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Home Smoking and Vaping Policies among US Adults: Results from the Population Assessment of Tobacco and Health (PATH) Study, Wave 3

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Abstract

We examined the prevalence of home smoking and vaping restrictions among US adults, and compared home policy differences for smoking and vaping among vapers, smokers, and dual users.

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Author contributions

DL, DJO: Conceived and designed the Study; DL, HS: analyzed the data; DL, HS, ZX, IR, and DJO: wrote and edited the manuscript; SM, MBT, JW, JD contributed to interpreting results and editing the manuscript.

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Data Availability: The PATH Wave 3 data can be publicly accessed from the National Addiction & HIV Data Archive Program (NAHDAP) website public user files (https://www.icpsr.umich.edu/icpsrweb/NAHDAP/studies/36498/datadocumentation).

Secondary data from the Population Assessment of Tobacco and Health (PATH) Study Wave 3 (2015 – 2016) with 28,148 adults were analyzed using weighted multivariable logistic regression models that account for complex sampling design to compare differences in home policies among non-users, vapers only, smokers only, and dual users.

Compared to never-users, current vapers who were ex-smokers and dual users were more likely to allow home vaping (aOR = 11.06, 95% CI: 8.04 – 15.21; aOR = 6.44, 95% CI: 5.01 – 8.28) and smoking (aOR = 1.62, 95% CI: 1.19 – 2.22; aOR = 3.58, 95% CI: 2.88 – 4.45). Current smokers were more likely to allow vaping (aOR = 3.53, 95% CI: 3.06 – 4.06) and smoking (aOR = 4.27, 95% CI: 3.73 – 4.89) inside the home than never-users. Current vapers who never smoked were more likely to allow vaping inside the home than never-users (aOR = 2.45, 95% CI: 1.53 – 3.93). Vapers reported much lower rates of vape-free home policies relative to both their smoke-free home policies and to vape-free home policies among smokers.

Vapers may be using e-cigarettes in hopes of harm reduction, but interpreting “harm reduction” as safe, thus exposing non-users in their homes to second- and thirdhand aerosols. This underscores the need to healthcare providers to extend intervention with vapers to include implementing vape-free home policies.

Introduction

The health effects from cigarette smoking and associated risks from secondhand smoke exposure are well studied [1–3]. Although long-term effects of exposure to secondhand aerosol (SHA) on health are still unknown, the toxicants in e-cigarette aerosol include nicotine, carbonyls, ultrafine particulates, heavy metals and volatile organic compounds [4], which are substances known to be biologically associated with cardiovascular disease [5] and carcinogenesis [6] in other contexts. Hess et al. systematically reviewed 16 studies before 2015 on health risks from e-cigarette SHA and concluded that although they are at lower risk compared to conventional tobacco smoke, bystanders who are passively exposed to SHA are at risk of inhaling numerous pollutants that are known to be associated with developing respiratory diseases in different contexts [7]. A recent study also found an association between SHA exposure and increased risk of asthma exacerbations in children [8]. Previous studies have found that e-cigarette aerosol includes high concentration of ultrafine particles (even higher than cigarette smoking), which can worsen respiratory disease symptoms like asthma and might trigger heart attack [9–12]. One of the primary components in the e-cigarettes aerosol is propylene glycol, which is a chemical that can generate known carcinogens when heated, and can cause eye, throat, and airway irritation with short-term exposure [13,14]. Previous experimental studies on human lung cells also found the exposure to e-cigarette aerosols could damage lung tissues with increased oxidative stress and inflammatory response [15]. In addition, nicotine and other chemicals deposited on indoor surface from e-cigarette aerosols increases the risk of third-hand exposure [16–18].

The public perceptions of harms associated with secondhand exposure to e-cigarette aerosol are low [19]. A recent study found only 1 in 5 adults would ask others not to vape in public places compared with 1 in 2 adults who would ask others not to smoke in public places (restaurants, bars, and parks) [20]. Data from an online survey in 2015 showed that almost

40% of US adults failed to identify potential harms of SHA on children (i.e., either responded “no harm” or “don’t know”) [21]. Similarly, a recent national survey of public knowledge regarding composition of e-cigarette SHA on US adults found that 58%–75% of the respondents reported not knowing whether SHA contained only water vapor as e-cigarette companies marketed [22]. Social media may also be influencing people’s opinions about the relative risks of SHA. A recent review of e-cigarette related messages in social media found that e-cigarettes were perceived healthier and safer than traditional tobacco products on social media, and the smoke-free aspect of vaping was usually highlighted and promoted to be used where tobacco is restricted [23]. Similarly, a recent study found adult vapers perceived advantages for their social environment (i.e., safety for bystanders) when switching from smoking to vaping, while youth vapers highlighted the trendiness of vaping as a perceived benefit [24]. This misinformation may be influencing conclusions that users and nonusers of electronic products reach about the harms from both use and exposure to SHA from these products, particularly in their personal environment including their homes.

