ELECTRONIC CIGARETTES: WHAT ARE THE IMPLICATIONS

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DISCLOSURE/CONFLICT OF INTEREST

I, Miranda Andrus, have no actual or potential conflict of interest in relation to this program.
ATTRIBUTIONS


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  - https://creativecommons.org/licenses/by/2.0/legalcode
  - Images were cropped to fit in the space provided
  - Brand names were removed where possible
OBJECTIVES

- Describe the public health, health system, and regulatory concerns surrounding e-cigarette use
- Describe the evidence surrounding the safety of e-cigarettes
- Describe the evidence regarding the use of e-cigarettes as aids in smoking cessation
- Discuss the use of e-cigarettes in older adults
CASE STUDY

A 71 y/o patient asks you about using e-Cigarettes to quit smoking. He smokes 1 ppd x 55 yrs and has tried to quit 3 times in the past using “cold turkey” (quit 1 day), nicotine patch (quit 2 weeks), and bupropion (did not quit). He is very interested in trying an e-cigarette for smoking cessation.

How would you respond??
### E-Cigarette History

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>Herbert Gilbert patented first electronic cigarette</td>
</tr>
<tr>
<td>2003</td>
<td>E-cigs brought to market in China</td>
</tr>
<tr>
<td>2007</td>
<td>E-cigs brought to market in US</td>
</tr>
<tr>
<td>2012</td>
<td>First tobacco company enters the US e-cig market</td>
</tr>
<tr>
<td>2014</td>
<td>&gt;460 e-cig brands and &gt;7000 flavors</td>
</tr>
</tbody>
</table>


E-Cigarettes

Vapors

Cig-a-likes

Mini's

Tanks

Pens

eHookah

ENDS

Clearomizers
VAPE, VAPING, AND VAPER

- Vape (v.) - Word of the year, 2014
  - “To inhale and exhale the vapor produced by an electronic cigarette or similar device”
- Vape / Vaping (n.):
  - “An electronic cigarette or similar device”
  - “An act of inhaling and exhaling the vapour by an electronic cigarette or similar device”
- Vaper (n.): someone who vapes

http://www.oxforddictionaries.com/definition/english/vape#vape_3
WHAT'S YOUR VAPOR?

http://the-best-electronic-cigarette-review.com
ELECTRONIC CIGARETTES (E-CIGS)

- **Cartridge**
  - Propylene glycol (throat hit)
  - Glycerin (cloud)
  - Flavoring
  - Nicotine
- **Power source**
  - Battery
- **Atomizer / vaporizer**
  - Heating element

Image: [http://www.fda.gov/NewsEvents/PublicHealthFocus/ucm172906.htm](http://www.fda.gov/NewsEvents/PublicHealthFocus/ucm172906.htm)
<table>
<thead>
<tr>
<th>Style</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pen Style</strong></td>
<td>Larger, higher capacity battery and cartridge, prefilled or refillable cartridge, switch that regulates duration and frequency of puffs</td>
</tr>
<tr>
<td><strong>Tank Style</strong></td>
<td>Largest, highest capacity battery - often customizable, larger refillable cartridge, switches to regulate dose, duration, and frequency of puffs, modifiable</td>
</tr>
</tbody>
</table>

FLAVOR MENU

SWEET TOOTH - VANILLA GRAHAM CRACKER
JADE - CUCUMBER MINT + MELON
SCARLETT - LYCHEE
FLATLINE - PINEAPPLE + MANGO + CREAM
RINGER - BLUE COTTON CANDY
CHILLAKIN - REFRESHING MINT
CURIOS JORGE - BANANAS
HARD CANDY - SWEET TART FLAVOR
CHERRY BOMB - DELICIOUS CHERRY
XXX - KIWI, MANGO, PINEAPPLE
ANDROMEDA - BLUEBERRY + POMEGRANATE
STARSHIP 41 - VANILLA CUSTARD + KIWI
OMEGA - PEACHES AND CREAM
M80 - WATERMELON + DRAGONFRUIT
SNACK OIL - MINT + WATERMELON
PLUTO - MELON, BUBBLE GUM + MINT
KEY LIME PIE - KEY LIME + GRAHAM CRACKER CRUST

