# Center for the Assessment of Tobacco Regulations [CAsToR]

# Pilot Project Program
# Lightning Talk Sessions
# *January 2023*

## Live Sessions with Q & A
### *Wednesday, January 18 and Thursday, January 19, 2023*

Presentation slides / e-posters and supplemental materials will be posted online prior to the live sessions.

**TCORS 2.0**
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# WELCOME TO CAsToR'S PILOT PROJECT PROGRAM LIGHTNING TALK SESSIONS

The Center for the Assessment of Tobacco Regulations (CAsToR) at the University of Michigan and Georgetown University is hosting Pilot Project Program Lightning Talk Sessions on January 18 and 19, 2023.

To date, CAsToR has awarded funding for 21 pilot projects over four years. Open to new and early- stage investigators, the Pilot Project Program supports research projects that can inform the Food and Drug Administration's tobacco regulatory actions. You can read more about the pilot project program, including information about each project, here.

These Lightning Talk Sessions will provide you with the opportunity to learn about 11 research projects that have received funding as part of this program Pilot PIs will present their studies, including key findings, implications, and future directions in both asynchronous and synchronous formats. Pilot PIs will also share how their pilot project work has impacted their research careers.

- **Lightning Talk Sessions:** We will also host three live virtual Lightning Talk Sessions where each PI will provide a brief ~5-minute presentation of their research, followed by time for Q & A. The sessions will also be recorded for future viewing on the CAsToR website. The schedule and roster for each session is listed here, and registration for this event is here.

- **Online viewing:** Presentation slides/e-posters and supplemental materials will be posted here prior to the live sessions.

## REGISTER FOR THIS EVENT | VIEW ONLINE MATERIALS

# LIGHTNING TALK SESSIONS SCHEDULE

## Session 1: Tobacco Use Among Youth
### Wednesday, January 18, 2023: 1:30 - 2:30pm ET

***The effects of Tobacco 21 adoption on cigar sales in the US***
*Dr. Alex Liber, Georgetown University*

***Automating the detection of American adolescents at risk of e-cigarette dependence using machine learning***
*Dr. Rui "Ray" Fu, University of Toronto*

***The impact of individual decision making and social network structure on anti-tobacco program effectiveness and disparities in adolescent tobacco use behavior***
*Dr. Yuefan "Iris" Shao, University of California San Francisco*

***Cross State Border Nicotine Vaping Products Purchase - Early Evidence from State Emergency Sales Restrictions in 2019***
*Dr. Kai-Wen Cheng, Governors State University*

## Session 2: Tobacco Use Transitions
### Thursday, January 19, 2023: 11:30am - 12:30pm ET

***Determinants of tobacco use transitions among smokers and dual users of cigarettes and e-cigarettes***
*Dr. Andrew Brouwer, University of Michigan*

***Identifying causal pathways in longitudinal tobacco product transition studies***
*Dr. Shu "Violet" Xu, New York University*

***Predicting smoking behaviors using machine learning***
*Dr. Mona Issabakhsh, Georgetown University, and Dr. Thuy Le, University of Michigan*

***Substitutability of cigarettes for salt- and free-based ENDS devices in young adult ENDS users***
*Dr. Amanda Quisenberry, Roswell Park Comprehensive Cancer Center*

## Session 3: Tobacco Related Disparities
### Thursday, January 19, 2023: 1:00 - 2:00pm ET

***Trajectories of tobacco use, stress and health among U.S. transgender youth and adults***
*Dr. Luisa Kcomt, Wayne State University*

***Longitudinal trends in the prevalence of menthol cigarette use and disparities in use at sub-national levels by sex, age, and race/ethnicity: Findings from the International Tobacco Control US Surveys from 2002 to 2020***
*Dr. Pete Driezen, University of Waterloo*

