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## Prevalence of population smoking cessation by electronic cigarette use status in a national sample of recent smokers

Daniel P. Giovenco, PhD, MPH<sup>1</sup> and Cristine D. Delnevo, PhD, MPH<sup>2</sup>

<sup>1</sup>Columbia University Mailman School of Public Health, Department of Sociomedical Sciences, 722 W. 168<sup>th</sup> St., New York, NY, USA 10032

<sup>2</sup>Rutgers School of Public Health, Center for Tobacco Studies, 683 Hoes Ln West, Piscataway, NJ, USA 08854

### Abstract

**Introduction**—Amid decreasing rates of cigarette smoking and a rise in e-cigarette use, there is a need to understand population patterns of use to inform tobacco control efforts and evaluate whether e-cigarettes may play a role in tobacco harm reduction.

**Methods**—This study merged data from the 2014 and 2015 National Health Interview Survey (NHIS) and restricted the sample to recent smokers [i.e., current smokers and former smokers who quit in 2010 or later (n=15,532)]. Log-binomial regression estimated adjusted prevalence ratios (aPR) for being quit by e-cigarette use status (i.e., daily, some day, former trier, never). All analyses controlled for factors traditionally correlated with smoking cessation.

**Results**—A quarter of the sample (25.2%) were former smokers. The prevalence of being quit was significantly higher among daily e-cigarette users compared to those who had never used e-cigarettes [52.2% vs. 28.2%, aPR: 3.15 (2.66, 3.73)]. Those who used e-cigarettes on some days were least likely to be former smokers (12.1%). These relationships held even after accounting for making a quit attempt and use of other tobacco products.

**Conclusions**—Among those with a recent history of smoking, daily e-cigarette use was the strongest correlate of being quit at the time of the survey, suggesting that some smokers may have quit with frequent e-cigarette use or are using the products regularly to prevent smoking relapse. However, the low prevalence of cessation among infrequent e-cigarette users highlights the need to better understand this subgroup, including the individual factors and/or product characteristics that may inhibit cessation.

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Corresponding Author: Daniel P. Giovenco, PhD, MPH, 722 W. 168<sup>th</sup> St., Room 940, New York, NY 10032, 212-342-0616, dg2984@columbia.edu.

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## Keywords

e-cigarettes; cigarettes; tobacco; smoking cessation

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## 1. INTRODUCTION

Electronic cigarette (e-cigarette) use among U.S. adults has increased substantially since the products entered the mainstream market,<sup>1,2</sup> concurrent with a decline in smoking rates.<sup>3</sup> Many advocacy groups posit that e-cigarettes and other vaping products are helping smokers quit, citing user testimonials,<sup>4,5</sup> but questions regarding a clear relationship between e-cigarette use and smoking cessation remain.<sup>6</sup> Findings from a few small, randomized controlled trials<sup>7-9</sup> and prospective observational studies<sup>10-15</sup> have been mixed. While some have demonstrated positive associations between e-cigarette use and smoking reduction or cessation,<sup>7-9,11,12,15</sup> others have found no evidence that e-cigarettes help smokers quit<sup>10,13</sup> or that e-cigarette use is associated with reduced cessation.<sup>14</sup> Limitations common to many of these studies include crude categorizations of e-cigarette use (e.g., ever use, at least once in the past 30 days) and a lack of detailed information on device attributes and patterns of use, including frequency. Moreover, non-representative samples and small sample sizes can limit the generalizability of the findings.

In the only known nationally-representative, longitudinal study examining the duration of e-cigarette use and its impact on cessation, Zhuang et al. assessed the odds of quitting smoking among “long-term” e-cigarette users (i.e., reported using e-cigarettes at baseline and at 2-year follow-up).<sup>16</sup> Compared to short-term and never users, long-term users had a significantly higher likelihood of cessation after adjusting for intention to quit, cigarettes per day, and demographic variables. There was no difference in quit success between short-term and never e-cigarette users. Despite this study’s unique focus on the *duration* of e-cigarette use, it did not capture the *frequency* of e-cigarette use and its association with cessation.

