffee)
- Carcinogens present (e.g., formaldehyde)
- Second hand exposure (not free of emissions)
- Additional concerns include acute nicotine poisoning, and explosion and fire from batteries
- U.S. and Kansas control policies are inadequate

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References (Con't.)

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