GORILLA GUTS - BANANA + BUTTERSCOTCH
APPLE DELIGHT - CARAMEL APPLE
APPLE JACKS - LIKE THE CEREAL
TKO - RASPBERRY LEMONADE
TATER - NEapolITAN ICE CREAM
FRENCH VANILLA
PARADISE - PINEAPPLE, GUAVA, ORANGE
F. O. E. S. - VANILLA CUSTARD
BULLSEYE - NY CHEESECAKE
A-TRAIN - MANGO + PINEAPPLE
SWEET MELON - HONEYDEW + MELON
DOUBLE TAP - STRAWBERRY + DRAGONFRUIT
C4 - BLUEBERRY SHOTCAKE
CREAMY STRAWBERRY - CREAM + STRAWBERRY
ASTRO - APPLE, PEACH, BERRY
LAVA FLOW - PINA COLADA, COCONUT, PINEAPPLE
TIGERS BLOOD - WATERMELON, STRAWBERRY, COCONUT

Behind the Vapor. http://www.bu.edu/research/articles/behind-the-vapor/
CURRENT STATS ON E-CIG USE

❖ Adults
  • 12.6% have ever tried, and about 3.7% use regularly (2014)
  • 37% of current cigarette smokers have used

❖ Youth
  • >30 million middle and high school students use (2015)
  • Most commonly used tobacco product

REASONS FOR RAPID UPTAKE

- Affiliate marketing
- Storefront / Product placement
- TV advertising
- Social media and viral video sharing
- Successful marketing claims

MARKETING CLAIMS

- Celebrity use
- Cessation claims
- Smoke where not allowed
- Modern
- No Secondhand Smoke
- Smoke Anywhere
- Cleaner
- Cheaper
- Healthier

ADVERTISING EXPENDITURES IN MILLIONS OF DOLLARS

MARKETING TO CHILDREN AND ADOLESCENTS

Stanford Tobacco Education Research
http://tobacco.stanford.edu/tobacco_main/index.php
TOBACCO USE BY TYPE IN PAST 30 DAYS HIGH SCHOOL STUDENTS

Arrazola et al. MMWR 2015;64(14):381-385
FDA has authority to regulate the manufacturing, distribution, and marketing of tobacco products to protect public health.

FDA regulates cigarettes, cigarette tobacco, roll-your-own tobacco, smokeless tobacco products.

Flavorings in cigarettes can be banned.

New products seeking to enter the market required to meet FDA pre-market standards.

REGULATION: E-LIQUIDS OR E-JUICE

Child Nicotine Poisoning Prevention Act of 2015

Note: Lack of childproof caps!

By Oscarsussa218 (Own work) [CC BY-SA 4.0 (http://creativecommons.org/licenses/by-sa/4.0)], via Wikimedia Commons
FDA Regulation, May 2016

- Extended regulation to pipe tobacco, hookah tobacco, cigars, and e-cigarettes
  - Minimum age to purchase = 18 yo
  - Require health warnings for products and advertising
  - Prohibited vending machine sales unless minors are prohibited in the location
  - Prohibited free samples
  - Requires manufacturers to receive authorization from FDA for any products not on the market before 2007

NICOTINE COMPARISONS

- Cigarettes contain 8 to 20 mg of nicotine, avg at 12 mg
  - Deliver about 1 mg of nicotine
- Amount of nicotine consumed varies by smoking technique
  - Finger placement, interpuff interval, number of puffs, puff volume, puff duration
- 15-30 puffs of a high nicotine e-cig is considered roughly equivalent to smoking 1 cigarette

NICOTINE COMPARISONS

- Inconsistencies in amount compared to labeled content

- One study showed that the nicotine in a puff of highest nicotine e-cig contained 20% of the nicotine of a conventional cigarette

- Actual nicotine delivery is likely impacted by smoking behavior

Hadwinger et. al, 2010. Journal of Chromatography A.
E-CIGS: NICOTINE CONTENT COMPARISON

16 Brands of e-Cigs analyzed, 20 samples across brands
- Used adapted smoking machine – 300 puffs
- Nicotine content varied from labeled by >20% in 9 samples
- Nicotine content ranged from 0.5 mg to 15.4 mg