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# ABSTRACTS

***The effects of Tobacco 21 adoption on cigar sales in the US – Dr. Alex Liber, Georgetown University***

Laws raising the minimum age of sale to 21 years of age for tobacco products (Tobacco 21 or T21 laws) proliferated across the US in the past decade, leading to the adoption of a federal T21 law in December 2019. By severing the social sources of tobacco products in US high schools, T21 appears to have helped further contain youth tobacco use. Prior research has confirmed that T21 policies have decreased both the use of tobacco products among young people and the sales of the cigarettes which young people smoke. However, little research has yet examined the effects of T21 passage on cigar use, the second-most used tobacco product among young people in the US. Glover-Kudon et al found that sales declines of large cigars and cigarillos declined faster than national trends after Hawaii and California passed the first state-level T21 laws in 2016. Little else has examined whether cigar smoking among young people has been affected by the proliferation of this important health policy.

To better understand the effects of T21 on youth cigar use, we will examine state-level cigar sales trends using Nielsen Company data. To gauge the effects on the young, we will focus on sales of cigar brands consumed disproportionately by young people that are expected to be affected by T21 adoption. Prior work on the effects of T21 has not captured the effects of important policy implementation differences across states, namely the presence of provisions that ban the purchase, use, and possession of tobacco products by young people, or the effects of cannabis legalization. By running an adequately powered study, this proposed project tackles these issues through four specific aims.

1. Identify which cigars are disproportionately used by youths and young adults: Using data from the Population Assessment of Tobacco and Health, Current Population Survey-Tobacco Use Supplement, and the National Survey on Drug Use and Health, we will identify which cigar brands, flavors, price bands (premium v. economy) and styles, are consistently consumed by those under the age of 21 in a manner out of proportion with total youth and young adult consumption of all cigars. Those brands, flavors, price bands and styles that are consistently consumed by youth and young adults in disproportionately high proportions across the surveys will be deemed "disproportionately young" while those which are consistently consumed in low proportions will be deemed "disproportionately old."

2. Describe pre- and post- T21 cigar sales trends: Using the Nielsen data from 30 states, we will test whether cigar sales are changed before and after T21 2 implementation using difference-in-difference techniques among total, disproportionately young, and disproportionately old brands.

3. Determine if key features of T21 laws including prohibitions on purchase, use, and possession (PUP) were associated with different sales trends: To control for state heterogeneity in tobacco youth access laws and to account for additional changes made beyond simply raising the minimum age of sale for

tobacco products, additional analyses will consider PUP rules and changes to them which came into effect with T21. The variety of PUP law changes range from Kentucky maintaining all PUP prohibitions when T21 was passed in that state to Maryland dropping all prohibitions on youth purchase use and possession of tobacco products when T21 was passed there. Understanding the effect of these policy choices is essential to developing best practices and avoiding potential harms from inequitably enforced policies.

4. Determine if T21 affected sales of cigars used disproportionately by youth and young adults: Replicating the techniques used in Liber et al, we will determine whether the true date of T21 implementation best predicts sales patterns for disproportionately young (treatment) and old (control) cigars compared to randomly generated alternative "placebo" dates of T21 implementation in a modified exact permutation test. The analyses will control for other relevant state policy levels and changes, such as PUP laws, cannabis legalizations, and tobacco taxation.

### Automating the detection of American adolescents at risk of e-cigarette dependence using machine learning – Dr. Rui "Ray" Fu, University of Toronto

INTRODUCTION: American adolescents are showing a concerning trend in frequent e-cigarette use (vaping) that might indicate signs of dependence. Although risk factors for vaping dependence have been assessed using conventional regression, these approaches have limitations when dealing with a large number of potential predictors and complex non-linear interactions. Furthermore, a practical model capable of accurately identifying adolescents at risk of vaping dependence has yet to be developed to allow for a timely intervention. As such, the overarching aim of this project is to develop and validate a random forest-based machine learning model to predict the status of frequent vaping—defined as nicotine-containing vaping in 20 or more days in the past 30 days—in 6 months after baseline. Using this model, we further identify the top predictors of frequent vaping and important interactions formed by sociodemographic variables to characterize vulnerable subgroups.

