The impact of current tobacco product use definitions on estimates of transitions between cigarette and e-cigarette use

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Background

- Definitions of **current tobacco product** use vary and depend on frequency of use, established use criteria, and the product type.
  - Established use: Do not-yet-established users count as “current” users?
  - Threshold of use: How frequently does an individual have to use to be a “current” user?
  - Product type: do the answers above differ for e-cigarettes vs cigarettes?

- It is not known how and to what extent estimates of **transition rates** between different tobacco products depend on the choice of current use definition.
Data

• PATH is a longitudinal study of tobacco use
• Waves 1–4 (2013–17)
• Include 24,309 adult participants (in at least two waves and no relevant missing data)
• Our variables are derived from questions about:
  • Established use of cigarettes or e-cigarettes/e-products
  • Number of days of use in the past 30 days of cigarettes and e-cigarettes/e-products
Methods – Multistate transition model

- Continuous time stochastic model tracking a person’s tobacco-use state through time estimates underlying transition hazard rates

Brouwer et al. (2020). Tobacco Control.
Example code is accessible at tcors.umich.edu
Analysis

• Estimate hazard rates for transitions between never, non-current, cigarette, e-cigarette, and dual user states
  • For different thresholds for current use
    • 1+, 10+, 20+, and 30 days of the past 30 days
  • With and without established use criteria
    • Cigarettes: has smoked at least 100 cigarettes
    • E-cigarettes: ever a fairly regular user of e-cigarettes

• Two classes of models
  • Infrequent (below threshold) users are classified as non-current users
  • Infrequent users are distinct from both non-current and frequent (above threshold) users
Tobacco use states

Infrequent users are non-current users

Never user

Non-current user

No cigarette

No e-cigarette

cigarette

e-cigarette

Infrequent users are distinct

Never user

Non-current user

No cigarette

No e-cigarette

Infrequent cigarette

Infrequent e-cigarette

Infrequent cigarette

Infrequent e-cigarette

Infrequent cigarette

Infrequent e-cigarette

Infrequent cigarette

Infrequent e-cigarette

Frequent cigarette

Frequent e-cigarette

Frequent cigarette

Frequent e-cigarette

Frequent cigarette

Frequent e-cigarette
Results – infrequent users are non-current

From
1. Never use
2. Non-current use
3. Exclusive cigarette use
4. Exclusive e-cigarette use
5. Dual use

To

Current, established users using at least 1 day in past 30

1-wave cumulative transition probability (%)
Including non-established users reduces persistence, especially for e-cigarette and dual use.
Transitions are largely robust to changing the threshold of use.

Using stricter definitions of use increases the fraction of ENDS users that transition to dual use, that is more frequent users of ENDS are more likely to pick up cigarettes.
## Results – infrequent users are distinct

Infrequent use is <30 days, frequent is 30 days

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Non-current</th>
<th>Infrequent cig</th>
<th>Frequent cig</th>
<th>Infrequent e-cig</th>
<th>Frequent e-cig</th>
<th>Infrequent dual</th>
<th>Infreq cig, freq e-cig</th>
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# Results – infrequent users are distinct

Infrequent use is <30 days, frequent is 30 days

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<th>Infrequent cig</th>
<th>Frequent cig</th>
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<th>Frequent e-cig</th>
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<tr>
<td><strong>Non-current</strong></td>
<td>93.3</td>
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<td>3.8</td>
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<tr>
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<tr>
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</tbody>
</table>

1-wave cumulative transition probability (%)

- **Infrequent cigarette users** are equally likely to stop using or increase use frequency in the next wave.
- **Frequent cigarette users** stay frequent cigarette users.
- **Infrequent e-cigarette users** are more likely to not be using than they are to be using more in the next wave.
- **Frequent e-cigarette users** are more likely to not be using than they are to be using more in the next wave.
- **Frequent e-cigarette users** mostly continue to be frequent e-cigarette users.
Unlike before, this class of models is robust to including non-established users.

<table>
<thead>
<tr>
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</tbody>
</table>

Non-established cigarette users **excluded**
Non-established e-cigarette users **excluded**
But, transitions involving infrequent use are not robust to changing the threshold of use.
Conclusions

• Product use definitions have important implications for assessing product use transitions and thus the public health implications of cigarette and e-cigarette control strategies.

• Transition models that treat infrequent users as non-current are more robust to thresholds of use and less robust to inclusion of non-established users.

• Transition models that treat infrequent users as distinct are less robust to thresholds of use and more robust to inclusion of non-established users.

• Greater attention needs to be placed on understanding patterns of infrequent use.
Acknowledgments

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