7 e-Cig solutions analyzed
- 2 labeled as containing 24mg/ml, and 4 marked “low” (expected 6-14 mg/ml), “medium” (10-18mg/ml), “high” and “super high” (25-36mg/ml)
- Only 2 products were in the expected range, 4 were lower than specified

Goniewicz ML et al, Addiction. 2013:500-7
E-CIGS NICOTINE ABSORPTION (18MG E-CIG)

Adapted from Farsolinos et al. Scientific Reports. 2014. DOI: 10.1038/srep04133 under http://creativecommons.org/licenses/by-nc-nd/3.0/legalcode
CONCERNING INGREDIENTS

- Flavorings are safe for ingestion but safety in inhalation is largely unknown
  - Majority do not show cytotoxicity
- Diacetyl – flavoring in microwave popcorn caused outbreak of severe and irreversible lung disease in workers exposed to aerosolized diacetyl
- Cinnamon and coffee flavors are associated with cytotoxicity
- Propylene Glycol may irritate the throat, mouth, and eye
- Diethylene glycol (antifreeze)

Physiologic Effects for Users

- E-Cigs linked to mild side effects of throat irritation (33%), dry mouth/throat (39%), headache (28%), dry cough (22%), Dizziness (16%), and nausea (15%)
- No change in heart rate, carbon monoxide level, complete blood counts, cardiac function via echocardiogram, or inflammatory markers
- No change in short term lung function but one study showed increased respiratory impedance and respiratory flow resistance similar to cigarette use

REPORTED SAFETY CONCERNS

- 47 adverse event reports to the FDA
  - Range from nausea and vomiting to death due to ingestion
  - 8 events defined as serious
  - Heart failure, hypotension, pneumonia, chest pain, and possible infant choking death

ADR reporting: HHS Safety Reporting Portal
https://www.safetyreporting.hhs.gov/

Chen IL Tobacco Research. 2013:15:615-16.
http://www.fda.gov/NewsEvents/PublicHealthFocus/ucm172906.htm
## E-Cigarette Liquid

<table>
<thead>
<tr>
<th>Toxicant</th>
<th>Nicotine Inhaler (15 puffs)</th>
<th>E-Cigarettes (15 puffs)</th>
<th>Traditional Cigarette</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde, mcg</td>
<td>0.2</td>
<td>0.2-5.61</td>
<td>1.6-52</td>
</tr>
<tr>
<td>Acetaldehyde, mcg</td>
<td>0.11</td>
<td>0.11-1.36</td>
<td>52-140</td>
</tr>
<tr>
<td>Acrolein, mcg</td>
<td>ND</td>
<td>0.07-4.19</td>
<td>2.4-62</td>
</tr>
<tr>
<td>Toluene, mcg</td>
<td>ND</td>
<td>0.02-0.63</td>
<td>8.3-70</td>
</tr>
<tr>
<td>Nickel, ng</td>
<td>0.09</td>
<td>0.011-0.029</td>
<td>---------</td>
</tr>
<tr>
<td>Lead, ng</td>
<td>0.004</td>
<td>0.003-0.057</td>
<td>---------</td>
</tr>
<tr>
<td>NNN, ng</td>
<td>ND-0.43</td>
<td>ND-0.43</td>
<td>5-190</td>
</tr>
<tr>
<td>NNK, ng</td>
<td>ND-2.83</td>
<td>ND-2.83</td>
<td>12-110</td>
</tr>
</tbody>
</table>

HISTORY OF DEVICE QUALITY ISSUES

- Prefilled cartridges leaked when handled
- Fluid present on outside of cartridges
- E-cigs explode, catch fire injuring user and bystanders, and causes fire in cargo hold of commercial airline
- Increasing fire reports in UK (43 in 2013 and 62 in 2013)
- Study was discontinued due to unreliable e-cig function
- Tin particles and whiskers (solder joints) were found in aerosolized vapor