METHODS: Using the longitudinal survey data from the Los Angeles-based Happiness and Health Study, we focused on 12th-grade students who had ever tried an e-cigarette and followed them for 6 months. A wide range of 130+ candidate predictors were entered into a cross-validation process to construct and validate a random forest model. In a post-hoc analysis, we identified the top individual predictors of 6-month frequent vaping and depicted interactions formed by sociodemographic variables using a partial dependence-based method.

KEY FINDINGS: Among the 1281 ever-vaping 12th-grade students in the cohort, 40 (3.1%) reported frequent vaping at the 6-month follow-up. When compared to their infrequent vaping counterparts, frequent vapers were more likely to be male (80.0% vs. 46.3%), Asian (25.6% vs. 11.5%) or Native American/Pacific Islander (15.4% vs. 5.1%), and recipients of full-cost (61.8% vs. 43.8%) rather than reduced cost or free lunch at their school. Mothers of frequent vapers were more educated (percentage of mothers with high school diploma 89.1% vs. 75.8%), although the difference was absent between fathers (p-value=0.2). Frequent vapers also reported experiencing discrimination more often by scoring higher on average on the Everyday Discrimiation Scale (mean score=1.21 vs. 0.82). The random forest model demonstrated high predictive performance by reaching a test C-index of 0.87. Using 0.25 as a

decision threshold, this model had sensitivity of 0.88 (95% CI 0.62-0.98), specificity of 0.80 (95% CI 0.76-0.83), and accuracy of 0.80 (95% CI 0.76-0.83). Higher past-month nicotine concentration in vape, more daily vaping sessions, greater self-reported nicotine dependence, increased willingness to vape, more past-month puffs per vape, high perceived discrimination, negative cigarette smoking expectancies, past-month use of nicotine in vape, higher percentage of students receiving reduced-cost lunch at school, and past-month use of marijuana in vape were the top ten most important individual predictors of 6-month frequent vaping. Interactions were found between age and perceived discrimination and between age and race/ethnicity; specifically, students who were younger than their classmates and either reported experiencing discrimination often or identified as Asian or Native American/Pacific Islander were at increased risk of becoming frequent vapers in 6 months.

IMPLICATIONS: This study demonstrates the utility of machine learning in predicting the status of frequent vaping over 6 months and understanding predictors and nuanced intersectionality by sociodemographic attributes. The high performance of the random forest model has practical implications for a personalized risk calculator that supports a vaping prevention program. Public health officials need to recognize the importance of social factors that contribute to frequent vaping, particularly perceived discrimination. Youth subpopulations, including younger high school students and Asians or Native Americans/Pacific Islanders, might require specially designed interventions to help prevent habit-forming in vaping.

PUBLICATIONS: Dr. Fu was the lead author of an article resulting from her pilot project work. The article, published in Nicotine & Tobacco Research, is entitled "A Machine Learning Approach to Identify Predictors of Frequent Vaping and Vulnerable Californian Youth Subgroups" and is available [here](#).

### *The impact of individual decision making and social network structure on anti-tobacco program effectiveness and disparities in adolescent tobacco use behavior – Dr. Yuefan "Iris" Shao, University of California San Francisco*

Several existing tobacco product regulatory actions and changes in tobacco product characteristics, such as required warning messages displayed on cigarette packaging, provide an excellent opportunity for prevention among adolescent tobacco product users. However, evaluating the impact and sustainability of these regulatory actions on long-term adolescent tobacco use behaviors still faces tremendous obstacles, especially given mixed evidence of effectiveness in different target populations and persisting disparities among the socially disadvantaged. Extensive evidence has shown that social networks have a significant impact on information diffusion and behavioral choices, which are key determinants of long-term effectiveness of tobacco product regulations.