National health surveys produce current, representative estimates of smoking cessation and e-cigarette use and can provide additional insight into the association between patterns of e-cigarette use and quitting smoking at the population level. Reports using national data frequently demonstrate that e-cigarette use is highest among current smokers and is relatively low among former and never smokers,<sup>17,18</sup> leading some to conclude that e-cigarettes encourage dual use and are not associated with smoking cessation. One methodological limitation of these studies,<sup>17,18</sup> however, is the aggregation of all “former smokers,” regardless of how long ago they quit. Importantly, e-cigarettes could not have played a role in cessation for smokers who quit before the products entered the market. Two recent studies using more precise categories of “former smokers” documented the highest rates of regular e-cigarette use among former smokers who quit in the past year – a rate more than triple that of current smokers.<sup>19,20</sup> Furthermore, current use of e-cigarettes is extremely rare among former smokers who quit before e-cigarettes became available and individuals who have never smoked.<sup>20</sup>

This study combines two years of data from the National Health Interview Survey (NHIS) to examine correlates of being quit among U.S. adults who were established smokers in the last

5 years (i.e., current smokers and former smokers who quit in 2010 or later), with a specific focus on e-cigarette use status. By excluding former smokers who quit before e-cigarettes entered the market and employing measures of e-cigarette use frequency, we can more accurately characterize potential relationships between smoking cessation and the use of e-cigarettes. The aims of this study are to: 1) describe patterns of e-cigarette use between smokers who have quit and those who are currently smoking, and 2) examine e-cigarette use as an independent correlate of population smoking cessation after controlling for other factors known to predict quitting (e.g., age, educational attainment, race/ethnicity, health insurance coverage). Based on previous research documenting higher rates of smoking cessation among “long term” e-cigarette users,<sup>16</sup> and a higher prevalence of daily e-cigarette use among recently former smokers,<sup>19,20</sup> we hypothesize that daily e-cigarette use will be significantly associated with being quit.

## 2. METHODS

### 2.1 Data source

The National Health Interview Survey (NHIS) is an annual, cross-sectional household interview survey and is the principal source of information used to monitor the health status of the civilian, non-institutionalized, adult population in the United States. Details about the NHIS methodology are published elsewhere.<sup>21</sup> Briefly, NHIS survey data are obtained through a complex, multistage probability design and generate representative estimates of health behaviors, including tobacco use. This study pooled 2014 and 2015 NHIS data and restricted the sample to current smokers and former smokers who quit in 2010 or later. Although e-cigarettes technically entered the U.S. market as early as 2007, they were not widely available in traditional tobacco retailers until after 2010.<sup>22,23</sup> Moreover, before 2010, less than 40% of Americans had ever heard of e-cigarettes.<sup>17</sup> This year was selected as an optimal cut-point since it marks the beginning of the rapid rise in e-cigarette sales, awareness, and use.

### 2.2 Measures

Consistent with population-level estimates of smoking prevalence,<sup>1</sup> current smokers were defined as individuals who have smoked at least 100 cigarettes and currently smoke “every day” or “some days.” Former smokers included respondents who have smoked at least 100 cigarettes, currently smoke “not at all,” and reported quitting within the last 4 years (in the 2014 dataset) or 5 years (in the 2015 dataset). This definition of “former smoker,” referred to hereafter as “being quit” or “smoking cessation,” is the study’s primary outcome of interest. A total of 15,532 respondents met the inclusion criteria and were included in the final analytic sample.