SAFETY CONCERNS

Poison center calls involving e-cigarettes

215 Calls per Month

1 Call per Month

September 2010 - February 2014
SAFETY FOR BYSTANDERS

- Aerosolized nicotine lasts on surfaces for weeks or months
- Exhaled aerosol can contain tobacco specific nitrosamines
  - Levels are 9-450 times lower than conventional cigarettes and similar to nicotine inhaler
- Potential for indoor air pollution
  - Nicotine and 7 polycyclic hydrocarbons (probable carcinogens per Int Agency for Cancer Research) in room air in café model

SAFETY FOR BYSTANDERS: INDOOR AIR POLLUTION

- Exposure to fine particles 6.6 – 85 ug/m³
- Particle number
  - Directly associated with nicotine concentration
  - Increases with longer puffing time
  - Similar or greater in amount to conventional cigarettes
  - After 2 hours increased from 400 particles per cm to 49,000-88,000 particles per cm³ depending on e-cigarette used

- In March 2016, US Dept. of transportation banned e-cigs on planes

http://casaa.org/E-cigarette_History.html
CASE STUDY

A 71 y/o patient asks you about using e-Cigarettes to quit smoking. He smokes 1 ppd x 55 yrs and has tried to quit 3 times in the past using “cold turkey” (quit 1 day), nicotine patch (quit 2 weeks), and bupropion (did not quit). He is very interested in trying an e-cigarette for smoking cessation.

How would you respond??
WHY USE E-CIGS FOR SMOKING CESSATION?

- Mimic physical, sensory and behavioral aspects of cigarettes
- Slower nicotine delivery than cigarettes
- Lower serum nicotine levels than cigarettes
- More acceptable to use than nicotine replacement products (NRT)
- Readily available

ASCEND DESIGN

- 3 parallel group, RCT:
  - Nicotine e-Cigs vs. Patch vs. Placebo e-Cigs.
- Conducted in Auckland, New Zealand
  - Nicotine e-Cigs are not permitted to be sold
  - Non-nicotine e-Cigs are widely available
- Included ONLY those motivated to quit smoking
Ellusion brand e-Cigs - powered by rechargeable battery

- From New Zealand

Trial commissioned analysis:

- Free of diethylene glycol
- Nicotine 16 mg cartridges
  - Contained 10-16 mg nicotine/ml
  - 300 puffs = 3-6 mg/nicotine delivered = 1-5 tobacco cigarettes
- Placebo: no nicotine

http://www.elusionelectroniccigarett.co.nz/
ASCEND OUTCOMES

**Primary:** Continuous smoking abstinence 6 months after quit date
- Self-reported over the whole follow-up period, allowing ≤ 5 cigs total
- Verified by exhaled CO measurement ≤ 10 ppm

**Secondary:** Assessed at 1, 3 and 6 months post quit date:
- Continuous abstinence
- 7 day point prevalence abstinence
- Number of tobacco cigs smoked per day
- Proportion of participants reducing tobacco smoking
- ADEs

CO = carbon monoxide
### ASCEND Baseline Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Nicotine e-Cigs (n=289)</th>
<th>Patches (n=295)</th>
<th>Placebo e-Cigs (n=73)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>43.6</td>
<td>40.4</td>
<td>43.2</td>
</tr>
<tr>
<td>Women</td>
<td>62%</td>
<td>62%</td>
<td>62%</td>
</tr>
<tr>
<td>Average cigs/day</td>
<td>18.4</td>
<td>17.6</td>
<td>17.7</td>
</tr>
<tr>
<td>At least 1 quit attempt in last 12 mo</td>
<td>55%</td>
<td>57%</td>
<td>53%</td>
</tr>
<tr>
<td>FTND score</td>
<td>5.6</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td>Lost to follow-up</td>
<td>17%</td>
<td>27%</td>
<td>22%</td>
</tr>
</tbody>
</table>