Using agent-based computational experiments, this project incorporated individual decision making and opinion dynamics over social networks into a social learning model to evaluate how individual decision making and diffusion over social networks collectively affect tobacco product regulation effectiveness. Findings from this project suggested that individual decision making and social network structural characteristics are both critical to the long-term effectiveness of tobacco product regulations. Ensuring communities' openness to adopt novel opinions alone can lead to reduced prevalence of harmful behaviors. When taking into consideration the presence of social networks, the presence of a highly clustered network does not imply more necessity or higher effectiveness of tobacco product regulations

as a result of network-based diffusion. Paradoxically, in more scattered networks with longer average path length, regulatory actions targeting individual incentives may be more effective. Findings from our model highlighted the importance of individual inertia in decision making in shaping the outcomes of tobacco product regulations.

### Cross State Border Nicotine Vaping Products Purchase - Early Evidence from State Emergency Sales Restrictions in 2019 – Dr. Kai-Wen Cheng, Governors State University

INTRODUCTION AND AIMS: Flavors in tobacco products have particularly strong appeal to youth and young adults. The FDA has considered banning flavors in non-cigarette tobacco products and menthol in cigarettes. This pilot grant focused on the period where several states implemented an emergency policy and prohibited flavored or non-flavored NVP sales in response to the EVALI outbreak in 2019 in the states of Washington (WA), Rhode Island (RI), and Massachusetts (MA). I used 2019 Nielsen Scanner data from Kilts Marketing Data Center Archive of the Nielsen Company at the University of Chicago Booth School of Business. I investigated the impact of a state-level NVP characterizing flavor ban on sales of restricted flavored or non-flavored NVPs. Further, I investigated potential cross-border shopping to get around sales restrictions by investigating NVP sales from the borders of surrounding states where flavored NVP sales were allowed. I contributed to the current literature by identifying NVP sales displacement due to cross-border purchase and quantifying the share of NVP sales displacement from states where sales of NVP flavors or NVPs were prohibited to states where NVP flavors or NVPs were allowed.

KEY FINDINGS: The findings indicated that flavored NVP sales declined significantly in WA, MA, and Rl after the implementation of non-flavored and/or flavored NVP sales restrictions in response to the EVALI outbreak in 2019. Potential displacements, such that individuals switched to non-restricted tobacco flavored NVPs and/or non-restricted retail channels, were identified. Findings indicated a significant increase in non-restricted tobacco flavored NVP sales after the flavor ban. Results also indicated that after WA imposed a flavor ban, weekly sales for the Washington-Oregon border area increased significantly by 69.4 (6%), 1169.7 (39%), and 2.4 (2%) (all p-values <0.01) for tobacco flavored, menthol/mint flavored, and other flavored NVPs, respectively, compared to sales in the non-border area. Similarly, after MA imposed an NVP sales ban, sales for the border areas in surrounding states, including New York, New Hampshire, Vermont, and Connecticut, increased significantly by 1637.16 (56%), 5196.78 (51%), and 276.74 (79%) (all p-values <0.01) for tobacco flavored, menthol/mint flavored, and other flavored NVPs, respectively, compared to sales for their non-border counterparts. Finally, after RI imposed its NVP flavor ban, sales from the border area in Connecticut increased significantly by 843.5 (47%), 1191.75 (16%), and 61.31 (18%) (all p-values <0.01) for tobacco flavored, menthol/mint flavored, and other flavored NVPs, respectively, compared to sales for their non-border counterparts.

PUBLICATIONS: Dr. Cheng is the lead author of a manuscript resulting from her pilot project work. The paper, under preparation, is entitled "Cross State Border Nicotine Vaping Products Purchase – Early Evidence from State Emergency Sales Restrictions in 2019" with Alex Liber and David Levy.

