Improving E-Cigarette Research through Measurement and Design
Disclosures

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- This work was supported by Truth Initiative and RWJF
- Other funding from FDA (HHSN: 271201600001C) and NIH (U54CA189222; R03CA187756; R21DA041548; R03DA042010; P50DA036114; P20GM103644)

- No support from any industry sources

- Opinions expressed are solely our own and do not necessarily reflect those of Truth Initiative, University of Vermont, or any funding agencies.
Research is focused on the public health impact of e-cigarettes
FDA’s “public health standard” calls for the review of the scientific evidence regarding

1. Risks and benefits of the proposed rule to the population as a whole, including both users and non-users of tobacco products;

2. Whether there is an increased or decreased likelihood that existing users of tobacco products will stop using such products; and

3. Whether there is an increased or decreased likelihood that those who do not currently use tobacco products, most notably youth, will start to use tobacco products
Trajectories of e-cigarette use?

E-cigarette Policy Research Framework

Tobacco Control Policies → Exposure to Policy → Tobacco Use Behavior → Outcomes

Psychosocial Mediators

Moderators
Overview of Electronic Nicotine Delivery Systems: A Systematic Review

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Lesson 1: Products matter.
E-cigarettes are not a single product class

First generation
“Cigalikes”

Second generation
“Mid-size electronic cigarettes”

Third generation
“Advanced personal vaporizers”
E-cigarette nicotine delivery

E-cigarette nicotine delivery

E-cigarette manufacturers vary
Advertising is impacted by manufacturer

E-cigarette Advertising Expenditures, U.S.

Year | U.S. Dollars (Millions)
--- | ---
2010 | $5
2011 | $12
2012 | $22
2013 | $76
2014 | $115

Lorillard acquires blu eCigs
Reynolds launches Vuse
Altria launches MarkTen
Products matter

1. E-cigarettes are a heterogeneous group of products, typically not differentiated in surveys
2. These products vary in nicotine delivery and consumer satisfaction – both of which are likely to impact their uptake
3. There are no established quality or safety standards for these products
4. Variety of e-cigarette manufacturers; not just cigarette companies
5. Product advertising largely driven by cigarette company products

Source: https://www.youtube.com/watch?v=UFsRgJsF6Ug
Lesson 2: Context matters.
Prevalence of past 30-day smoking among 12th graders in the US, 2005-2016

Past 30-Day E-Cigarette Use by Grade and Year

*Question broadened to ask about use of electronic vaporizers

Distribution of tobacco and e-cigarette co-use among U.S. middle and high school students (weighted); NYTS, 2014

E-cigarette use frequency

- Any combustible use
- Non-combustible use
- Exclusive e-cigarette use
- No past 30-day use

Distribution of tobacco and e-cigarette co-use among past 30-day e-cigarette users (weighted); NYTS, 2014

E-cigarette use frequency

- Any past 30-day combustible use
- Past 30-day Non-combustible use
- Exclusive past 30-day e-cigarette use

Youth frequency of product use, 2014 NYTS

Cigarette use

- Polysubstance use in past 30 days: 2.4%
- Exclusive use in past 30 days: 0.6%

Smokeless tobacco use

- Polysubstance use in past 30 days: 1.1%
- Exclusive use in past 30 days: 0.4%

Cigar use

- Polysubstance use in past 30 days: 2.8%
- Exclusive use in past 30 days: 0.6%

E-cigarette use

- Polysubstance use in past 30 days: 4.4%
- Exclusive use in past 30 days: 2.2%

Substance Use in Past 30-Days among 12th Graders

Source: Monitoring the Future 2015 (Table 3)
Context matters

- Youth cigarette use continues to decline.
- Youth e-cigarette use increased from 2011, but seems to have leveled off or decreased in the past 2 years.
- Total tobacco product and e-cigarette use in youth has not declined since 2011.
- Polytobacco use is the dominant pattern in youth.
- E-cigarette and tobacco product use occurs in the context of:
  - Other substance use
  - Marketing
Lesson 3:
Measurement matters.
E-cigarette Use in Youth and Adults, 2014

Source: 2014 NYTS; Delnevo (2015)  Patterns of Electronic Cigarette Use Among Adults in the United States; Data NHIS, 2014
E-cigarette Use in Youth and Adults, 2014

Source: 2014 NYTS; Delnevo (2015) Patterns of Electronic Cigarette Use Among Adults in the United States; Data NHIS, 2014
What measures are relevant to assessing public health impact?

- Never use
- Ever use
- Current/regular use
  - Frequency: Number of days used in the past 30
  - Intensity: Number of times products used on days used in the past 30
Measurement methods impact estimates

<table>
<thead>
<tr>
<th></th>
<th>Ever use</th>
<th>Past 30-day use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forced choice</td>
<td>Check-all-that- apply</td>
</tr>
<tr>
<td>E-cigarette (overall)</td>
<td>24.1%</td>
<td>14.9%</td>
</tr>
</tbody>
</table>

**Table 2.** Validity (%) and Predictive Value (%) of Check-All-That-Apply Measures\(^a\) of Electronic Cigarette and Hookah Use (n = 3,909), New Jersey Youth Tobacco Survey, 2014

<table>
<thead>
<tr>
<th></th>
<th>Electronic Cigarettes</th>
<th>Hookah Pipes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ever Use</td>
<td>Current Use</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>58.3</td>
<td>40.4</td>
</tr>
<tr>
<td>Specificity</td>
<td>98.5</td>
<td>98.8</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>92.6</td>
<td>82.1</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>88.2</td>
<td>92.3</td>
</tr>
</tbody>
</table>

\(^a\) The forced-choice question format was treated as the “true” measure.
Measurement matters

1. Terminology is important
   • What is “use”?
     • Ever vs. past 30-day vs. more detailed measures?

2. Need more meaningful measures of exposure
   • High rates of experimentation

3. Measurement methods affect prevalence estimates

4. Few national surveys ask more detailed e-cigarette items
   • Device type
   • Nicotine vs. non-nicotine
   • Reasons for use
Recommended minimum core items to assess e-cigarette use in national surveys

**KEY CONSTRUCTS**

- Ever use
- Frequency of use
- Relative harm
- Former daily use
- Device type
- Presence of nicotine
- Flavor preference
- Primary reason for use

(Pearson et al. Manuscript under review.)
Lessons learned
Lessons learned

• Assessing public health impact of a specific product, like e-cigarettes, requires:
  – High quality scientific measurement and design
  – Attention to the marketplace (i.e., products, marketing, manufacturers)
  – Consideration of broader contexts of use

• E-cigarette surveillance would benefit from standard measures to inform and evaluate their public health impact (Pearson et al. Manuscript under review.)
E-cigarette Policy Research Framework

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- Tobacco Use Behavior
- Outcomes
- Psychosocial Mediators
- Moderators
Thank you

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