FTND = Fagerström test of nicotine dependence (Br J Addict 1991;86:1119-27)
ASCEND RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Nic e-Cigs (%)</th>
<th>Patches (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Continuous abstinence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 mo</td>
<td>23.2</td>
<td>15.9</td>
<td>0.03</td>
</tr>
<tr>
<td>3 mo</td>
<td>13.1</td>
<td>9.2</td>
<td>0.12</td>
</tr>
<tr>
<td>6 mo</td>
<td>7.3</td>
<td>5.8</td>
<td>0.46</td>
</tr>
<tr>
<td><strong>7 day point prevalence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 mo</td>
<td>23.9</td>
<td>17.3</td>
<td>0.05</td>
</tr>
<tr>
<td>3 mo</td>
<td>21.5</td>
<td>17.0</td>
<td>0.17</td>
</tr>
<tr>
<td>6 mo</td>
<td>21.1</td>
<td>15.6</td>
<td>0.09</td>
</tr>
</tbody>
</table>
## ASCEND Results

<table>
<thead>
<tr>
<th></th>
<th>Nic e-Cigs (%)</th>
<th>Placebo e-Cigs (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Continuous abstinence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 mo</td>
<td>23.2</td>
<td>16.4</td>
<td>0.21</td>
</tr>
<tr>
<td>3 mo</td>
<td>13.1</td>
<td>6.8</td>
<td>0.14</td>
</tr>
<tr>
<td>6 mo</td>
<td>7.3</td>
<td>4.1</td>
<td>0.44</td>
</tr>
<tr>
<td><strong>7 day point prevalence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 mo</td>
<td>23.9</td>
<td>16.4</td>
<td>0.17</td>
</tr>
<tr>
<td>3 mo</td>
<td>21.5</td>
<td>16.4</td>
<td>0.35</td>
</tr>
<tr>
<td>6 mo</td>
<td>21.1</td>
<td>21.9</td>
<td>0.88</td>
</tr>
</tbody>
</table>
ASCEND ADVERSE EVENTS

- Not significant different between nicotine e-Cigs and patches ($p=0.7$)
- No association with any study product
ASCEND AUTHOR’S CONCLUSION

“E-cigarettes, with or without nicotine, were modestly effective at helping smokers to quit, with similar achievement of abstinence as with nicotine patches, and few adverse events.”
ASCEND CRITIQUE

**Strengths:**
- Conservative primary outcome measure confirmed with CO
- Real world e-Cig use – minimal to no support or counseling

**Weaknesses:**
- Not blinded to patches
- Acquisition of product differed between groups
- Effect size and estimates of abstinence were optimistic, statistical power reduced
- 20% had used NRT previously
- Inadequate nicotine delivery in e-Cig
EFFICACY AND SAFETY OF AN ELECTRONIC CIGARETTE (ECLAT) AS TOBACCO CIGARETTES SUBSTITUTE: A PROSPECTIVE 12-MONTH RANDOMIZED CONTROL DESIGN STUDY.

Randomized, controlled, double-blind, 12 month trial

Conducted in Italy
  • Nicotine e-Cigs are permitted to be sold

Not currently attempting to quit smoking or wishing to in the next 30 days
ECLATE-Cig

Categoria Model “401”

- Approved for marketing in 2010 by the Italian Institutes of Health

- 3 versions
  - “Original” 7.2 mg nicotine
  - “Categoria” 5.4 mg nicotine
  - “Original” without nicotine (“sweet tobacco” aroma)

- Model no longer available
## ECLAT Randomization

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2 mg nicotine cartridges x 12 weeks</td>
<td>7.2 mg nicotine cartridges x 6 weeks</td>
<td>Non-nicotine cartridges x 12 weeks</td>
</tr>
<tr>
<td></td>
<td>5.4 mg nicotine cartridges x 6 weeks</td>
<td></td>
</tr>
</tbody>
</table>
ECLAT Outcomes