***Determinants of tobacco use transitions among smokers and dual users of cigarettes and e-cigarettes – Dr. Andrew Brouwer, University of Michigan***

INTRODUCTION: The introduction of e-cigarettes has dramatically changed the landscape of tobacco products and product-use patterns in the US. Although e-cigarettes have the potential to promote smoking cessation, their real-world impact remains uncertain. A systems approach can help to understand transitions between different patterns of tobacco and nicotine product use.

METHODS: The aims of this project were to leverage frequent follow-up data from the University of Wisconsin Center for Tobacco Research and Intervention's Exhale cohort of cigarette users and dual users of cigarettes and e-cigarettes (2015-2017) to 1) determine how transition rates between cigarette and e-cigarette use depend on sociodemographic, smoking behavior, smoking dependence, and smoking biomarker measures as well as 2) time since one's last transition. A supplementary aim was to develop a continuous spline estimator to facilitate estimation of the impact of continuous variables on transitions. In this project, we leveraged a multistate transition model, which is a type of continuous-time Markov chain model, to estimate the underlying transition hazard rates that collectively inform observed transition patterns as well as hazard ratios (HRs) comparing subgroups.

RESULTS: In this cohort, dual users were more likely to quit smoking than cigarette-only users, but the overall impact was small because most dual users returned to cigarette-only use. Moreover, e-cigarette dependence promoted continued dual use rather than smoking cessation. E-cigarette users motivated by harm or toxicity reduction or because of restrictions on where or when they could smoke had reduced rates of smoking relapse. Cigarette dependence and spousal smoking were barriers to cigarette cessation for dual users, while using e-cigarettes first in the morning, motivation to quit smoking, and sensory, social, and emotional enjoyment of e-cigarettes (secondary dependence motives) were facilitators of smoking cessation among dual users. The longer participants remained cigarette-only or dual users, the lower their propensity to transition to the other patterns of use, stabilizing around 8-12 months post-transition.

IMPLICATIONS: Ultimately, a better understanding of the barriers and facilitators of transitions can help to develop regulations and interventions that lead to more effective use of e-cigarettes for smoking cessation.

ACCOMPLISHMENTS: Dr. Brouwer was co-author on an article resulting from his pilot project work. The article, published in Nicotine & Tobacco Research, is entitled "Associations of demographics, dependence, and biomarkers with transitions in tobacco product use in a cohort of cigarette users and dual users of cigarettes and e-cigarettes" and is available here. This project also supported, in part, one published paper, one submitted paper, and one paper in preparation; four conference posters; several webinars and an instructional workshop; a U54 center renewal proposal; and a planned R21 proposal submission.

### *Identifying causal pathways in longitudinal tobacco product transition studies – Dr. Shu "Violet" Xu, New York University*

Prior studies have established an association between e-cigarette use in new tobacco users and subsequent uptake of cigarettes. Little is known, however, regarding mechanisms through which e-cigarette use leads to more severe tobacco use behaviors. The aim of this project was to use longitudinal data to evaluate *whether* and *how* initiators of e-cigarettes transition into more severe tobacco use behaviors. The data for the study were from the Population Assessment of Tobacco Research (PATH) study Waves 1 - 4. We conducted mediation analyses using the data from 7511 youth who initiated e-cigarette use or remained tobacco naive at Wave 2, reported harm perceptions of e-cigarette use at Wave 3 and current tobacco use at Wave 4. All potential confounders (e.g., demographics, drug use history, perception of harm) were reported at Wave 1.

Among the 7.3% (n = 546) of youth who initiated e-cigarette use at Wave 2, 47.4% (n = 259) perceived e-cigarette use as less harmful than cigarette use at Wave 3, and 33.7% (n = 184) became current tobacco users at Wave 4. Among the 92.7% (n = 6965) of youth who did not initiate e-cigarette use at Wave 2, 27.5% (n = 1912) perceived e-cigarette use as less harmful than cigarette use at Wave 3, and 9.4% (n = 654) became current tobacco users at Wave 4 (reported past-30-day use of any tobacco products including e-cigarettes, traditional cigarettes, cigars, chewing tobacco/snuff/dip, hookah, roll-your-own cigarettes, pipes, snus, dissolvable, bidi, or heated tobacco).