Participants were asked if they had ever used an e-cigarette and how often they currently use the product. E-cigarette use was categorized as: daily, some days, former trier (i.e., used an e-cigarette at least once but currently uses “not at all”) or never user.<sup>20</sup> Participants were considered other tobacco product users if they reported using any of the following tobacco products daily, some days, or rarely: smokeless tobacco, cigars, little cigars, cigarillos, pipes, or hookah. Among current smokers, making a past-year quit attempt was assessed using the

question, “*During the past 12 months, have you stopped smoking for more than one day because you were trying to quit smoking?*”

Covariates included gender, age group, race/ethnicity, educational attainment, census region, health insurance status, and serious psychological distress (SPD). Health insurance status was dichotomized as having any form of health insurance (i.e., public or private) or having no health insurance. Respondents were classified as having SPD if they recorded a score greater than 13 on the Kessler-6 (K6) Scale. The K6 is a series of six Likert-scale items that ask about feelings of sadness, nervousness, restlessness, worthlessness, hopelessness, and feeling like everything is an effort during the past 30 days. Participants respond on a scale from ‘None of the Time’ (score: 0) to ‘All of the time’ (score: 4). This scoring system has been validated as a tool to screen for SPD in the general population.<sup>24,25</sup> Each of the covariates enumerated above have been empirically demonstrated to predict smoking cessation at the population level<sup>26</sup> and were included in all analyses to minimize confounding and enable us to examine the independent effect of e-cigarette use status on being quit.

### 2.3 Statistical analysis

All analyses applied final survey weights provided by the National Center for Health Statistics to adjust for various probabilities of selection and household non-response. To appropriately estimate variances, we used recommended survey procedures<sup>21</sup> that accounted for the complex sampling design. Demographic distributions were calculated overall and by smoking status (i.e., current, former), and Rao-Scott chi-square tests assessed significant differences between groups. Log-binomial regression estimated adjusted prevalence ratios for smoking cessation by e-cigarette use, controlling for all covariates. Because odds ratios can overestimate effect sizes when the outcome of interest is common,<sup>27</sup> prevalence ratios were preferred for this analysis, as 25% of the overall sample were quit at the time of the survey. SAS software (v.9.4) was used to analyze all data (SAS Institute Inc., Cary, NC, USA).

The primary outcome of interest was being a former smoker, but some smokers have no interest in quitting and have not made a recent quit attempt. Additionally, some smokers may be using or have switched to using other tobacco products, and so have not quit tobacco completely. To assess the robustness of the model across various groups that may differ in their motivation to quit tobacco, the regression analysis was repeated using several sample restrictions.<sup>28</sup> Group 1 contains the overall sample with no exclusions. Group 2 includes former smokers and current smokers who made a past-year quit attempt. Group 3 includes former smokers and current smokers who do not currently use other tobacco products. Group 4, the most restrictive sample and perhaps the most motivated to quit smoking, includes former smokers and current smokers who have made a past-year quit attempt and are not currently using other tobacco products.

## 3. RESULTS

Among adults with a recent history of smoking, current smokers and those who were quit significantly differed across all demographic variables except for gender. Compared to

current smokers, former smokers were significantly more likely to be Hispanic (12.6% vs. 10.3% of current smokers), less likely to be non-Hispanic black (8.7% vs. 13%), and more likely to be under the age of 34 (39.2% vs. 33%) (Table 1). Additionally, former smokers had higher levels of educational attainment and health insurance, and a lower prevalence of serious psychological distress ( $p < .001$ ). The majority of former smokers (58%) had never tried e-cigarettes, but daily e-cigarette use was significantly more common in this group compared to current smokers (10.7% vs. 3.3%). Other tobacco product use was more prevalent among current smokers (16%) than former smokers (9.6%). Nearly half (48.9%) of current smokers made a quit attempt in the past 12 months.

Table 2 displays smoking cessation prevalence by demographic factors in each sample restriction. Overall, a quarter of recent smokers were quit at the time of the survey; patterns of cessation were consistent with factors historically demonstrated to predict quitting.<sup>26</sup> For example, smoking cessation was more prevalent among younger adults and those with higher levels of educational attainment. Compared to those without health insurance, the probability of being a former smoker was 75% higher among those with health insurance (aPR: 1.75 [1.50, 2.04]). Those with SPD were only half as likely to be quit at the time of the survey compared to those without SPD (aPR: 0.54 [0.42, 0.69]).

