The Epidemiology of Poly Substance Use Among Youth and Adults

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Disclaimer

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FIGURE 1. Estimated percentage of high school students who currently use any tobacco products,* ≥2 tobacco products,† and select tobacco products§ — National Youth Tobacco Survey 2011–2015

* Any tobacco product use is defined as past 30-day use of cigarettes, cigars, smokeless tobacco, e-cigarettes, hookahs, pipe tobacco, and/or bidis.
† ≥2 tobacco product use is defined as past 30-day use of two or more of the following product types: cigarettes, cigars, smokeless tobacco, e-cigarettes, hookahs, pipe tobacco, and/or bidis.
§ E-cigarettes and hookahs demonstrated a nonlinear increase (p<0.05). Cigarettes and smokeless tobacco demonstrated a linear decrease (p<0.05). Cigars, pipe tobacco, and bidis demonstrated a nonlinear decrease (p<0.05).
E-CIGARETTE PROFITS COULD SURPASS THOSE OF COMBUSTIBLE CIGARETTES WITHIN 10 YEARS

Marijuana regulations in the US today...

Status of marijuana laws in the United States

Legalized  Medical  Decriminalized  Medical and decriminalized  Fully illegal

Source: NORML, Drug Policy Alliance, and the Marijuana Policy Project

Prevalence of marijuana, cigarette, and cigar use among US 12th graders (YRBS)
“The HIGH TIMES Cannabis Cup is the world’s leading marijuana trade show, celebrating the world of ganja through competitions, instructional seminars, expositions, celebrity appearances, concerts and product showcases.”

http://www.cannabiscup.com/
Today...

Who?

Social & health outcomes

Tobacco

ENDS

Marijuana
Note:

- This is not a systematic review.
- This is a highlight of studies that tried to answer these questions.

Act 1: Tobacco and ENDS Use
Current polytobacco use (2+) in US high school students by sex

(Arrazola et al, 2014a; Arrazola et al, 2014b; Arrazola et al 2015; Singh et al, 2016)
Current polytobacco use (2+) in US high school students by race/ethnicity

(Arrazola et al, 2014a; Arrazola et al, 2014b; Arrazola et al 2015; Singh et al, 2016)
Tobacco product-use pattern model

<table>
<thead>
<tr>
<th>Tobacco product no.</th>
<th>Single tobacco products</th>
<th>Single product category use</th>
<th>Dual product category use</th>
<th>Polytobacco product category use</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Cigarettes</td>
<td>A</td>
<td>D (any two product categories)</td>
<td>E (cigarettes &amp; non-cigarette combustibles &amp; noncombustibles)</td>
</tr>
<tr>
<td>II</td>
<td>Bidis</td>
<td></td>
<td>D₁ (cigarettes &amp; non-cigarette combustibles)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cigarillos</td>
<td></td>
<td>D₂ (cigarettes &amp; noncombustibles)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cigars</td>
<td></td>
<td>D₃ (non-cigarette combustibles &amp; noncombustibles)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clove cigarettes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hookah</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Little cigars</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pipe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roll-your-own cigarettes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Chewing tobacco</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dip</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dissolvable tobacco</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E-cigarettes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E-vapor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Snuff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Snus</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(El-Toukhy & Choi, 2016)
NYTS 2012 middle and high school current tobacco users

(El-Toukhy & Choi, 2016)
Correlates of youth tobacco product use patterns

<table>
<thead>
<tr>
<th></th>
<th>Cigarette only</th>
<th>Non-cigarette combustible only</th>
<th>Non-combustible only</th>
<th>Dual product category</th>
<th>Polytobacco product category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived ease of access</td>
<td>Ref.</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Exposure to ads</td>
<td>Ref.</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Exposure to coupons</td>
<td>Ref.</td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Exposure to promotions</td>
<td>Ref.</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Denied smoking is cool</td>
<td>Ref.</td>
<td>+</td>
<td>+</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Thought all tobacco products are dangerous</td>
<td>Ref.</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Adjusted for age, gender, race/ethnicity, and living with tobacco users.

(El-Toukhy & Choi, 2016)
Youth dual use of cigarettes and ENDS

NYTS 2012

(Lee et al, 2015; Wills et al, 2015)
# Youth ENDS only vs. Dual ENDS and Cigarette Users in Hawaii

<table>
<thead>
<tr>
<th></th>
<th>ENDS only</th>
<th>Dual use</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social-cognitive protective factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental support</td>
<td>23.3</td>
<td>21.8</td>
<td>0.03</td>
</tr>
<tr>
<td>Parental monitoring</td>
<td>20.0</td>
<td>19.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Grades past year</td>
<td>3.9</td>
<td>3.5</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Social-cognitive risk factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking expectancies</td>
<td>10.1</td>
<td>14.3</td>
<td>0.01</td>
</tr>
<tr>
<td>Peer smoking</td>
<td>1.5</td>
<td>2.8</td>
<td>0.001</td>
</tr>
<tr>
<td>Sensation seeking</td>
<td>15.8</td>
<td>17.8</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Other substance use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marijuana (0-6 pts)</td>
<td>0.6</td>
<td>2.6</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Adjusted for gender, grade, family structure, ethnicity, parental education, and accounted for school clustering.