Based on the analysis of Tobacco Use Supplement to the Current Population Survey (TUS-CPS) over two decades, the overall prevalence of smoke-free home policies in the U.S. increased from 43.0% (1992–1993) to 83.0% (2010–2011) [25]. Although increases were observed among both households without smokers (from 56.7% to 91.4%) and those with at least one smoker (from 9.6% to 46.1%) [25], a smoking ban at home is still much less likely reported by a current smoking respondent compared with a nonsmoker. The reported statistically significant adjusted odds ratio (aOR) of not having a complete home smoking ban among current smokers (compared to nonsmokers) ranged from 2.08 to 7.90 in the U.S. based on different populations [26–32]. Among smokers, home bans may be further influenced by factors such as time to first cigarette in the morning, number of cigarettes per day, and whether or not there are children in the household [26,33–35]. Home smoking bans not only reduce secondhand smoke risk for other household members, but the consistent adoption of a smoke-free home policy may also help reduce tobacco consumption among smokers [36]. Further, youth smoking behaviors can be influenced by home smoking ban [37]. Overall, the receptivity to a home smoking ban among young adults was associated with both their own and their parents’ smoking status [38]. Previous studies showed that restrictions on smoking at home were associated with reduced smoking uptake and prevalence in teenagers [39,40]. Interestingly, however, one study found that a complete home smoking ban was associated with an increase in odds of youth smoking onset when both parents were smokers, possibly due to inconsistent household message about smoking[41].

Few studies have examined home policies regarding vaping, or compared vaping policy differences between smokers, vapers, and dual users. An internet-based panel survey conducted in 2017 on 4,107 US adults has found that respondents with high income, greater education, and children less than 18 years old at home were more likely to have vape-free home policies. Meanwhile, respondents living with e-cigarette or other tobacco product users were less likely to prohibit vaping inside the home [42]. A recent examination of parent interviews conducted in 2017 in five pediatric practices found that parent dual users were more likely to have smoke-free than vape-free home policies, suggesting that some may perceive e-cigarette aerosol as safe for indoor use [43]. Using recently released nationally representative Population Assessment of Tobacco and Health (PATH) Wave 3 data, we aim

to examine the prevalence of smoking and vaping restrictions at homes among US adults and compare the differences in home vaping policies across smokers, vapers, and dual users. This is the largest study to date to compare home smoking and vaping rules across different categories of tobacco product use including never-users, ex-smokers, current vapers who never smoked, current vapers who were ex-smokers, current smokers, and dual users.

Methods

Study Population

The study was conducted using the nationally representative, cross-sectional PATH Wave 3 data collected from October 19, 2015 to October 23, 2016 on 28,148 adults (18 years and older) [44]. The PATH study includes both tobacco and electronic nicotine product users and nonusers; the current analyses focus on adult cigarette smokers, e-cigarette users and non-tobacco users. The cross-sectional PATH Wave 3 data were de-identified open-source data that are publicly available from the National Addiction & HIV Data Archive Program (NAHDAP) website (https://www.icpsr.umich.edu/icpsrweb/NAHDAP/studies/36498/datadocumentation).

Current Vaping and Smoking Status

Using multiple derived variables from the cross-sectional PATH Wave 3 data, we defined current smoking and vaping status based on current established cigarette smoking status, current established e-cigarette using status, and whether subjects had completely quit. We excluded all subjects who were currently established users of traditional cigars, cigarillos, filtered cigars, blunts only, pipes, hookah, snus pouches, smokeless tobacco, or dissolvable tobacco to have a clean vaping and cigarette smoking status. Currently established cigarette smokers were adult respondents who have smoked at least 100 cigarettes in their lifetime, and currently smoke every day or some days. Currently established e-cigarette users were adult respondents who had ever used an e-cigarette, had ever used fairly regularly, and currently used every day or some days. Current vaping and smoking status was defined according to the “yes” or “no” values of the three derived variables. The current vaping and smoking status included six categories: 1) dual users (“yes” values to both the current established cigarette smoker variable and the current established e-cigarette user variable), 2) current smokers (a “yes” value to current established cigarette smoker variable and a “no” value to current established e-cigarette user variable), 3) current vapers who were ex-smokers (a “no” value to current established cigarette smoker variable and a “yes” value to current established e-cigarette user variable and a “yes” value to have completely quit smoking cigarettes variable), 4) current vapers who never smoked (a “no” value to current established cigarette smoker variable and a “yes” value to current established e-cigarette user variable and an “inapplicable” or “have never smoked a cigarette in entire life, not even one or two puffs” value to have completely quit smoking cigarettes variable), 5) ex-smokers (“no” values to both the current established cigarette smoker variable and the current established e-cigarette user variable and a “yes” value to have completely quit smoking cigarettes variable), 6) never-users (“no” values to both the current established cigarette smoker variable and the current established e-cigarette user variable and an “inapplicable” or

"have never smoked a cigarette in entire life, not even one or two puffs" value to have completely quit smoking cigarettes variable).

Outcome Variables and Covariates

Smoke-free and vape-free home policies were examined among the six categories of current vaping and smoking status. The smoke-free home policy variable was created from the statement that best describes rules about smoking a combustible tobacco product inside your home (PATH question: "Please think about everyone who might be in your home including children, adults, visitors, guests, or workers. For tobacco products that are burned, such as cigarettes, cigars, pipes or hookah, which statement best describes the rules about smoking a tobacco product inside your home?") [45]. The smoke-free home policy variable has two categories: 1) not allowed and 2) allowed. The "not allowed" category is the value of "It is not allowed anywhere or at any time inside my home" in the statement, while the "allowed" category combines the value of "It is allowed anywhere and at any time inside my home" and "It is allowed in some places or at some times inside my home" in the statement [45]. Similarly, the vape-free home policy was created from the statement that best describes rules about using e-cigarettes and other electronic nicotine products inside your home (PATH question: "Now think about e-cigarettes and other electronic nicotine products. Which statement best describes the rules about using these products inside your home?") [45]. The vape-free home policy variable also has two categories: 1) not allowed (It is not allowed anywhere or at any time inside my home) and 2) allowed (either it is allowed anywhere and at any time inside my home or it is allowed in some places or at some times inside my home). Subjects who answered "Don't know" or "Refused" to those two questions were excluded from the data analysis.