We used three estimation methods, the traditional mediation analysis, and two causal mediation analysis using resampling and weighting methods, to adjust for confounding in the causal pathways. The results of three methods consistently indicated that e-cigarette initiation is causally associated with lower perceived harm of e-cigarette use relative to cigarette use, which leads to subsequent current tobacco product use.

Publications: Dr. Xu was the lead author of an article resulting from her pilot project work. The article, published in Prevention Science, is entitled "Relationships Between E-cigarette Use and Subsequent Cigarette Initiation Among Adolescents in the PATH Study: an Entropy Balancing Propensity Score Analysis" and is available [here](#).

### *Predicting smoking behaviors using machine learning – Dr. Mona Issabakhsh, Georgetown University and Dr. Thuy Le, University of Michigan*

The United States' smoking prevalence has significantly decreased over time (from 23.3% in 2000 to 13.7% in 2018). Cigarette smoking, however, is currently responsible for about 480,000 deaths annually and is still a major public health issue. Identification of factors and policies driving the transition of individuals between never smokers, current smokers, and former smokers is a critical need.

Machine learning has been investigated widely in the last decades in various research studies and can recognize patterns and detect complicated relationships among data features, which humans are not able to do, to make accurate estimations, predictions, and decisions. Several studies have recently started to apply machine learning algorithms in tobacco research, such as smoker status classification

from narrative clinical texts, and tobacco-related outcome prediction using administrative, survey, or clinical trial data. Current literature on smoking prevalence mainly employs mathematical and statistical models, accounting for few predictors (e.g., age, sex, and race). Complex multistate Markov models are established for smoking prevalence prediction, considering more predictors (e.g., age, sex, race, education, and income). These models focus only on a limited number of factors and policies to explain the transition of individuals between never, current, and former smokers. Another disadvantage of these models is that the state transition rates must be estimated, which increases the complexity of the model development. Machine learning algorithms make use of a flexible model structure with little or no parameter estimations, allowing for rapid updates and modifications. Machine learning also enables more efficient use of massive data for tobacco research by accounting for multiple predictors and policies and the discovery of complex patterns in large datasets to produce high-quality estimations and predictions. Given the enormous data on tobacco use, both cross-sectional and longitudinal, machine learning is a promising tool to leverage all the available data.

For this study, we will apply machine learning classification models to group individuals by smoking status (never, current, and former cigarette use). Classification is a supervised machine learning methodology that determines which class the dependent variable (response) belongs to, based on one or more independent variables (predictors). Classification algorithms involve predicting a qualitative response for an observation, or in other words, assigning the observation to a category or class. A classification algorithm learns from labeled data. After understanding the data, it determines how to best map input data to specific class labels by associating patterns to the unlabeled new data and learns how to assign labels to the new data. The dataset, therefore, must sufficiently represent the problem and have multiple examples of each class label. Many possible classification techniques or classifiers are available in the literature.

The specific aims of this project are:

Aim 1: Develop and train machine learning classifiers using the PATH data from earlier waves ( waves 1-2) to find the key variables involved in the transition of individuals between never smokers, current smokers, and former smokers.
Expected Outcomes. The model of each classifier will be developed with relevant features from the PATH survey, and the classifiers will be trained to detect the smoking status of individuals, using the trained dataset.

Aim 2: Compare the performance of the trained classifiers and select the best one(s).
Expected Outcomes. The best classifier(s) will be selected to predict the smoking behavior of individuals.

Aim 3: Validate and test the performance of the selected classifiers using the PATH data from later waves (waves 3-5).
Expected Outcomes. This study produces an exploratory model to understand how individuals' transitions between never, current, and former smokers happen over time, and to provide insights into which attributes and policies are relevant to an individual's decision to initiate or quit smoking.

