E-Cigarettes and Tobacco Abuse: Even Trade?

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Disclosure Statement of Financial Interest

I, Sarah and Hughes Melton,

**DO NOT** have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.
Back then......

https://www.youtube.com/watch?v=aphGEVFpFT4&list=PL1467D7B2D11D4E69&index=20
Now......

Take Back Your Freedom featuring Stephen Dorff - blu Electronic Cigarettes
“We are dealing with a product that is marketed and appeals to youth, highly addictive, reminiscent of a very popular [product] and driven by an industry with a profit-based model rather than a public health’s harm-reduction one.”¹

Learning Objectives

1. Describe the various types, components, and chemistry of electronic cigarettes (e-cigarettes)

2. Discuss the role of e-cigarettes and vaping in the initiation, reduction and cessation of nicotine abuse.

3. Discuss policy considerations.

4. Contrast the sides of the debate among healthcare providers about the pros and cons of e-cigarette use.
LO 1: Types, Components and Chemistry

First Generation ECs ('cigalikes')

- Disposable
- Re-chargeable with pre-filled cartridges

Battery

Atomizer

Cartridge

screw atomizer to battery

push cartridge to atomizer
LO 1: Types, Components and Chemistry

Second Generation ECs

- Refillable with liquids
LO 1: Types, Components and Chemistry

Third Generation ECs ('mods')
Big Daddy 5ml Polycarbonate Delrin Cap Tank Kit
$22.99
Stainless Steel Slap Yo' Mama Multi-Purpose Adapter
$12.99
Remember, Big Tobacco has a long history of manipulating components to achieve maximal addiction...

- **Battery**: Variable, unpredictable voltage. Higher voltage = more nicotine. Rest assured, it will increase...or will it?
- **Heating Element**: Source of heavy metals
- **Fluid**: propylene glycol with and without glycerol
- **Nicotine**: The “Juice”
- **Flavoring**: Only ingestion toxicity studied.
  - Why Bubble gum? Why only menthol allowed in cigarettes?
Parts of an e-cigarette structure and substances that may be found in the vapor

- Propylene glycol
- Glycerin
- Nicotine
- Water
- Flavoring
- Potentially toxic contaminants and vaporization by-products

- Heating element in the atomization chamber vaporizes the nicotine solution.
- Nicotine cartridge holds the nicotine solution. The nicotine content may be high, medium, low, or none.
- Mouthpiece
- Battery
Chemistry of E-cigarettes

- Nicotine
- Chemicals vs toxins
- Particulates
- Secondhand exposure
- Health effects
Chemistry: Nicotine “The Juice”

“They’ll take cigarettes ahead of food if starved of nicotine.” - Dr. Helmut Wakeman to board of Philip Morris 1969¹

<table>
<thead>
<tr>
<th>Substance</th>
<th>Withdrawal</th>
<th>Reinforcement</th>
<th>Tolerance</th>
<th>Dependence</th>
<th>Intoxication</th>
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<tbody>
<tr>
<td>Nicotine</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Heroin</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
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<td>Cocaine</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Alcohol</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Caffeine</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Marijuana</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

Chemistry: Nicotine “The Juice”

- Dosage varies 0-35ug per “hit.” Different strength juices. Off the shelf or custom made.
- At 30 mcg, 1 hit = 20% of a puff. 30 hits = 1 cigarette. For now.
- Nicotine Threshold and The Tipping Point
- Adverse effects on human brain development in youth

Chemistry: Nicotine Poisonings

Half are children < 6 years of age

http://www.aapcc.org/alerts/e-cigarettes/
First 'e-cigarette child death': New York baby dies after drinking liquid nicotine
Chemistry: Chemicals vs Toxins