Covariates adjusted for in the data analysis included age categories, sex, marital status, race/ethnicity, education level, income level, insurance status, currently live with anyone who is a smoker, and currently live with anyone who is a vaper, frequency of smoking in lifetime, and frequency of vaping in lifetime.

Statistical Analysis

We used weighted frequency distributions and the Rao-Scott Modified Likelihood Ratio test to examine the association between covariates/outcomes and current vaping and smoking status. Multi-collinearity among covariates was examined using variance inflation factor (VIF) and no multi-collinearity was found among covariates. Listwise deletion was used to deal with missing values for the outcomes, predictor variables, and covariates. The associations of current vaping and smoking status with home vaping and smoking policies were examined by univariable and multivariable weighted logistic regression models. The first multivariable weighted logistic regression models included only the main effects. The moderation effects of important demographic variables were examined using the second multivariable weighted logistic regression models with both the main effects and interactions (current vaping and smoking status with important demographic variables). Linear contrasts were used to estimate the odds ratios of outcome variables for comparing different smoking and vaping status groups with never-users at each level of the moderators. The covariates were selected using purposeful model selection process [46]. We adjusted the covariates in the

multivariable weighted logistic regression models and used the balanced repeated replication (BRR) method to form replicate weights in variance estimation to account for the complex sampling design. Odds ratios and 95% confidence intervals were calculated to measure the associations of current vaping and smoking status with home vaping and smoking policies. Analyses were conducted using the proc survey procedures in SAS v9.4 (SAS Institute Inc., Cary, NC), with a .05 significance level for two-sided tests.

Results

Prevalence of allowing smoking and vaping inside home

The weighted prevalence of allowing smoking and vaping inside homes from the PATH Wave 3 data were 16.22% (95% CI: 15.48% – 17.00%) and 20.59% (95% CI: 19.76% – 21.45%) respectively. The PATH wave 3 data set included 606 dual users (1.42%, 95% CI: 1.28% – 1.59%), 412 current vapers who were ex-smokers (0.99%, 95% CI: 0.87% – 1.13%), 104 vapers who never smoked before and currently use e-cigarette exclusively (0.18%, 95% CI: 0.13% – 0.24%), 6,104 current smokers (14.56%, 95% CI: 14.03% – 15.11%), 6,315 ex-smokers (34.79%, 95% CI: 33.75% – 35.85%), and 8,728 never-users (47.84%, 95% CI: 46.55% – 49.13%). Table 1 shows the weighted prevalence of allowing smoking and vaping inside homes across current vaping and smoking status categories. Rates of allowing combustible tobacco product use inside the home varied across the main categories of tobacco product users including never-users, ex-smokers, current vapers who never smoked and now use e-cigarette exclusively, current vapers who were ex-smokers, dual users, and current smokers. Similarly, rates of allowing e-cigarette use inside the home also varied across the main categories of tobacco product users.

Comparison of home smoking and vaping policies among different smokers/vapers groups

Adjusted odds ratios of allowing combustible tobacco product use or allowing e-cigarette use inside the home, using never-users as the reference group, were calculated. Compared to never-users, current vapers who were ex-smokers were more likely to allow combustible tobacco product use (aOR = 1.62, 95% CI: 1.19 – 2.22) and much more likely to allow e-cigarette use inside their homes (aOR = 11.06, 95% CI: 8.04 – 15.21). Current vapers who never smoked and now use e-cigarettes exclusively were also more likely to allow combustible tobacco product use (aOR = 1.89, 95% CI: 1.14 – 3.14) and e-cigarette use inside their homes than never-users (aOR = 2.45, 95% CI: 1.53 – 3.93).

Similar to current vapers who were ex-smokers, dual users were more likely to allow combustible tobacco product use (aOR = 3.58, 95% CI: 2.88 – 4.45) and e-cigarette use inside their homes (aOR = 6.44, 95% CI: 5.01 – 8.28) compared to never-users. Current smokers were also more likely to allow combustible tobacco product use (aOR = 4.27, 95% CI: 3.73 – 4.89) and e-cigarette use inside their homes (aOR = 3.53, 95% CI: 3.06 – 4.06) than never-users. The policies of ex-smokers for combustible tobacco product use inside their homes were not significantly different from never-users (aOR = 1.05, 95% CI: 0.88 – 1.25), although they were slightly more likely to allow e-cigarette use inside their homes than never-users (aOR = 1.35, 95% CI: 1.15 – 1.58).

Characteristics of PATH Wave 3 adult respondents across current vaping and smoking status categories

Table 1 also shows the characteristics of PATH Wave 3 adult respondents across current vaping and smoking status categories. We note that current vapers who never smoked and now use e-cigarettes exclusively were mainly young adults (81.68% from age 18–34), with a majority of them never married (75.77%); conversely, ex-smokers who did not vape or smoke were mainly middle-aged adults or seniors. Males were more likely to vape than females. Never-users and ex-smokers were more likely to be married than vapers, smokers and dual users. Dual users and current smokers were more likely to live with another smoker than current vapers, while current vapers were more likely to live with someone who currently vapes than currently smokes.

Moderation effects of age, sex, marital status, and living with smokers or vapers

Table 2 and 3 showed the moderation effects of age, sex, marital status, and living with smokers or vapers on the association of smoking and vaping status with the probability of allowing combustible tobacco product use or vaping inside home. The age categories of respondents included three levels: < 35, 35–64, and ≥65, which were used to denote young adults, middle-aged adults, and older adults. When comparing vapers who were ex-smokers to never users, respondents who were young adults or older adults or not living with smokers or not living with vapers (regardless of their sex and marital status) were more likely to allow vaping inside home than smoking. Dual users who were less than 65 years old or female or married or not living with smokers or vapers were more likely to allow both smoking and vaping inside the home when compared to their ex-smokers and never-users counterparts. Regardless of sex, those who were living with a smoker, young and married dual users were more likely to allow vaping inside home than their current smoker, ex-smoker, and never user counterparts.

