Latent Transition Analysis of Tobacco Use Frequencies for Multiple Products in US Adults

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Tobacco Regulatory Science Meeting
October 18, 2021
Disclosures and Funding

• Authors do not have any disclosures.

• This work was supported by funding from the National Institutes of Health and Food and Drug Administration (U54CA229974). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Food and Drug Administration.
Background

• In the context of multi-tobacco products, there are practical and computational challenges in characterizing the complexity and dynamism in tobacco use behaviors over time.

• There is particular interest in transitions between tobacco use products and behaviors.
  • transitions between single, dual and poly tobacco use
  • transitions in frequency and intensity of use, product switching, cessation and relapse.
Objectives

• Use Latent Transition Analysis (LTA) to identify latent states of tobacco use characterized by the tobacco product(s) used and the frequencies of use over time.

• Estimate transition probabilities between latent states of tobacco use
  • To higher/lower frequency of use
  • To more/less harmful tobacco product use

• Identify demographic factors associated with transitions
Methods

• PATH Waves 1-4 (2013-2018) Adult PUF (n=21284)
  • Analytic sample: Ever established tobacco users with no missing data (n=12036)

• Latent Transition Analysis
  • Tobacco products: Cigarettes, traditional cigars, cigarillos, filtered cigars, hookah, e-products, traditional smokeless tobacco, snus pouches
  • Past 30-day frequency of use: 0 (non-current), 1-25 (non-daily), and 26-30 days (daily)
  • Covariates: age, sex, sexual orientation, race/ethnicity, education, income

• Multivariate multinomial logistic regression identified demographics factors associated with transitions

• Accounted for survey design and longitudinal weights
Tobacco Use Latent States

- Daily Cigarette
- Daily Cigarette and Non-daily Polytobacco
- Daily E-product and Non-daily Cigarette
- Daily Smokeless and Non-daily Cigarette
- Non-daily Cigarette
- Non-daily Cigar/Pipe
- Non-Current
# Latent State Prevalence Rates

<table>
<thead>
<tr>
<th>Latent States of Tobacco Use</th>
<th>Wave 1</th>
<th>Wave 2</th>
<th>Wave 3</th>
<th>Wave 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Daily cigarette</td>
<td>29.7</td>
<td>28.9</td>
<td>28.8</td>
<td>29.0</td>
</tr>
<tr>
<td>2. Daily cigarette and polytobacco</td>
<td>7.4</td>
<td>6.0</td>
<td>4.8</td>
<td>3.8</td>
</tr>
<tr>
<td>3. Non-daily cigarette</td>
<td>9.8</td>
<td>9.5</td>
<td>8.4</td>
<td>8.0</td>
</tr>
<tr>
<td>4. Daily e-product and non-daily cigarette</td>
<td>2.4</td>
<td>3.3</td>
<td>3.6</td>
<td>3.6</td>
</tr>
<tr>
<td>5. Daily smokeless tobacco</td>
<td>4.9</td>
<td>4.8</td>
<td>4.7</td>
<td>4.8</td>
</tr>
<tr>
<td>6. Non-daily cigar</td>
<td>3.2</td>
<td>2.9</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>7. Non-current</td>
<td>42.5</td>
<td>44.7</td>
<td>46.9</td>
<td>48.2</td>
</tr>
</tbody>
</table>
### One-wave Transition Probabilities

<table>
<thead>
<tr>
<th>Previous wave state</th>
<th>Later wave state</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Daily cigarette</td>
<td></td>
<td>92.9</td>
<td>1.0</td>
<td>2.2</td>
<td>1.7</td>
<td>0.0</td>
<td>0.0</td>
<td>2.2</td>
</tr>
<tr>
<td>2. Daily cigarette and polytobacco</td>
<td></td>
<td>15.7</td>
<td>75.6</td>
<td>3.4</td>
<td>3.5</td>
<td>0.9</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>3. Non-daily cigarette</td>
<td></td>
<td>4.8</td>
<td>0.7</td>
<td>82.4</td>
<td>0.4</td>
<td>0.2</td>
<td>0.2</td>
<td>10.8</td>
</tr>
<tr>
<td>4. Daily e-product and non-daily cigarette</td>
<td></td>
<td>7.3</td>
<td>0.5</td>
<td>0.8</td>
<td>87.3</td>
<td>0.1</td>
<td>0.0</td>
<td>3.9</td>
</tr>
<tr>
<td>5. Daily smokeless tobacco</td>
<td></td>
<td>0.3</td>
<td>0.2</td>
<td>0.0</td>
<td>0.2</td>
<td>96.2</td>
<td>0.4</td>
<td>2.8</td>
</tr>
<tr>
<td>6. Non-daily cigar</td>
<td></td>
<td>0.1</td>
<td>0.7</td>
<td>0.5</td>
<td>0.9</td>
<td>0.0</td>
<td>90.1</td>
<td>7.8</td>
</tr>
<tr>
<td>7. Non-current</td>
<td></td>
<td>0.1</td>
<td>0.0</td>
<td>0.8</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>98.8</td>
</tr>
</tbody>
</table>
## Number of Transitions (n=33,996)