- Evidence base in its infancy. We just DON'T know.
- Nicotine is NOT cytotoxic. Flavorings ARE.
- Teratogenic? Stem cells are more sensitive than pulmonary fibroblasts.
- Heavy metals from liquid and heating element
- Level of toxins highly variable due to variable voltage, lack of quality control, etc.
<table>
<thead>
<tr>
<th>Toxic Compound</th>
<th>Conventional cigarette (mcg in mainstream smoke)</th>
<th>Electronic cigarette (mcg per 15 puffs)</th>
<th>Average ratio (conventional vs. electronic cigarette)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde</td>
<td>1.6-52</td>
<td>0.20-5.61</td>
<td>9</td>
</tr>
<tr>
<td>Acetaldehyde</td>
<td>52-140</td>
<td>0.11-1.3</td>
<td>450</td>
</tr>
<tr>
<td>Acroten</td>
<td>2.4-62</td>
<td>0.07-4.19</td>
<td>15</td>
</tr>
<tr>
<td>Toluene</td>
<td>8.3-70</td>
<td>0.02-0.63</td>
<td>120</td>
</tr>
<tr>
<td>NNN</td>
<td>0.005-0.19</td>
<td>0.00008-0.00043</td>
<td>380</td>
</tr>
<tr>
<td>NNK</td>
<td>0.012-0.11</td>
<td>0.00011-0.00283</td>
<td>40</td>
</tr>
</tbody>
</table>

NNK, N-nitrosonornicotine (NNN) and 4-(methylnitrosoamino)-1-(3-pyridyl)-1-butanone; NNN, N-nitrosonornicotine.

- Formaldehyde a group 1 carcinogen
- 1 pack of cigarettes = 3 mg gaseous formaldehyde
- 3 ml liquid nicotine = 14 mg formaldehyde-releasing agents at voltage of 5 volts. Low voltage is <3.5v.
- Incremental lifetime cancer risk at least 5x as high not counting for particulate delivery efficiency
Chemistry: Particulates “No Big Deal?”

- Deliver nicotine by aerosol of ultrafine particles the same size as cigarette particles.
- Variable, chemically complex and poorly understood.
  - FRA- formaldehyde-releasing agents.
- Frequent low level exposure to ultrafine particles contributes to inflammatory response.
- Higher nicotine content equals higher particulate numbers. Some deliver MORE particulates than cigarettes.
- 20-27% of e-cig particles deposited in circulatory system and thus into organs. Cigarettes average 25-35%.
Chemistry: What do Particulates DO?

From healthy to diseased lung

In most cases of black-lung disease, small stains and hardened areas of swelling develop in the lungs as a reaction to the dust.

Coal macules and nodules, small collections of dust and scarring, are distributed throughout the lung.

Chemistry: Secondhand Exposure

- Don’t smolder. No carbon monoxide.

- Simulated café air testing:
  - Nicotine levels $1/10^{th}$ that of cigarette smoke
  - Carcinogens formaldehyde, acetaldehyde and isoprene present but at much lower levels than with cigarette smoke
  - Glycerin and aluminum present
  - After 2 hours in the café particles increased from 400 to 65,000 per cubic cm of air. Over 100-fold worsening of air quality!
  - Reek of passion fruit, vanilla almond and banana cream pie

- Remember: Lower levels of toxins but NOT of particulates
Chemistry: Health Effects

- **Propylene glycol**
  - Dow Chemical says: “Inhalation exposure to mists should be avoided.”
  - When heated and vaporized it becomes propylene oxide, a class 2B carcinogen

- **Glycerin** heated and vaporized forms acrolein that causes respiratory tract irritation

- Some evidence for increased dynamic airway resistance

- Common reports: trouble breathing, headache, cough, dizziness, sore throat, nose bleeds, chest pain, palpitations, allergic reactions
Chemistry: Health Effects

- Cautious using occupational threshold limits. They are much higher than ambient exposure limits and don’t account for sensitive subgroups like asthmatics and the youth.

- Vapor increases virulence of drug-resistant bacteria.¹

- Last but not least: POISONINGS
“People smoke for the nicotine but they die from the tar.”

-False assessment by Michael Russell in 1976

- Marketing, Big Tobacco and Prevalence
- Current state of regulation
- Gateway drugs and initiation
- Reduction vs cessation of conventional cigarettes

Marketing: “Today’s Joe Camel”

- Ads: Healthier (95%), cheaper (93%), cleaner (95%) than cigarettes...and driving 90 is safer than 100 mph. Circumvent smoke-free policies (76%). Cessation-related claims (64%).

- Celebrity Endorsements: Katherine Heigl at http://www.youtube.com/watch?v=ysGyfLwwr1s

- Make me think about smoking (76%). Made me think about quitting (74%). Makes me likely to try e-cigarettes (66%).