Notably, over half of daily e-cigarette users (52.2%) quit smoking in the last 5 years, a higher prevalence than any other demographic or behavioral subgroup. After adjusting for all covariates, this group was three times more likely than never e-cigarette users to be quit at the time of the survey (aPR: 3.15 [2.66, 3.73]). Across all four sample restrictions, daily e-cigarette use was consistently the strongest independent correlate of smoking cessation. In contrast, both former triers and some day e-cigarette users were significantly less likely to be former smokers compared to never e-cigarette users. Some day e-cigarette users, in particular, had an exceptionally low prevalence of smoking cessation (12.1%).

#### 4. DISCUSSION

Among U.S. adults with a history of smoking in the past 5 years, the prevalence of being quit at the time of the survey was highest among daily e-cigarette users. Although the cross-sectional nature of the survey prohibits assertions about the use of e-cigarettes for smoking cessation, we hypothesize several plausible pathways that may explain this finding. First, some recent smokers may have quit by intensely using e-cigarettes, which is consistent with evidence from prospective studies demonstrating that frequent or sustained e-cigarette use may contribute to smoking cessation.<sup>10–12,16,20</sup> Alternatively, some smokers may have quit with or without the help of e-cigarettes, and began using the devices regularly to control cravings and prevent smoking relapse. While it is possible that some former smokers who quit in the past 3–5 years recently “relapsed” to daily e-cigarette use, the extremely low rate of e-cigarette use among longer term former smokers<sup>19,20</sup> suggests that this scenario is less likely.

Whereas frequent e-cigarette use was associated with higher rates of cessation, some day e-cigarette users were substantially less likely to be quit from cigarettes at the time of the survey. There is concern in the public health community that some smokers, rather than

trying to quit, are intermittently using e-cigarettes in places where they cannot smoke (i.e., “dual use”). Our findings may support this theory to some extent; however, even when restricting the sample to smokers who made a past-year quit attempt, some day e-cigarette use remained negatively associated with being quit. Possibly, current smokers who are using e-cigarettes on some days are dually using the products in an attempt to cut back on and eventually eliminate cigarette use. That is, they may have been interviewed in the middle of an attempt at smoking reduction or cessation. It is also conceivable that these dual users may be more nicotine dependent compared to other groups, thereby having more difficulty quitting.

Without knowing detailed information about device attributes, user experiences, reasons for use, and other individual factors, the reasons for low quit rates among some day e-cigarette users and former triers are unclear. Dissatisfaction with nicotine delivery and other device characteristics may play a role in discontinued or intermittent e-cigarette use and inhibit cessation. Indeed, individuals who use early, “first generation” device types report less satisfaction and poorer cessation outcomes compared to users of more advanced products, which allow the user to customize characteristics such as nicotine strength, flavorings, and battery power.<sup>29–31</sup> Additionally, many some day e-cigarette users may be using the devices for reasons other than cessation. One study of quitline callers documented lower rates of cessation among individuals using e-cigarettes for reasons other than quitting smoking.<sup>32</sup>

This study has important methodological limitations that should be considered when interpreting the results. Primarily, the data are cross-sectional, so hypothesized relationships between e-cigarette use and smoking cessation are speculative since the time point when individuals began using e-cigarettes is unknown. Similarly, because the data are not longitudinal, it is unknown if the primary outcome – being quit – was sustained after the survey. It is possible that the former smokers in this study relapsed in subsequent years. Moreover, this study excluded former smokers who quit before 2010, the year we used as a cutpoint to mark the rapid rise in e-cigarette awareness and use. Since early generations of e-cigarettes did exist before 2010, the final sample may have excluded some “early adopters.” However, observable population-level effects of e-cigarette use would likely only materialize after the products became mainstream.