Discussion

Principal findings

Using the nationally representative PATH Wave 3 cross-sectional data, the present study found that all vaping groups (including dual users) were more likely to allow vaping than smoking inside the home. This discrepancy is greatest among vapers who are ex-smokers, as observed from both the significantly different weighted prevalence and adjusted odds ratios. Vapers who are ex-smokers are also much less likely to have vape-free home policies relative to smokers, for whom the rates of smoke-free vs. vape-free home policies does not differ. Vapers who are ex-smokers are more likely to have smoke-free home policies relative to smokers and dual users.

These discrepancies between home smoking and vaping policies among vapers and between vapers and smokers suggest that vapers are switching to e-cigarettes or using e-cigarettes because they perceive that they are harm reducing, which they may be interpreting as “safe” and thus exposing others to e-cigarette aerosol in the home where they do not allow smoking. A similar pattern was observed for dual users, who were also more likely to have a rule prohibiting smoking inside the home than they were to have a rule not allowing vaping

inside the home from both significantly different weighted prevalence and adjusted odds ratios.

Our moderation effects of age indicated that young vapers who were either dual users or ex-smokers were more likely to allow vaping inside homes than young smokers or ex-smokers. Previous research showed the higher prevalence of vaping in young adults relative to middle-aged and older adults [47]. The majority of young vapers were either dual users or ex-smokers [47,48]. They might have used e-cigarettes as an alternative way to quit smoking and perceive vaping is less harmful than smoking, thus were more likely to allow vaping inside the home than are current smokers and ex-smokers counterparts. Our moderation effects analysis further indicated that dual users who were young, female, and married were more likely to allow vaping inside their home than both their current smoker and ex-smoker counterparts. Again, this suggests e-cigarette are being perceived as safe enough to be used inside the home by many of the same individuals who do not allow cigarettes to be smoked in the home. This finding is consistent with a recent study that suggests parents who were dual users may perceive e-cigarette use in the home as safe for their children [43].

Public health implications for restricting vaping inside home

In light of the emerging literature on potential health effects of secondhand e-cigarette aerosol exposure, findings from this study raises concerns. Although the World Health Organization (WHO) recommends not using e-cigarettes and other electronic nicotine products inside home to minimize the risk to bystanders exposed to the aerosols, the large majority of current vapers and dual users still vape inside homes [49]. Since the 1970s, protecting innocent bystanders from secondhand smoke has been the central issue in tobacco control policy in the United States [50,51]. Committing to create healthy environments for nonsmokers, US public health community had advocated the smoke-free policy in public areas such as bars, restaurants, workspaces, schools etc. With the increasing prevalence of e-cigarettes in recent years, the US public health community (nearly 40 US public health organizations) has recommended that the Department of Housing and Urban Development ban both smoking and vaping in public housing because of evidence of potential risks that vaping poses to nonsmokers. The 2016 US Surgeon General report also emphasized the importance of protecting bystanders from secondhand smoke and e-cigarette aerosols [52]. There is a need for enhanced public communication from trusted sources about SHA that can help people form more accurate opinions about e-cigarettes based on the emerging scientific evidence. This study also supports the increased need for interventions involving current vapers and dual users to prevent exposure of household members to potentially toxic e-cigarette aerosol. Interventions delivered through healthcare providers [43] and public awareness campaigns [53] should prioritize the prevention of secondhand and thirdhand e-cigarette aerosol exposure as important goals. The latter could be tested by adapting existing channels, such as the Food and Drug Administration's (FDA's) "The Real Cost" peer-to-peer campaign, the FDA's "Every Try Counts" campaign and the FDA's "Fresh Empire" public education campaign, to include secondhand e-cigarette aerosol and vape-free home messaging to examine the effects of perception and home policies to protect non-users from exposure in the home.

The present study found that, though ex-smokers who did not vape were very similar to never-users in terms of their smoke-free and vape-free rules, ex-smokers who vaped and dual users were much less likely to have vape-free rules. This finding suggests that smokers who try to quit smoking by transitioning to e-cigarettes may continue to create an unsafe home environment through both dual-use and e-cigarette exclusive pathways. The broader implications of this finding are that, for overall public health, complete cessation should be the primary goal to result in the least amount of exposures among household members. In this context, a non-aerosolized form of nicotine, through increasing access to FDA approved nicotine replacement products, may be the most recommended form of cessation assistance for those who are not yet ready to stop nicotine use. Altogether, education, intervention and cessation efforts are all needed to restrict smoking and vaping inside homes to create a safe environment for all household members and bystanders.

Strength and limitations

The nationally representative PATH survey data with a large sample size increased the robustness of the current study's estimated proportions of smoke-free and vape-free home policies among different vaping and smoking status groups. The self-reported cross-sectional data are subject to recall bias, which is a limitation of the current study. In addition, the current study may have failed to account for other confounding variables such as the knowledge of third-hand smoke, the age of children inside their home, and whether participants lived in apartments with building/property smoking bans (e.g., in MUH common areas, patios, individual units), which were not included in the publicly available PATH Wave 3 dataset. Further, the PATH Wave 3 dataset does not include the question on vaping and smoking restrictions in the car and perceived health risks of electronic vs traditional cigarettes, which will be included in future PATH data and will be evaluated in future studies. In addition, the PATH Wave 3 data were collected four years ago, thus the application to current situation could be limited due to the evolution of vaping technology and the increased media coverage around the potential harms of e-cigarettes. For example, the recent national outbreak of e-cigarette, or vaping, product use-associated lung injury (EVALI) in US that led to 2558 nonfatal cases and 60 fatal cases as of January 7, 2020 may have influenced more people to adopt home vaping policies [54]. In addition, the recent US Food and Drug Administration (FDA) flavor enforcement policy that restricted the sale of all flavored, cartridge-based e-cigarettes, other than tobacco or menthol flavors may affect who adopts home vaping policies [55].

