# The Impact of Tobacco Use History on e-Cigarette and Cigarette Transition Patterns A Longitudinal Analysis of Population Assessment of Tobacco and Health (PATH) Study Lai Wei<sup>1</sup>, Ryan Black<sup>2</sup>, Raheema Muhammad-Kah<sup>2</sup>, Yezdi B.Pithawalla<sup>2</sup>, Simeon Chow<sup>1</sup>, and Thomas Bryan<sup>1</sup> <sup>1</sup>Consumer Insights and Engagement and <sup>2</sup>Research, Development & Sciences, Altria Client Services LLC, 601 East Jackson Street, Richmond, VA 23219, USA Altria SRNT 24th Annual Meeting, February 21 - 24, 2018, Baltimore, MD, USA Altria Client Services

# Introduction

ition Health Standard employed by the FDA in the evaluation of premarket tobacco product applications and modified risk tobacco product applications requires evaluating risks and benefits to the population as a whole. We have developed computational models to assess the overall population level impact of new tobacco products. To simulate the changes in tobacco use behaviors leading to mortality and prevalence projections, established tobacco user transitions are needed as input parameters for computational models. In 2011, the PATH study funded by the FDA Center for Tobacco Products was established to generate longitudinal data on tobacco-use behavior and health in the U.S. population. The longitudinal and comprehensive nature of the PATH dataset provides tobacco use transition patterns between cigarette and other tobacco products for computational models.

# Method & Definitions

Longitudinal data gathered from the first two waves of PATH Study, which involves 26,446 continuing adults from wave 1 (Sep 2013) to wave 2 (Dec 2014), were analyzed to explore transitional use patterns among different types of cigarette and/or e-cigarette users. The sample composition of continuing adults based on cigarette and e-cigarette wave 1 use status is shown in the pie chart with further breakdown based on experimental and established use patterns of cigarette and/or e-cigarette. Wave 1 to wave 2 transitions are analyzed using surveyfreq procedure in SAS 9.4. Multinomial logistic regression models were then employed to study factors that may be related to transition patterns between wave 1 and wave 2. The models accommodated the complex multistage sample survey design utilizing appropriate sampling weights using surveylogistic in SAS 9.4 following PATH User Guide.

#### Wave 1 Definitions

- Age: 18-24, 25-44, 45-64, 65+ (age specific results are not shown in the poster but are included in final analysis).
- Current use: Using everyday OR somedays now.
- Never User of Any Tobacco: Has never used any tobacco products to life-time criteria AND currently not using any tobacco products
- Exclusive cigarette smoker: Currently smoking cigarettes AND not using e-cigarettes - Experimental cigarette smoker: Smoked less than 100 cigarettes in entire life Established cigarette smoker: Has smoked 100+ cigarettes in entire life
- Exclusive e-cigarette user: Currently using e-cigarettes AND not smoking cigarettes
- Experimental e-cigarette user: Has not used e-cigarettes fairly regularly Established e-cigarette user: Has used e-cigarettes fairly regularly
- Dual user of cigarette and e-cigarette: Currently smoking AND using e-cigarettes • Experimental dual user: Has not smoked 100+ OR has not used e-cigarettes fairly regularly Established dual user: Has smoked 100+AND has used e-cigarette fairly regularly
- Other user: Has not used cigarette/e-cigarette to lifetime criteria AND is using other tobacco products

#### Wave 2 Definitions

- Current cigarette smoker: Smoking cigarette every day or somedays now and have smoked 100+
- Current e-cigarette user: Using e-cigarette every day or somedays now and have used e-cigarette fairly regularly
- W2 Cigarette: Currently smoking cigarettes AND not using e-cigarettes
- W2 E-cigarette: Currently using e-cigarettes AND not smoking cigarettes
- W2 Dual: Currently using both cigarettes and e-cigarettes
- W2 Neither: Currently not using cigarettes nor e-cigarettes

### **Multinomial Logistic Regression**

- The multinomial logistic regression models are fitted for three types of user groups:
- Exclusive Cigarette Smoker Group (Model 1)
- Dual User of Cigarette and E-cigarette Group (Model 2), and
- Exclusive E-cigarette User Group (Model 3).
- The outcome variable Wave 2 Use Status has four levels, i.e., W2 Cigarette, W2 E-cigarette, W2 Dual or W2 Neither. The following covariates have been included in the final models: age, gender, race/ethnicity, education background, poverty level, wave 1 cigarette/e-cigarette use status and years of smoking for cigarette smokers.

Note: Analysis of former and never users are not discussed in this poster but are considered in population models and will be included in an upcoming manuscript.

## References

PATH Study Public Use Files: User Guide. www.icpsr.umich.edu/icpsrweb/NAHDAP/studies/36498.

The PATH Study Team. (2017). Tobacco Use Transitions Among Youth and Adults: Descriptive Longitudinal Data From Wave 1 and 2 of the PATH Study. 2017 Society For Research On Nicotine and Tobacco Meeting, Florence, Italy. Ambrose, B. (2017). E-cigarette Use Transitions: a Case Study from Wave 1 & 2 of the PATH Study. 2017 Society For

Research On Nicotine and Tobacco Meeting, Florence, Italy. Rodu, B., & Plurphanswat, N. (2017). E-cigarette Use Among US Adults: Population Assessment of Tobacco and Health (PATH) Study. Nicotine & Tobacco Research.