<table>
<thead>
<tr>
<th>Previous wave state</th>
<th>Later wave state</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1. Daily cigarette</td>
<td>12826</td>
</tr>
<tr>
<td>2. Daily cigarette and polytobacco</td>
<td>503</td>
</tr>
<tr>
<td>3. Non-daily cigarette</td>
<td>263</td>
</tr>
<tr>
<td>4. Daily e-product and non-daily cigarette</td>
<td>102</td>
</tr>
<tr>
<td>5. Daily smokeless tobacco</td>
<td>3</td>
</tr>
<tr>
<td>6. Non-daily cigar</td>
<td>1</td>
</tr>
<tr>
<td>7. Non-current</td>
<td>15</td>
</tr>
</tbody>
</table>
Demographic Factors Associated with Transition from Daily Cigarette Use (ORs)*

*Models adjusted for age, sex, sexual orientation, race/ethnicity, education and income
Demographic Factors Associated with Transition from Daily Cigarette Use (ORs)*

- **Daily Cigarette and Poly**
  - 2.36 (1.36, 4.10): NH Black (v. NH White)
  - 2.28 (1.17, 4.46): Sexual minority (v. Heterosexual)

- **Daily E-product**
  - 2.11 (1.17, 3.81): Age 18-24 (v. 55+)
  - 2.42 (1.48, 3.95): Age 25-29 (v. 55+)
  - 0.51 (0.32, 0.80): <High school (v. Some college or more)
  - 0.64 (0.43, 0.95): High school (v. Some college or more)
  - 0.54 (0.32, 0.89): Income <$50K (v. $101+)
  - 0.29 (0.13, 0.64): NH Black (v. NH White)

- **Non-daily Cigarette**
  - 0.55 (0.31, 0.99): Age 18-24 (v. 55+)
  - 0.58 (0.36, 0.92): Income <$50K (v. $101+)
  - 0.51 (0.28, 0.93): Income $51-$100K (v. $101+)
  - 3.21 (2.08, 4.94): NH Black (v. NH White)
  - 2.64 (1.63, 4.28): Hispanic (v. NH White)

- **Non-current**
  - 0.59 (0.43, 0.81): Age 35-54 (v. 55+)
  - 0.61 (0.45, 0.84): <High school (v. Some college or more)
  - 0.78 (0.53, 1.14): Income <$50K (v. $101+)

*Models adjusted for age, sex, sexual orientation, race/ethnicity, education and income
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Demographic Factors Associated with Transition from Daily Cigarette Use (ORs)*

*Models adjusted for age, sex, sexual orientation, race/ethnicity, education and income
Demographic Factors Associated with Transitions from Daily Cigarette and Polytobacco Use

1.81 (1.20, 2.71): Age 18-24 (v. 55+)
1.83 (1.21, 2.76): Age 25-29 (v. 55+)
0.66 (0.49, 0.88): NH Black (v. NH White)

4.14 (1.60, 10.71): Age 18-24 (v. 55+)
2.29 (1.12, 4.68): Male (v. Female)
0.30 (0.11, 0.78): <High school (v. Some college or more)
0.53 (0.33, 0.85): High school (v. Some college or more)
0.20 (0.10, 0.37): Income <$50K (v. $101+)
0.29 (0.13, 0.62): Income $51-$100K (v. $101+)

0.30 (0.11, 0.81): Income <$50K (v. $101+)
0.28 (0.09, 0.88): Income $51-$100K (v. $101+)
1.87 (1.11, 3.15): NH Black (v. NH White)
2.65 (1.27, 5.53): NH Other (v. NH White)

*Models adjusted for age, sex, sexual orientation, race/ethnicity, education and income
Demographic Factors Associated with Transitions from Daily Cigarette and Polytobacco Use

- Daily Cigarette
  - 1.81 (1.20, 2.71): Age 18-24 (v. 55+)
  - 1.83 (1.21, 2.76): Age 25-29 (v. 55+)
  - 0.66 (0.49, 0.88): NH Black (v. NH White)

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  - 2.29 (1.12, 4.68): Male (v. Female)
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  - 0.20 (0.10, 0.37): Income <$50K (v. $101+)
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- Non-daily Cigarette
  - 0.30 (0.11, 0.81): Income <$50K (v. $101+)
  - 0.28 (0.09, 0.88): Income $51-$100K (v. $101+)
  - 1.87 (1.11, 3.15): NH Black (v. NH White)
  - 2.65 (1.27, 5.53): NH Other (v. NH White)

*Models adjusted for age, sex, sexual orientation, race/ethnicity, education and income*
Demographic Factors Associated with Transitions from Daily Cigarette and Polytobacco Use

*Models adjusted for age, sex, sexual orientation, race/ethnicity, education and income
Demographic Factors Associated with Transitions from Daily Cigarette and Polytobacco Use

*Models adjusted for age, sex, sexual orientation, race/ethnicity, education and income
Demographic Factors Associated with Transitions from Daily E-product use

*Models adjusted for age, sex, sexual orientation, race/ethnicity, education and income
Conclusions and Implication

- There were distinct tobacco use latent states characterized by:
  - primary use of cigarettes, cigars, e-products and SLT
  - secondary use of cigarettes, and polytobacco use

- Latent states of tobacco use can inform measurement of *a priori* states.

- The ‘daily cigarette and poly tobacco’ use latent state may have the highest level of nicotine dependence among all states.

- Though about 4% of ‘daily e-product and non-daily cigarette use’ transition to non-current use (remission), almost twice as many transition to ‘daily cigarette use’.

- Demographic differences in transitions may influence tobacco-related health disparities.
Thank you!

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