### *Substitutability of cigarettes for salt- and free-based ENDS devices in young adult ENDS users – Dr. Amanda Quisenberry, Roswell Park Comprehensive Cancer Center*

The recent increase in electronic nicotine delivery systems (ENDS) use among youth and young adults and associated nicotine dependence may increase the risk for uptake of other tobacco products in this population. We must understand both the conditions in which young users of ENDS may switch to using cigarettes, which are more toxic, and the associated regulatory efforts that may curb these transitions to protect the health of these young people.

This study aimed to identify: 1) the actions of ENDS salt-base nicotine users when their ENDS device increases in price and 2) if menthol cigarettes are stronger substitutes than non-menthol cigarettes. Participants (n=9) were endowed with an account balance based on their baseline intake of tobacco products for use in an online purchasing analog called the Experimental Tobacco Marketplace (ETM). The ETM included a variety of tobacco products, including menthol and non-menthol cigarettes, available for purchase at constant prices while the price of the participants' ENDS product increased (¼ market price (MP), ½ MP, MP, 2X MP, and 4X MP).

All participants have been salt-based young adult users of ENDS. Preliminary ETM findings with nine participants show a decrease in purchasing of their ENDS product as price increased. Their average number of ENDS product purchases were 3.1 at ¼ MP, 1.5 at ½ MP, 1.5 at MP, 1 at 2X MP, and 0.5 at 4X MP. They, however, did not choose to substitute with cigarettes, either menthol or non-menthol. Only three of the participants selected any alternative products no matter the price of their ENDS product. One of those participants chose to substitute with IQOS smooth menthol heat sticks at 2X and 4X the MP for their ENDS product, another chose to substitute smooth menthol and tobacco IQOS at ½ - 2X MP, and the third chose to substitute On! mint flavor at 4X market price for their ENDS product. These substitution results could suggest that the menthol and mint flavoring is an appealing factor related to choice of alternative tobacco products among current users.

Results should be interpreted cautiously given that only nine participants have completed the study. Recruitment is ongoing.

***Nicotine/tobacco use among gender-fluid and gender-stable adolescents and adults in the U.S. – Dr. Luisa Kcomt, Wayne State University***

INTRODUCTION: Prior work has shown that nicotine/tobacco use is more prevalent among transgender populations (individuals whose gender identity differs from their assigned sex at birth) relative to cisgender populations (i.e., non-transgender individuals). There remains a paucity of information on gender-fluid individuals (i.e., persons who experience changes in their gender identity over time) and nicotine/tobacco use. We aimed to estimate the prevalence of nicotine/tobacco use among U.S. adolescents and adults who are fluid versus stable in their gender identities.

METHODS: We fit multivariable logistic regression models to data from Waves 2 to 4 (2014/15 to 2016/18) of the Population Assessment of Tobacco and Health (PATH) Study ($N$ = 33,197 U.S. individuals aged 14 years and older). We examined associations of gender stability/fluidity over three waves with nicotine/tobacco use at wave 4. Differences in any past 30-day tobacco, cigarette, e-cigarette, other tobacco, and poly-tobacco use were assessed among cisgender-stable, transgender-stable, and gender-fluid participants. All models adjusted for sex, age, race/ethnicity, geographic region, sexual stability/fluidity, and past-year psychological distress.

RESULTS: An estimated 1.0% of adolescents and adults were classified as gender-fluid. Prevalence of any past 30-day tobacco use was higher among gender-fluid individuals (42.7%) than among gender-stable individuals (transgender-stable, 37.8% and cisgender-stable, 26.7%). Evidence suggests that gender-fluid participants had significant increased odds of any past 30-day tobacco use (adjusted odds ratio [AOR] = 2.0, 95% confidence interval [CI] = 1.3, 3.0), cigarette use (AOR = 1.7, 95% CI = 1.1, 2.5), e-cigarette use (AOR = 2.2, 95% CI = 1.4, 3.5), other tobacco use (AOR = 2.2, 95% CI = 1.4, 3.4), and poly-tobacco use (AOR = 2.0, 95% CI = 1.3, 3.1) compared with cisgender-stable individuals.