Conclusions

Although the long-term health effects of exposure to e-cigarette aerosol remain unknown, research has demonstrated the presence of both secondhand and thirdhand e-cigarette vapor that includes constituents with potential short-term harm to human health. Current vapers and dual users might use e-cigarettes for presumed harm reduction, but may not be aware of potential secondhand and thirdhand risks to other household members. The large percentage of vapers (dual users, and vapers who both are and are not ex-smokers) who allow e-cigarettes use inside the home indicates a necessity for increased education and interventions as well as cessation efforts to promote completely smoke-free and vape-free homes to

protect the health of all household members. Because of the implications of household exposure to e-cigarette aerosol, clinicians should consider treating e-cigarette users with non-aerosolized, FDA-approved tobacco cessation medications for those unwilling or unable to quit nicotine. Given the limited success rates of even the best cessation interventions and issues of access/cost, implementing effective indoor smoking and vaping bans is a highly obtainable prevention strategy that yields immediate benefits by eliminating the primary source of indoor secondhand and thirdhand smoke pollution. In addition to health concerns related to the e-cigarette user, the current study provides a separate rationale for caution in the promotion of e-cigarettes for harm reduction relative to the risk exposures to others in the home.

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Highlights

- All vaping groups were more likely to allow vaping than smoking inside the home.
- Vapers (ex-smokers and dual users) were more likely than smokers to allow vaping in their homes.
- Vapers who switch to e-cigarettes may be interpreting “harm reduction” as “safe”.
- Harm reduction promotion of e-cigarettes needs to consider risk exposures to others.
- Young and married dual users who live with smokers allow home vaping at higher rates than smoker and ex-smoker counterparts.

Table 1:

Characteristics of PATH Wave 3 adult participants across current vaping and smoking status.

	Current vaping and smoking status (% with 95%CI)						
Variables	**Dual users (n=606)**	**Current smokers (n=6104)**	**Current vapers who were ex-smokers (n=412)**	**Current vapers who never smoked and now use e-cigarettes exclusively (n=104)**	**Ex-smokers (n=6335)**	**Never users (n=8728)**	**P-value**
Home rule on combustible tobacco product use							<.0001
It is not allowed anywhere or at any time inside my home	62.16 (60.33, 64.03)	55.53 (54.98, 56.09)	83.59 (82.55, 84.64)	83.56 (81.18, 85.97)	91.41 (91.20, 91.63)	91.64 (91.20, 92.08)	
It is allowed anywhere or in some places, or at any time or some times inside my home	37.84 (35.31, 40.56)	44.47 (43.39, 45.57)	16.41 (13.52, 19.92)	16.44 (10.58, 25.49)	8.59 (8.00, 9.23)	8.36 (7.85, 8.89)	
Home rule on e-cigarettes and other electronic nicotine products use							<.0001
It is not allowed anywhere or at any time inside my home	25.33 (22.72, 28.25)	54.23 (53.70, 54.78)	21.23 (18.19, 24.77)	55.68 (50.15, 61.79)	86.42 (86.24, 86.60)	89.57 (89.18, 89.96)	
It is allowed anywhere or in some places, or at any time or some times inside my home	74.67 (73.38, 75.98)	45.77 (44.69, 46.86)	78.77 (77.46, 80.10)	44.32 (38.01, 51.70)	13.58 (12.68, 14.54)	10.43 (9.92, 10.97)	
Age (years)							<.0001
18–34	37.69 (35.16, 40.40)	28.05 (27.34, 28.79)	37.73 (34.73, 40.98)	81.68 (79.02, 84.41)	18.16 (17.57, 18.76)	33.23 (32.79, 33.69)	
35–64	56.36 (54.33, 58.47)	61.16 (60.55, 61.77)	51.95 (49.36, 54.67)	17.32 (10.08, 29.71)	52.16 (51.67, 52.67)	48.30 (47.89, 48.73)	
65+	5.95 (3.94, 8.99)	10.79 (10.05, 11.59)	10.34 (7.63, 14.00)	1.06 (0.15, 8.51)	29.68 (28.57, 30.82)	18.47 (17.53, 19.45)	
Sex							<.0001
Male	48.13 (45.84, 50.53)	49.52 (49.07, 49.99)	53.17 (50.63, 55.84)	58.79 (53.60, 64.53)	49.61 (49.16, 50.08)	40.29 (39.73, 40.87)	
Female	51.87 (49.69, 54.15)	50.48 (49.93, 51.03)	46.83 (44.07, 49.77)	41.21 (34.82, 48.84)	50.39 (49.98, 50.80)	59.71 (59.56, 59.88)	
Marrital status							<.0001
Married	37.89 (35.36, 40.61)	38.37 (37.52, 39.23)	46.22 (43.42, 49.21)	12.66 (7.38, 21.64)	61.18 (60.54, 61.84)	55.82 (54.60, 57.06)	
Widowed, divorced or separated	28.18 (25.56, 31.08)	32.09 (31.42, 32.78)	22.52 (19.44, 26.07)	11.57 (6.04, 22.08)	23.00 (21.91, 24.14)	16.73 (15.50, 17.42)	
Never married	33.93 (31.34, 36.74)	29.54 (28.79, 30.32)	31.27 (28.16, 34.71)	75.77 (72.41, 79.29)	15.81 (15.36, 16.29)	27.74 (27.26, 28.25)	
Ethnicity							<.0001
Hispanic	6.67 (4.87, 9.13)	12.37 (11.64, 13.14)	8.86 (6.51, 12.05)	27.05 (20.42, 35.77)	13.50 (12.96, 14.05)	18.05 (17.73, 18.39)	
Non-Hispanic	93.33 (92.97, 93.69)	87.63 (87.49, 87.77)	91.15 (90.57, 91.72)	72.95 (69.25, 76.90)	86.50 (86.25, 86.76)	81.95 (81.63, 82.28)	