(Wills et al, 2015)
Youth ENDS ↔ Tobacco use

• Tobacco → ENDS
  – Youth smokers are more likely to use ENDS, but no evidence of a complete switch
  – Influence of other tobacco products on ENDS initiation is unknown

• ENDS → Tobacco
  – Leventhal et al, 2015
    • 14 year-old never combustible tobacco user from 10 public high schools in Los Angeles, CA, followed for 12 months
    • ENDS ever use at baseline predicted ever using cigarettes, cigars, and hookah at follow-up
  – Primack et al, 2015
    • National sample of 16 to 26 year-old never cigarette smokers who were attitudinally non-susceptible to smoking cigarettes (n=694), followed for a year
    • ENDS ever use at baseline predicted ever using cigarettes at follow-up
Tobacco and ENDS use in US Adults

Never smokers
Former smokers
Non-daily smokers
Daily smoker

(McMillen et al, 2015)
Adult ENDS ↔ Tobacco use

- **Tobacco → ENDS**
  - RCTs: Insufficient evidence
  - Observational: not occurring

- **ENDS → Tobacco?**
  Unknown

(McRobbie et al, 2014; Kalkhoran & Glantz, 2016)
Act 2: Tobacco and Marijuana Use

First, let look at some trends…
Past 30 days cigarette/cigar + marijuana use among youth reported product use (NSDUH)

(Kennedy et al, 2016)
Past 30 days cigarette/cigar + marijuana use among young adults reported product use (NSDUH)

(Kennedy et al, 2016)
Correlates and consequences of marijuana and tobacco co-use

• Correlates
  – Older age (2/3 studies, 66%)
  – African American (5/6 studies, 83%)
  – Mental health (e.g., externalizing symptoms, anxiety symptoms; 10/15 studies, 66%)
  – Parenting characteristics (e.g., authoritative parenting style; 2/2 studies, 100%)
  – School characteristics (e.g., education enrollment, good grades; 4/4 studies, 100%)
  – Exposure to violence (e.g., childhood sexual abuse; 2/2 studies, 100%)

• Consequences
  – Engaging in health risk behaviors (e.g., drug driving, unsafe sex; 3/3 studies, 100%)
  – Mental health symptoms (e.g., depressive symptoms and diagnosed depression; 4/4 studies, 100%)

(Ramo et al, 2012)
Tobacco ↔ Marijuana: “Gateway”

• Tobacco → Marijuana
  – 24 longitudinal studies
  – Most studies found a positive association between tobacco use and subsequent marijuana use

• Marijuana → Tobacco
  – 15 longitudinal studies
  – Most studies found a positive association between marijuana use and subsequent tobacco use

(Ramo et al, 2012)
### Tobacco → Marijuana dependence

- National Epidemiologic Survey on Alcohol and Related Conditions

<table>
<thead>
<tr>
<th>Tobacco type</th>
<th>Smoked only (AOR, 95% CI)</th>
<th>Smokeless only (AOR, 95% CI)</th>
<th>Both (AOR, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannabis abuse /dependence</td>
<td>1.55 (1.31, 1.83)</td>
<td>1.04 (0.69, 1.58)</td>
<td>1.68 (1.35, 2.10)</td>
</tr>
</tbody>
</table>

Adjusted for age, gender, race, poverty, education, census region, nativity, conduct disorder, major depression, anxiety disorder, panic disorder, social anxiety disorder, nicotine dependence, alcohol dependence, other illicit drugs, family history.

(Ford et al, 2002)
Marijuana → Nicotine addiction

- Baltimore Epidemiologic Catchment Area study
  - 431 adults <45 year-old smokers followed from 1981 to 1993-4 (13 years)

(Ford et al, 2002)
Act 3: Tobacco, ENDS, and Marijuana Use

Few studies have examined all three substance in the same sample.

Here are three examples, one focused on youth, one focused on young adults.
Monitoring the Future Study 2014

- 41,551 nationally representative 8th, 10th, and 12 graders

(Miech et al, 2016)
Legacy Youth Adult Cohort 2013

- 4,288 nationally representative 18-34 year-olds

% Current Marijuana Use

<table>
<thead>
<tr>
<th></th>
<th>P30D Smokers</th>
<th>P30D Cigar users</th>
<th>P30D ENDS user</th>
<th>P30D hookah user</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current marijuana use</td>
<td>27%</td>
<td>57%</td>
<td>42%</td>
<td>25%</td>
</tr>
<tr>
<td>Adjusted for age, gender, race/ethnicity, education.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Cohn et al, 2015)
So… sky falling?
# Summary

<table>
<thead>
<tr>
<th>%</th>
<th>Who?</th>
<th>Why?</th>
<th>Effect on use of other substance</th>
<th>Social &amp; Health outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco and ENDS</td>
<td>![Checkmark]</td>
<td>![Checkmark]</td>
<td>![Question Mark]</td>
<td>![Question Mark]</td>
</tr>
<tr>
<td>Tobacco and marijuana</td>
<td>![Checkmark]</td>
<td>![Checkmark]</td>
<td>![Checkmark]</td>
<td>![Question Mark]</td>
</tr>
<tr>
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<td>![Question Mark]</td>
<td>![Question Mark]</td>
<td>![Question Mark]</td>
<td>![Question Mark]</td>
</tr>
<tr>
<td>Tobacco, ENDS, and marijuana</td>
<td>![Question Mark]</td>
<td>![Question Mark]</td>
<td>![Question Mark]</td>
<td>![Question Mark]</td>
</tr>
</tbody>
</table>
Future research questions

• Are characteristics of marijuana users after legalization the same as those before legalization?
• Does ENDS worsen marijuana dependence? Or does marijuana worsen nicotine dependence through ENDS? Or both?
• What are the social and health outcomes of ENDS and marijuana co-use? Are they the same as those of tobacco and marijuana co-use?
• What are the trajectories of tobacco, ENDS, and marijuana co-use over time?
• How does the co-use of these products affect tobacco use disparities?
Questions?
My email: kelvin.choi@nih.gov

Special thanks to my fellows:
Dr. Sherine El-Toukhy
Dr. Melanie Sabado
Ms. Sarah Krosnick

http://www.rogerebert.com/reviews/thank-you-for-smoking-2006