CONCLUSIONS: Gender-fluid individuals are at higher risk for nicotine/tobacco use, placing them at greater risk for tobacco-related health consequences. Healthcare providers and tobacco cessation specialists should develop an awareness of gender diversity and understand changes over time to create a welcoming, inclusive environment for individuals who do not subscribe to a fixed, binary conceptualization of gender.

PUBLICATIONS: Dr. Kcomt was the lead author of an article resulting from her pilot project work. The article, published in Nicotine & Tobacco Research, is entitled "Tobacco Use among Gender-Varying and Gender-Stable Adolescents and Adults Living in the U.S." and is available here.

***Longitudinal trends in the prevalence of menthol cigarettes use and disparities in use at sub-national levels by sex, age, and race/ethnicity: Findings from the International Tobacco Control US Surveys from 2002 to 2020 – Dr. Pete Driezen, University of Waterloo***

**Background**: Targeted marketing of menthol cigarettes in the United States influences disparities in the prevalence of menthol smoking across demographic groups. Nationally, menthol use has increased since 2004. However, there are no sub-national data documenting differences in menthol use across demographic subgroups. The primary objective of this study was to estimate trends in the prevalence of

menthol use among current adult smokers for the nine US census divisions by sex, age group, and race/ethnicity from 2002-2020.

**Methods**: Data from 12 waves of the US ITC Survey (2002-2020) were used to estimate the prevalence of menthol use across census divisions and demographic subgroups using multilevel regression and poststratification (n=12,020), a type of small area estimation model. Weighted multilevel logistic regression was used to predict the prevalence of menthol use in 72 cross-classified groups of smokers defined by sex, age, race/ethnicity, and socioeconomic status. Division-level effects were with a random intercept. Fixed effects were sex (female, male), age group (18-29, 30-49, vs. 50+), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, all others), socioeconomic status (defined as a composite measure of income and education), survey wave, and the division-level labor force participation rate. Interaction effects between sex, age, and race/ethnicity were also fit, along with a random slope for race/ethnicity.

In the poststratification step, predicted prevalence was then weighted by the total number of smokers in each cross-classified group, estimated from the Behavioral Risk Factor Surveillance System and American Community Surveys, and aggregated to divisions within demographic subgroup. Estimates were validated against data from the Tobacco Use Supplement of the Current Population Survey (TUS-CPS).

**Results**: The overall modeled prevalence of menthol use was similar to external TUS-CPS estimates (concordance correlation=0.932: precision=0.966, accuracy=0.965), although precision and accuracy declined for sex-specific estimates stratified by race/ethnicity. The prevalence of menthol use increased in each division from 2002-2020. By 2020, prevalence was highest in the Middle Atlantic (46.3%) and South Atlantic (43.1%) and lowest in the Pacific (25.9%) and Mountain (24.2%) divisions. Prevalence was consistently higher among smokers aged 18-29 (vs. 50+) and females (vs. males). Prevalence exceeded 80% among Black smokers in the Middle Atlantic, East North Central, West North Central, and South divisions in all years but only reached 59.0% in the Mountain division in 2020. Prevalence varied most among Hispanic smokers, ranging from 26.5% in the Pacific to 55.3% in New England in 2020.

**Implications**: There was significant variation in the prevalence of menthol use among current smokers across US census divisions from 2002-2020. Prevalence was highest among Black smokers, and varied the most among Hispanic smokers. Results suggest the proposed US FDA menthol ban may exert differential effects across geographic and demographic subgroups, requiring tailored cessation support for smokers following the FDA ban.