Variables	Current vaping and smoking status (% with 95%CI)						P-value
	Dual users (n=606)	Current smokers (n=6104)	Current vapers who were ex-smokers (n=412)	Current vapers who never smoked and now use e-cigarettes exclusively (n=104)	Ex-smokers (n=6335)	Never users (n=8728)	
Race							<.0001
White alone	86.94 (86.24, 87.64)	78.18 (77.83, 78.52)	87.40 (86.59, 88.21)	70.46 (66.39, 74.74)	84.82 (84.54, 85.11)	73.10 (72.27, 73.94)	
Black alone	5.93 (4.21, 8.33)	14.51 (13.72, 15.36)	5.30 (3.42, 8.22)	11.27 (6.22, 20.35)	7.25 (6.73, 7.82)	14.57 (14.20, 14.97)	
Others	7.14 (5.28, 9.64)	7.31 (6.68, 8.00)	7.30 (5.12, 10.42)	18.32 (12.22, 27.46)	7.92 (7.17, 8.75)	12.32 (11.83, 12.84)	
Education							<.0001
Less than high school	10.47 (8.32, 13.19)	17.73 (16.95, 18.55)	10.25 (7.77, 13.54)	13.49 (8.08, 22.50)	8.52 (7.93, 9.16)	10.11 (9.66, 10.59)	
GED	10.71 (8.54, 13.44)	10.81 (10.12, 11.55)	5.04 (3.22, 7.89)	0.83 (0.08, 8.23)	4.34 (3.76, 4.99)	3.26 (2.81, 3.78)	
High school graduate	23.17 (20.57, 26.11)	27.65 (26.93, 28.40)	26.56 (23.47, 30.06)	36.13 (29.53, 44.19)	20.42 (19.50, 21.39)	22.89 (22.13, 23.68)	
Some college (no degree) or associates degree	41.20 (38.73, 43.84)	31.90 (31.19, 32.63)	44.36 (41.52, 47.40)	34.35 (27.72, 42.56)	31.22 (30.68, 31.77)	30.57 (29.97, 31.19)	
Bachelor's degree	11.53 (9.31, 14.30)	9.42 (8.75, 10.15)	9.09 (6.71, 12.30)	9.99 (5.29, 18.92)	22.30 (21.52, 23.10)	20.15 (19.37, 20.96)	
Advanced degree	2.91 (1.71, 4.93)	2.49 (2.08, 2.98)	4.70 (2.94, 7.50)	5.11 (1.74, 14.92)	13.21 (12.68, 13.76)	13.02 (12.55, 13.51)	
Income							<.0001
Less than $10 000	14.71 (12.29, 17.63)	19.96 (19.18, 20.78)	8.81 (6.42, 12.09)	24.88 (18.22, 34.01)	6.69 (6.07, 7.37)	10.31 (9.64, 11.03)	
$10 000 to $24 999	23.63 (20.98, 26.61)	27.33 (26.33, 28.37)	18.54 (15.52, 22.15)	25.26 (18.60, 34.33)	15.88 (15.16, 16.65)	18.15 (17.44, 18.89)	
$25 000 to $49 999	28.00 (25.33, 30.95)	24.64 (23.85, 25.47)	27.90 (24.73, 31.47)	22.90 (16.34, 32.10)	22.32 (21.38, 23.31)	22.27 (21.52, 23.04)	
$50 000 to $99 999	23.33 (20.68, 26.31)	20.15 (19.40, 20.92)	28.87 (25.71, 32.43)	16.60 (10.62, 25.96)	30.89 (30.08, 31.72)	27.32 (26.18, 28.52)	
$100 000 or more	10.33 (8.12, 13.13)	7.92 (7.22, 8.69)	15.88 (12.90, 19.55)	10.36 (5.50, 19.62)	24.22 (23.27, 25.21)	21.96 (20.83, 23.15)	
Health insurance							<.0001
Some private insurance	56.09 (54.04, 58.22)	49.69 (49.19, 50.19)	64.87 (62.62, 67.21)	64.25 (59.51, 69.36)	75.02 (74.47, 75.57)	72.61 (71.80, 73.42)	
No private insurance, some Medicare or Medicaid	24.46 (21.84, 27.39)	27.52 (26.50, 28.58)	19.89 (16.89, 23.43)	12.50 (7.19, 21.61)	15.63 (14.68, 16.63)	15.11 (14.45, 15.81)	
Other insurance only	4.68 (3.14, 6.95)	3.18 (2.73, 3.71)	1.91 (0.86, 4.22)	4.47 (1.55, 12.92)	2.59 (2.22, 3.03)	2.75 (2.36, 3.21)	
No insurance	14.77 (12.37, 17.62)	19.61 (18.74, 20.52)	13.33 (10.60, 16.75)	18.78 (12.67, 27.95)	6.76 (6.20, 7.38)	9.52 (8.95, 10.14)	
Currently lived with anyone who is a smoker							<.0001
Yes	42.62 (40.18, 45.20)	43.35 (42.43, 44.29)	21.41 (18.37, 24.94)	20.91 (14.64, 29.87)	11.87 (11.16, 12.63)	11.03 (10.44, 11.66)	
No	57.38 (55.38, 59.45)	56.65 (56.25, 57.06)	78.60 (77.28, 79.94)	79.09 (76.08, 82.15)	88.13 (87.75, 88.51)	88.97 (88.66, 98.28)	