Use Status with Wave 2 Status: Odds Ratio (OR) with 95% Confidence Interval (CI)

| lodel                                  | Wave 1 Use Status   | Wave 2<br>E-cigarette<br>OR (95%CI) | Wave 2<br>Dual<br>OR (95%CI) | Wave 2<br>Cigarette<br>OR (95%CI) | Wave 2<br>Neither<br>OR |
|--|---|-------------------------------------|------------------------------|-----------------------------------|-------------------------|
| Aodel 1                                | Experimental cigarette smokers  | 1[Reference]                        | 1[Reference]                 | 1[Reference]                      | 1[Reference]            |
| N=8613)                                | Established cigarette smokers<br>who have not used e-cigarette fairly regularly | 2.00<br>(1.08-3.71)                 | 8.58<br>(4.85-15.18)         | 8.02<br>(6.46-9.96)               | 1 [Reference]           |
|  | Established cigarette smokers<br>who have used e-cigarette fairly regularly     | 7.82<br>(2.78-22.00)                | 74.74<br>(29.68-188.22)      | 12.37<br>(6.29-24.35)             | 1 [Reference]           |
| Aodel 2                                | Experimental dual users   | 1[Reference]                        | 1[Reference]                 | 1[Reference]                      | 1 [Reference]           |
| nd E-cigarette Group<br>N=2340)        | Established dual users  | 3.99<br>(2.48-6.41)                 | 9.80<br>(6.14-15.64)         | 1.04<br>(0.69-1.57)               | 1 [Reference]           |
| <b>Nodel 3</b><br>xclusive E-cigarette | Experimental e-cigarette users who have not smoked fairly regularly             | 1[Reference]                        | 1[Reference]                 | 1[Reference]                      | 1 [Reference]           |
| N=580)                                 | Experimental e-cigarette users<br>who have smoked fairly regularly              | 1.93<br>(0.53-7.06)                 | 2.69<br>(0.28-26.09)         | 8.00<br>(2.05-31.25)              | 1 [Reference]           |
|  | Established e-cigarette users<br>who have not smoked fairly regularly           | 19.86<br>(6.28-62.79)               | 6.33<br>(0.74-53.82)         | 1.71<br>(0.33-8.73)               | 1 [Reference]           |
|  | Established e-cigarette users<br>who have smoked fairly regularly               | 47.12<br>(15.47-143.59)             | 57.48<br>(8.16-405.00)       | 12.39<br>(3.18-48.34)             | 1 [Reference]           |

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|                     |                   | 2% to E-cigarette   | PATH Wave 2               |
|---------------------|-------------------|---|---------------------------|
| okers               |                   | 1% to Dual<br>36% to Cigarette<br>61% to Neither  | 1% E-cigarette<br>4% Dual |
| okers<br>egularly   |                   | 1% to E-cigarette<br>4% to Dual<br>84% to Cigarette<br>10% to Neither                   | 76% Cigarette             |
|                     |                   | 4% to E-cigarette<br>23% to Dual<br>67% to Cigarette                                    | 18% Neither               |
| kers<br>arly        | $\longrightarrow$ | 7% to Neither   |                           |
|                     |                   | 4% to E-cigarette   | 5% E-cigarette            |
|                     |                   | 11% to Dual<br>68% to Cigarette   | 25% Dual                  |
|                     |                   | 17% to Neither<br>8% to E-cigarette<br>52% to Dual<br>34% to Cigarette<br>6% to Neither | 56% Cigarette             |
|                     |                   | $10\% \times 10\%$  | 13% Neither               |
| users<br>ularly     |                   | ** to Dual<br>9%* to Cigarette<br>79% to Neither  |                           |
| y<br>Sers<br>ularly |                   | 15% to E-cigarette<br>** to Dual<br>29% to Cigarette                                    | 45% E-cigarette           |
| sers<br>y           |                   | 52% to Neither<br>62% to E-cigarette<br>4%* to Dual                                     | 10% Dual<br>12% Cigarette |
|                     |                   | 7% <sup>*</sup> to Cigarette<br>26% to Neither<br>62% to E-cigarette                    | 33% Neither               |
|                     |                   | <ul><li>17% to Dual</li><li>9% to Cigarette</li><li>12% to Neither</li></ul>            |                           |

# Summary

- Analysis of transitions among various adult user groups shows different transition patterns. Transition behaviors among adult established users will be incorporated into population models to study the impact of allowing marketing of ecigarettes to the population as a whole.
- Multinomial logistic regression model results show:
- Compared to experimental cigarette smokers, established cigarette smokers are more likely to use e-cigarette at Wave 2
- Compared to experimental dual users, established dual users are more likely to stay in dual use at Wave 2; Compared with experimental e-cigarette users, established e-cigarette users are much more likely to keep using ecigarette exclusively at wave 2.
- The overall findings based on PATH wave 1 and wave 2 (2013-2014) data suggest that adult established tobacco users are more likely to become established e-cigarette users compared to adults experimenting with tobacco products.