- Smoking reduction
- Abstinence from smoking =
  - Complete self-reported abstinence from tobacco smoking since previous study visit (not even a puff) +
  - Exhaled CO ≤ 7 ppm since previous study visit
- Adverse effects
## ECLAT Patient Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Overall (n=300)</th>
<th>Group A (n=100)</th>
<th>Group B (n=100)</th>
<th>Group C (n=100)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Male</td>
<td>63</td>
<td>61</td>
<td>66</td>
<td>63</td>
<td>NS</td>
</tr>
<tr>
<td>Age (yrs ±SD)</td>
<td>44.0 ± 12.5</td>
<td>45.9 ± 12.8</td>
<td>43.9 ± 12.2</td>
<td>42.2 ± 12.5</td>
<td>*</td>
</tr>
<tr>
<td>Cig/day (median [IQ range])</td>
<td>20 (15-25)</td>
<td>19 (14-25)</td>
<td>21 (15-26)</td>
<td>22 (15-27)</td>
<td>NS</td>
</tr>
<tr>
<td>Past attempts to quit (% yes)</td>
<td>51</td>
<td>56</td>
<td>48</td>
<td>47</td>
<td>NS</td>
</tr>
<tr>
<td>FTND (mean ±SD)</td>
<td>5.8 ±2.2</td>
<td>5.6 ±2.3</td>
<td>6.0 ±2.1</td>
<td>5.8 ±2.2</td>
<td>NS</td>
</tr>
</tbody>
</table>

*p=0.04 between groups A and C
## EC LAT ITT ABSTINENCE RATES

<table>
<thead>
<tr>
<th>Week</th>
<th>Group A Nicotine</th>
<th>Group A + B</th>
<th>Group B Tapered Nicotine</th>
<th>Group C Non-Nicotine</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>14</td>
<td>14</td>
<td>6</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>11</td>
<td>15</td>
<td>2</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>12</td>
<td>4</td>
<td>0.31</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>7</td>
<td>15</td>
<td>3</td>
<td>0.01</td>
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<tr>
<td>12</td>
<td>11</td>
<td>17</td>
<td>4</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>14</td>
<td>4</td>
<td>0.0008</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>12</td>
<td>10</td>
<td>5</td>
<td>0.39</td>
<td></td>
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<tr>
<td>52</td>
<td>13</td>
<td>9</td>
<td>4</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td></td>
<td>11</td>
<td>4</td>
<td>0.04</td>
<td></td>
</tr>
</tbody>
</table>
“In smokers not intending to quit, the use of e-cigarettes, with or without nicotine, decreased cigarette consumption and elicited enduring tobacco abstinence without causing significant side effects.”
**ECLAT CRITIQUE**

- **Strengths**
  - Abstinence confirmed with exhaled CO
  - Trial length

- **Weaknesses**
  - Not compared to approved treatment
  - Smokers not wanting to quit
  - Concentrated on smoking reduction, not complete abstinence
  - Did not measure continuous abstinence
  - Product performed poorly and was discontinued before trial finished
### Longitudinal Population Based Studies

<table>
<thead>
<tr>
<th>Trial</th>
<th>Location</th>
<th>Study Design</th>
<th>Odds of Quitting OR, (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adkison, et al (2013)</td>
<td>US, UK, Canada, Australia</td>
<td>Current and former smokers surveyed 2 times, separated by 1 year</td>
<td>0.81 (0.43 – 1.53) (E-cig users no more likely to quit)</td>
</tr>
<tr>
<td>Vickerman, et al (2013)</td>
<td>US</td>
<td>Quitline callers surveyed at enrollment and 7 months post</td>
<td>0.50 (0.40 – 0.63) (E-cig users less likely to quit)</td>
</tr>
</tbody>
</table>

**Trial 1** – 85% reported they were using product to quit smoking, E-cig users had greater reduction in cigarettes per day, but no more likely to quit 1 year later.

**Trial 2** – 51.3% reported tobacco cessation as the main reason for using.

[http://escholarship.org/uc/item/13p2b72n](http://escholarship.org/uc/item/13p2b72n)
<table>
<thead>
<tr>
<th>Study Reference</th>
<th>n</th>
<th>Length</th>
<th>Design and Population</th>
<th>Abstinence results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manzoli, et al 2016;0:1-9</td>
<td>229</td>
<td>24 mo</td>
<td>Prospective cohort - compared e-cig users, cig uses and dual users</td>
<td>E-cigs: 61.1%  Cigs: 23.1%  Dual: 26.0%</td>
</tr>
<tr>
<td>Zawertailo, et al Nicotine Tob Res 2017, 183-189</td>
<td>6526</td>
<td>6 mo</td>
<td>26 week program of behavioral counseling + NRT +/- e-cigs (18.1%)</td>
<td>E-cigs+NRT: 26.3%  NRT: 42.0%  (p&lt;0.001)</td>
</tr>
<tr>
<td>Borderud, et al Cancer 2014;120:3527-35.</td>
<td>1074</td>
<td>1 yr</td>
<td>Observational, cancer pts in a smoking cessation program, 27% using e-Cigs</td>
<td>7 d PP:  E-cigs: 14.5%  No E-cigs: 30%  (p&lt;0.01)</td>
</tr>
</tbody>
</table>
## Summary of Survey Data