- In youth, smoking declined 10% and e-cigarettes doubled. Validates the effectiveness of advertising. Producers know what they are doing!

Find Out How James Can Smoke Anywhere

Learn More

Featured On:

CNN  NBC  U.S. News  Scientific American

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AVAILABLE NATIONWIDE!

Visit us at blucigs.com/store-locator
Big Tobacco (TTC’s) and Harm Reduction: “An Unlawful Marriage”

- Strategies
  - Target youth. Period.
  - Use FALSE harm reduction rhetoric to improving their reputation and gain access to policymakers hoping to prevent further anti-smoking policies.
  - E-cigarette advertising undermines smoke-free policies.
  - Detract attention from what should be the KEY public health focus- reducing tobacco use.
  - Divide the tobacco-control community.
  - Destigmatize smoking- one of the major factors in reducing use.
Big Tobacco (TTC’s) and Harm Reduction: “An Unlawful Marriage”

- Only one primary intention: to hook as many people as possible. This is their proven $85b business model.
- Same industry that claimed their advertising was aimed at brand switching and not initiation.
- Their scientists are unlikely to relinquish their tolerance for risk and toxicity that prematurely kills half their users.
- What public health considers an unintended consequence is industry’s intended effect.
Prevalence

- In 2014 $2.2 billion spent - exceeds that spent on NRT.
- Who uses them? Mostly dual users.
- E-cigarette use in youth never-smokers
  - Among never-smokers who had used e-cigarettes at least once, 43.9% had an intention to smoke conventional cigarettes compared to 21.5% of never-smokers who had never used e-cigarettes.¹
  - 30+% of middle school users are never-smokers
- 32.5% young adult users are never-smokers or prior smokers.

¹ [http://www.cdc.gov/tobacco/basic_information/e-cigarettes/youth-intentions/index.htm](http://www.cdc.gov/tobacco/basic_information/e-cigarettes/youth-intentions/index.htm)
QUITTING IS HARD
VAPING IS EASY
## Prevalence

<table>
<thead>
<tr>
<th>Metric</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Youth, ever-vaped</td>
<td>4.7%</td>
<td>10%</td>
<td>18%</td>
<td></td>
</tr>
<tr>
<td>Youth, vaped in last month (current)</td>
<td>1.5%</td>
<td>2.8%</td>
<td>4.5%</td>
<td>14%</td>
</tr>
<tr>
<td>Youth, smoked in last month</td>
<td>15.8%</td>
<td>14%</td>
<td>12.7%</td>
<td>8.3%</td>
</tr>
<tr>
<td>Youth, any tobacco in last month</td>
<td>24.3%</td>
<td>23.3%</td>
<td>22.9%</td>
<td></td>
</tr>
<tr>
<td>Adult, vaped in last month</td>
<td>6.3%</td>
<td>7%</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td>Adult, former smoker ever used</td>
<td>2.5%</td>
<td></td>
<td>9.6%</td>
<td></td>
</tr>
<tr>
<td>Adult, smoke in last month</td>
<td></td>
<td></td>
<td></td>
<td>18.1%</td>
</tr>
</tbody>
</table>


Current State of Regulation: International

- **US** - Unregulated by any authority
  - In April 2014 FDA proposed rules with a disturbing two year delay in implementation. Will take years to enact. They do NOT have the authority to regulate where e-cigs are used, but the states DO.¹
  - 27 states restrict sales to minors. Minnesota taxes e-cigs as tobacco products. NJ/ND/UT prohibit in 100% smoke-free environments.

- **EU** - <20mg/ml of nicotine as tobacco products and >20 as medical devices.
  - E-cigs must be childproof. Packaging has warnings. Marketing restrictions mirror tobacco. Refillable volume limited to 2ml.