Variables	Current vaping and smoking status (% with 95%CI)						P-value
	Dual users (n=606)	Current smokers (n=6104)	Current vapers who were ex-smokers (n=412)	Current vapers who never smoked and now use e-cigarettes exclusively (n=104)	Ex-smokers (n=6335)	Never users (n=8728)	
Currently lived with anyone who is a vaper							<.0001
Yes	27.73 (25.11, 30.62)	4.26 (3.68, 4.94)	32.86 (29.78, 36.25)	22.46 (16.08, 31.38)	3.54 (3.09, 4.06)	2.91 (2.47, 3.42)	
No	72.28 (70.87, 73.70)	95.74 (95.71, 95.77)	67.15 (65.21, 69.12)	77.54 (74. 34, 80.81)	96.46 (96.36, 96.55)	97.09 (97.01, 97.18)	
Number of cigarettes smoked in your entire life							<.0001
1 or more puffs but never a whole cigarette	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	2.63 (1.50, 4.61)	5.22 (2.68, 10.19)	10.07 (9.37, 10.82)	0.36 (0.27, 0.47)	
1 to 10 cigarettes (about 1/2 pack total)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	2.66 (1.52, 4.65)	5.26 (2.72, 10.24)	10.93 (10.25, 11.67)	0.74 (0.62, 0.88)	
11 to 20 cigarettes (about 1/2 pack to 1 pack)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	1.57 (0.74, 3.33)	9.16 (5.78, 14.54)	6.51 (5.98, 7.10)	0.53 (0.42, 0.68)	
21 to 50 cigarettes (more than 1 pack but less than 3 packs)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	3.04 (1.82, 5.10)	14.02 (10.02, 19.62)	5.46 (4.86, 6.14)	0.53 (0.43, 0.66)	
51 to 99 (more than 2 1/2 packs but less than 5 packs)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	1.55 (0.73, 3.29)	17.55 (10.52, 29.29)	2.74 (2.28, 3.28)	0.43 (0.34, 0.55)	
100 or more cigarettes (5 packs or more)	100.00 (100.00, 100.00)	100.00 (100.00, 100.00)	1.21 (0.51, 2.86)	0.00 (0.00, 0.00)	2.76 (2.35, 3.24)	0.00 (0.00, 0.00)	
Number of times used [primary electronic nicotine product] in entire life							<.0001
1 time, even just a few puffs	1.70 (0.97, 3.00)	8.00 (7.47, 8.56)	1.07 (0.43, 2.68)	5.02 (2.50, 10.05)	3.55 (3.25, 3.88)	1.69 (1.50, 1.90)	
2 to 10 times	4.92 (3.64, 6.66)	16.13 (15.54, 16.74)	2.56 (1.45, 4.54)	13.49 (9.49, 19.18)	4.76 (4.44, 5.10)	1.61 (1.44, 1.80)	
11 to 20 times	5.51 (4.16, 7.30)	8.45 (7.92, 9.02)	2.04 (1.07, 3.91)	8.84 (5.47, 14.29)	1.99 (1.78, 2.24)	0.67 (0.55, 0.82)	
21 to 50 times	14.35 (12.45, 16.54)	7.32 (6.81, 7.87)	6.69 (4.88, 9.17)	22.05 (17.53, 27.77)	1.60 (1.41, 1.83)	0.42 (0.33, 0.54)	
51 to 99 times	12.51 (10.68, 14.66)	3.29 (2.88, 3.76)	6.59 (4.79, 9.07)	8.81 (5.43, 14.24)	0.62 (0.49, 0.78)	0.10 (0.06, 0.17)	
100 or more times	39.05 (37.06, 41.14)	3.83 (3.42, 4.30)	41.44 (39.01, 44.02)	33.66 (26.98, 42.01)	0.82 (0.67, 1.00)	0.11 (0.07, 0.19)	

Table 2:

Adjusted odds ratios and their 95% confidence intervals of allowing combustible tobacco product use inside the home for the moderation effects of age, sex, marital status, whether living with smokers and whether living with vapers.