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Al-Delaimy, et al</td>
<td>1000</td>
<td>1 yr</td>
<td>Smokers in California (24% used e-Cigs)</td>
<td>E-cig users less likely to quit for 30 days (OR=0.41, 95% CI 0.18, 0.93)</td>
</tr>
<tr>
<td>Vickerman, et al</td>
<td>2758</td>
<td>7 mo</td>
<td>Callers to quit lines (31% used e-Cigs)</td>
<td>30 d PP (p&lt;0.001): 22% e-Cigs ≥ 1 mo, 17% e-Cigs &lt; 1 mo, 31% none</td>
</tr>
<tr>
<td>Etter, Bullen</td>
<td>367</td>
<td>1 yr</td>
<td>International survey of smokers and e-Cig users</td>
<td>46% in e-Cig users at 1 yr</td>
</tr>
<tr>
<td>Grana.</td>
<td>949</td>
<td>1 yr</td>
<td>US smokers (9% used e-Cigs)</td>
<td>10% e-Cigs, 14% non-e-Cigs</td>
</tr>
<tr>
<td>Brown, et al</td>
<td>5863</td>
<td>1 yr</td>
<td>UK adults with quit attempt in last 1 yr using e-Cigs, NRT, or no aid</td>
<td>20% e-Cigs, 10% NRT, 15% no aid</td>
</tr>
</tbody>
</table>
THE BOTTOM LINE...

- Majority of studies observational
- Intention to quit varies between studies
- Self-selection bias confounder
- None used the level of behavioral support used in the NRT trials
- Abstinence poorly defined and not consistently verified
- Reduction of smoking unreliable clinical outcome
- Products studied may not be available
- Limited or no assessment of nicotine delivery or product evaluation
A 71 y/o patient asks you about using e-Cigarettes to quit smoking. He smokes 1 ppd x 55 yrs and has tried to quit 3 times in the past using “cold turkey” (quit 1 day), nicotine patch (quit 2 weeks), and bupropion (did not quit). He is very interested in trying an e-cigarette for smoking cessation.

How would you respond??
American Heart Association Policy

- Reasonable to use e-Cigs if:
  - Failed initial treatment
  - Has been intolerant to or refused conventional smoking cessation medication
  - Wishes to use e-Cigs

- Inform users that products are unregulated, may contain low levels of toxic chemicals, have not been proven as cessation devices

- Advise to consider setting a quit date for the e-Cig use and not plan to use indefinitely

E-CIGS FOR SMOKING CESSATION

**PROs**
- Readily available
- Patients may prefer them to NRT or Rx treatments
- Mimic physical, sensory, and behavioral aspects of smoking
- May be as effective as nicotine patches

**CONs**
- Not regulated
- Unable to determine dose of nicotine
- May contain toxic products
- Efficacy not proven
- Other evidence-based treatment options available
ISSUES FOR OLDER ADULTS

- Should not begin using nicotine products
- High risk for the ADRs of e-Cigs
- Issues with safety around young children and adolescents in home
- Might consider for smoking cessation, but not for any other use
- If used for smoking cessation, plan for discontinuing use
KEY TAKEAWAYS

- E-cigs are numerous, unregulated, highly modifiable devices and use is rapidly increasing.
- Current limited literature suggests they are likely safer than conventional cigarettes but many unknowns remain and true safety is not established.
- E-cigs are not adequately studied in comparison to smoking cessation medications with proven efficacy and safety
  - Recommend approved medications FIRST (NRT, bupropion, varenicline)
  - E-cigs could be used as a last resort in patients who desire to use them, but are not without potential harms