- Singapore and Brazil have banned completely
Current State of Regulation: Virginia

- Illegal to sell any nicotine-containing products to minors as of July 1, 2014
- School divisions must create a policy by July 2015 to ban e-cigarettes on school property, school buses, and at school-sponsored events

2015 Legislation
- Parallel bills in the Virginia House and Senate (HB 2036 and SB 1325) would require e-liquid manufacturers to use child-resistant packaging on their bottles
- Two different bills (SB 1004 and HB 1310) would tax vapor products at varying rates
  - The Senate bill would tax vapor products at 18 cents /mL of consumable product
    - Ban any sales of “open system” e-liquids where the consumer can refill the vapor product. It would also ban the sales of any vapor products within 1,000 feet of a school. It would also ban free samples of vapor products, as well as vapor products that have so-called “characterizing flavors.”
  - House bill would tax the products at 40 cents /mL of consumable product
Lung association gives Virginia an F on anti-tobacco efforts

- Virginia’s 30 cents per pack cigarette tax is the second-lowest in the nation behind Missouri’s 17 cents.
- Virginia spends only 12.2 percent of the $91.6 million recommended by the Centers for Disease Control and Prevention for tobacco prevention and cessation.
Gateway Drugs and Initiation: “A joint today means a junkie tomorrow?”¹

- A long history preceded by the “stepping stone theory.” Term of association and not causation. Many explanations.

- Use of drugs in one class potentiate the use of drugs in another class. Clear empirical support for a patterned sequence in drug use.
  - Never-smoking youth e-cigarette users 1.9x more likely to have smoking intentions
  - FDA 1996: “The gateway drug in all substance abuse is basically smoking”... which means nicotine.

- Gateway to Relapse: How will a recovering addict do when eating at a restaurant next to someone vaping? How are you going to like it?

Reduction vs Cessation

- Patients say they help but existing studies are conflicting.¹
  - Some show reduction, some do not
  - Some show increased cessation, some show decreased cessation, and some show no benefit

- Only intention to quit and cigarettes/day are predictors of having quit at follow-up. Only NRT has shown its reduction in cigarettes per day leads to increased cessation.

- Certainly no better than nicotine patch. Both very modest effect without counseling.

- At least smoking half the amount reduces the CV and cancer risk by half, right? WRONG.

LO 3: Policy Considerations

- Advertise, purchase, and use only where cigarettes are currently allowed in order to protect minors.
- Prohibit claims that e-cigs are effective in smoking cessation.
- Tax e-cigs and take the opportunity to increase tax on cigarettes to discourage dual use. This approach supports TTC’s stated desire to “reduce harm.”
- Consider VA Public Health Advisory similar to TN
LO 3: Policy Considerations

- FDA should move BOLDLY on standards to regulate product ingredients and functioning. Comment period closes July 2016.
  - Childproof to avoid poisonings
  - Warnings on packaging and new product reviews
  - Product standards for safety, nicotine content, additives and carrier compounds
  - Dose-per-vape limits to decrease likelihood of addiction in experimenting youth
  - Dose-per-vape determines regulation as a medical device
LO 4: The Vape Debate: Pros and Cons

**PROS**
- Reduce health risks if electronic cigarettes are used in place of tobacco cigarettes
- E-cigs are less expensive than cigarettes
- Use of e-cigarettes by never smokers remains rare
- Lack of second-hand smoke

**CONS**
- No evidence that use helps with smoking cessation; many become dual users
- Lack of warnings on packaging implies safety
- No long-term studies on possible toxicity – still release carcinogens and particulates.
- Nicotine addiction and poisoning
- Targeting youth, access to minors, appeal to youth with flavorings
What to Tell My Patient?

- READ BETWEEN THE LINES! 70 percent of all smokers want to quit.

- NRT still safest. Start with proven regimens including varenicline with NRT. Include counseling support.

- Remind them of lack of demonstrated efficacy, absence of industrial quality controls and dangers of nicotine conversion to formaldehyde and propylene glycol.

- Use quality, factual patient education materials

What to Tell My Patient?

- So, your patient still plans to use e-cigarettes. Now what?
- Utilize a quit date, nicotine taper plan, counseling and Chantix or Buproprion.
- Stick with voltage below 3.5 volts to avoid FRA.
- Select nicotine liquid strength: 2 ppd (24mg/ml), 1 ppd (18mg/ml). Other strengths include 12 and 6mg/ml.
- Plan seed for future need to address nicotine addiction.
  - 10ml = $10. Use 3ml per day. $1000 per year.
Discussion

- Call for prescriber champions
- Opportunities to speak to decision makers and educators.
References


References

- Cressey D. The lingering questions. Nature. 2014; 513;24-26,
References

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