Finally, we were not able to control for other important covariates, such as use of pharmacotherapy or nicotine dependence, due to limited data availability. Questions related to pharmacotherapy were only available in the 2015 dataset for a small subset of current smokers and former smokers who quit in the past 2 years. We assessed differences in the use of pharmacotherapy in this subsample and found that use of nicotine replacement therapy or other medications during the last quit attempt was significantly lower among former smokers compared to current smokers (23.5% vs. 31.6%,  $p < .001$ ). There were no significant differences in use of pharmacotherapy by e-cigarette use, so pharmacotherapy unlikely explains the vast differences in cessation rates. Additionally, since NHIS does not assess heaviness of smoking or nicotine dependence among former smokers, we could not determine if the former smokers in the sample were more, less, or as nicotine dependent as those currently smoking, or if e-cigarette use differed based on nicotine dependence.



## 5. CONCLUSIONS

Using a large, nationally-representative dataset, this study revealed important patterns in cessation prevalence across e-cigarette user groups. Overall, the relationship between e-cigarette use and quitting smoking is mixed, but the findings suggest that for some, frequent e-cigarette use may play a role in cessation. Reasons for lower cessation rates among infrequent users of e-cigarettes are less clear, underscoring the need to better understand this behavioral subgroup and the factors that hinder cessation. Future cross-sectional and longitudinal research should incorporate nuanced measures of e-cigarette use, such as frequency and device attributes, as well as individual-level factors, such as nicotine dependence, intention to quit, and reasons for e-cigarette use, in order to fully understand the relationship between e-cigarette use and smoking cessation. Although national survey data can characterize patterns of use at the population level, randomized controlled trials remain the best method to determine the clinical efficacy of e-cigarettes for cessation and should continue to be a prioritized area of tobacco research.

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**Highlights**

- Over half of daily e-cig users in the sample quit smoking in the last 5 years
- Daily e-cig users were 3 times more likely to be quit than never e-cig users
- Some day e-cig users were least likely to be quit
- Some smokers may have quit or are preventing relapse with frequent e-cig use

**Table 1**

Demographic characteristics of recent smokers<sup>a</sup> overall and by smoking status, National Health Interview Survey, 2014–2015

	Overall n=15,532	Current smokers n=11,793	Former smokers n=3,739	<i>P</i> <sup>b</sup>
<b>Gender</b>				
Male	53.6	53.8	53.0	0.555
Female	46.4	46.2	47.0	
<b>Age group</b>				
18–24	11.8	11.7	12.1	<.0001
25–34	22.8	21.3	27.1	
35–44	19.2	19.2	19.2	
45–64	36.1	37.8	30.9	
65+	10.2	10.0	10.7	
<b>Race/ethnicity</b>				
White, non-Hispanic	72.4	72.2	73.1	<.0001
Black, non-Hispanic	11.9	13.0	8.7	
Hispanic	10.9	10.3	12.6	
Other, non-Hispanic	4.8	4.5	5.6	
<b>Educational attainment</b>				
Less than high school	17.2	18.7	12.7	<.0001
High school	34.1	35.7	29.3	
Some college	34.2	33.2	37.3	
Bachelor's degree or higher	14.5	12.4	20.7	
<b>Region</b>				
Northeast	15.6	15.7	15.5	0.004
Midwest	27.3	28.1	25.0	
South	38.0	38.0	37.9	
West	19.1	18.3	21.6	
<b>Health insurance</b>				
Yes	81.3	79.3	87.1	<.0001
No	18.7	20.7	12.9	
<b>Serious psychological distress<sup>c</sup></b>				
Yes	7.1	8.2	4.0	<.0001
No	92.9	91.9	96.0	
<b>Other tobacco product use<sup>d</sup></b>				
Yes	14.4	16.0	9.6	<.0001
No	85.6	84.0	90.4	
<b>E-cigarette use</b>				
Daily	5.1	3.3	10.7	<.0001
Some day	9.8	11.6	4.7	
Former trier <sup>e</sup>	33.1	35.4	26.5	

	Overall n=15,532	Current smokers n=11,793	Former smokers n=3,739	<i>p</i> <sup>b</sup>
Never	51.9	49.8	58.1	
<b>Past 12-month quit attempt</b>				
Yes	-	48.9	-	
No	-	51.1	-	