Moderators		Dual users vs. never users	Current smokers vs. never users	Current vapers who were ex-smokers vs. never users	Current vapers who never smoked and now use e-cigarettes exclusively vs. never users	Ex-smokers vs. never uses
Age						
	18–34	5.97 (3.27, 10.88)	4.29 (3.04, 6.05)	2.05 (0.96, 4.40)	2.69 (0.34, 20.99)	1.30 (0.81, 2.09)
	35–64	9.91 (5.97, 16.45)	8.93 (2.52, 31.60)	11.81 (2.32, 60.04)	2.53 (0.31, 20.43)	0.92 (0.15, 5.60)
	65+	0.00 (0.00, 0.00)	3.81 (2.39, 6.08)	3.77 (1.69, 8.39)	7.27 (0.96, 54.88)	1.43 (0.83, 2.47)
Sex						
	Male	3.95 (2.08, 7.51)	3.23 (2.35, 4.46)	1.64 (0.83, 3.24)	4.83 (0.76, 30.56)	1.52 (0.99, 2.32)
	Female	5.97 (3.27, 10.88)	4.29 (3.04, 6.05)	2.05 (0.96, 4.40)	2.69 (0.34, 20.99)	1.30 (0.81, 2.09)
Marital Status						
	Married	5.97 (3.27, 10.88)	4.29 (3.04, 6.05)	2.05 (0.96, 4.40)	2.69 (0.34, 20.99)	1.30 (0.81, 2.09)
	Widowed, divorced or separated	3.21 (1.52, 6.77)	5.06 (2.52, 10.15)	1.15 (0.46, 2.86)	1.64 (0.17, 15.60)	2.23 (0.13, 37.04)
	Never married	1.64 (0.21, 12.56)	3.05 (1.74, 5.33)	2.24 (1.03, 4.90)	2.18 (0.29, 16.42)	1.20 (0.87, 1.65)
Currently lived with anyone who is a smoker						
	Yes	3.37 (1.75, 6.49)	2.10 (1.45, 3.05)	1.52 (0.59, 3.94)	5.02 (0.64, 39.13)	1.06 (0.63, 1.79)
	No	5.97 (3.27, 10.88)	4.29 (3.04, 6.05)	2.05 (0.96, 4.40)	2.69 (0.34, 20.99)	1.30 (0.81, 2.09)
Currently lived with anyone who is a vaper						
	Yes	4.02 (1.76, 9.17)	3.78 (1.98, 7.21)	1.45 (0.57, 3.73)	1.32 (0.12, 14.98)	1.03 (0.45, 2.36)
	No	5.97 (3.27, 10.88)	4.29 (3.04, 6.05)	2.05 (0.96, 4.40)	2.69 (0.34, 20.99)	1.30 (0.81, 2.09)

Note: The aORs in the model are estimated from the linear contrasts within the weighted logistic regression models include the effects of smoking and vaping status, age, sex, race, ethnicity, education level, household income, health insurance, marital status, living with smokers, living with vapers, frequency of smoking in lifetime, frequency of vaping in lifetime, interaction between smoking and vaping status and age, interaction between smoking and vaping status and sex, interaction between smoking and vaping status and martial status, interaction between smoking and vaping status and living with smokers, interaction between smoking and vaping status and living with vapers.

Table 3:

Adjusted odds ratios and their 95% confidence intervals of allowing e-cigarettes and other electronic nicotine products use inside the home for the moderation effects of age, sex, marital status, whether living with smokers and whether living with vapers.

Moderators		Dual users vs. never users	Current smokers vs. never users	Current vapers who were ex-smokers vs. never users	Current vapers who never smoked and now use e-Cigarettes exclusively vs. never users	Ex-smokers vs. never uses
Age						
	18–34	17.69 (8.08, 38.70)	3.15 (2.19, 4.54)	19.20 (7.06, 52.26)	14.50 (3.63, 57.90)	2.08 (1.36, 3.17)
	35–64	21.71 (12.19, 38.68)	15.60 (2.92, 83.40)	159.20 (19.65, 1289.40)	23.06 (4.88, 109.00)	0.72 (0.07, 7.12)
	65+	0.00 (0.00, 0.00)	2.77 (1.83, 4.19)	35.51 (12.80, 98.48)	34.96 (8.30, 147.30)	1.83 (1.15, 2.93)
Sex						
	Male	8.30 (4.57, 15.07)	2.43 (1.75, 3.37)	13.47 (6.40, 28.39)	12.06 (2.64, 55.05)	1.99 (1.44, 2.76)
	Female	17.69 (8.08, 38.70)	3.15 (2.19, 4.54)	19.20 (7.06, 52.26)	14.50 (3.63, 57.90)	2.08 (1.36, 3.17)
Marital Status						
	Married	17.69 (8.08, 38.70)	3.15 (2.19, 4.54)	19.20 (7.06, 52.26)	14.50 (3.63, 57.90)	2.08 (1.36, 3.17)
	Widowed, divorced or separated	9.81 (3.67, 26.21)	1.87 (0.88, 3.98)	11.12 (3.85, 32.14)	5.20 (0.77, 35.14)	13.40 (0.92, 194.60)
	Never married	2.28 (0.46, 11.30)	2.04 (1.22, 3.41)	20.97 (7.92, 55.49)	13.08 (3.38, 50.65)	1.73 (1.29, 2.34)
Currently lived with anyone who is a smoker						
	Yes	9.64 (3.84, 24.23)	2.01 (1.26, 3.19)	9.99 (2.31, 43.11)	13.73 (2.61, 72.24)	1.50 (0.82, 2.73)
	No	17.69 (8.08, 38.70)	3.15 (2.19, 4.54)	19.20 (7.06, 52.26)	14.50 (3.63, 57.90)	2.08 (1.36, 3.17)
Currently lived with anyone who is a vaper						
	Yes	3.60 (1.46, 8.86)	1.63 (0.84, 3.16)	5.74 (2.55, 12.97)	4.43 (0.60, 32.75)	1.36 (0.63, 2.90)
	No	17.69 (8.08, 38.70)	3.15 (2.19, 4.54)	19.20 (7.06, 52.26)	14.50 (3.63, 57.90)	2.08 (1.36, 3.17)

Note: The aORs in the model are estimated from the linear contrasts within the weighted logistic regression models include the effects of smoking and vaping status, age, sex, race, ethnicity, education level, household income, health insurance, marital status, living with smokers, living with vapers, frequency of smoking in lifetime, frequency of vaping in lifetime, interaction between smoking and vaping status and age, interaction between smoking and vaping status and sex, interaction between smoking and vaping status and martial status, interaction between smoking and vaping status and living with smokers, interaction between smoking and vaping status and living with vapers.