<sup>a</sup>Sample includes current smokers and former smokers who quit since 2010;

<sup>b</sup>Rao-Scott chi square test determined significant differences between current and former smokers;

<sup>c</sup>measured by a score of 13 or greater on the Kessler 6 (K6) nonspecific distress scale;

<sup>d</sup>Currently uses any of the following other tobacco products [OTP]: smokeless tobacco, cigars, little cigars, cigarillos, pipes, or hookah;

<sup>e</sup>Ever tried but not currently using e-cigarettes

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Table 2

Prevalence and adjusted prevalence ratios (aPR) of population smoking cessation among recent smokers<sup>a</sup>, National Health Interview Survey, 2014–2015

	GROUP 1 <sup>b</sup> n=15,532		GROUP 2 <sup>c</sup> n=9,483		GROUP 3 <sup>d</sup> n=13,381		GROUP 4 <sup>e</sup> n=8,280	
	Prevalence (95% CI)	aPR (95% CI)	Prevalence (95% CI)	aPR (95% CI)	Prevalence (95% CI)	aPR (95% CI)	Prevalence (95% CI)	aPR (95% CI)
<b>Gender</b>								
Male	24.9 (23.6, 26.2)	0.97 (0.92, 1.03)	41.1 (39.2, 42.9)	1.01 (0.95, 1.08)	26.9 (25.4, 28.3)	1.00 (0.94, 1.06)	43.4 (41.4, 45.4)	1.04 (0.97, 1.01)
Female	25.5 (24.0, 27.0)	1.00 (ref)	40.4 (38.1, 42.7)	1.00 (ref)	26.3 (24.7, 27.9)	1.00 (ref)	41.6 (39.3, 43.9)	1.00 (ref)
<b>Age group</b>								
18–24	25.9 (22.1, 29.6)	<b>1.21 (1.01, 1.44)</b>	37.2 (32.0, 42.5)	1.04 (0.84, 1.28)	29.3 (24.7, 33.8)	<b>1.27 (1.04, 1.56)</b>	41.1 (35.0, 47.2)	1.08 (0.84, 1.38)
25–34	30.0 (28.1, 31.8)	<b>1.34 (1.20, 1.50)</b>	44.8 (42.2, 47.4)	<b>1.25 (1.10, 1.41)</b>	32.0 (29.9, 34.1)	<b>1.34 (1.19, 1.51)</b>	47.3 (44.4, 50.3)	<b>1.26 (1.10, 1.45)</b>
35–44	25.1 (23.0, 27.3)	0.94 (0.84, 1.05)	39.2 (36.2, 42.2)	<b>0.88 (0.77, 0.99)</b>	26.7 (24.4, 29.1)	0.94 (0.84, 1.05)	40.8 (37.7, 43.9)	<b>0.88 (0.77, 1.00)</b>
45–64	21.6 (20.1, 23.1)	<b>0.77 (0.70, 0.85)</b>	37.9 (35.7, 40.2)	<b>0.84 (0.75, 0.94)</b>	22.3 (20.7, 23.8)	<b>0.74 (0.67, 0.82)</b>	38.6 (36.3, 40.9)	<b>0.81 (0.72, 0.91)</b>
65+	26.4 (23.6, 29.2)	1.00 (ref)	48.7 (44.7, 52.7)	1.00 (ref)	27.5 (24.5, 30.5)	1.00 (ref)	49.7 (45.5, 53.9)	1.00 (ref)
<b>Race/ethnicity</b>								
White, non-Hispanic	25.4 (24.1, 26.7)	1.00 (ref)	41.9 (39.9, 43.9)	1.00 (ref)	26.6 (25.2, 28.0)	1.00 (ref)	43.5 (41.4, 45.7)	1.00 (ref)
Black, non-Hispanic	18.4 (16.2, 20.6)	<b>0.62 (0.52, 0.74)</b>	29.0 (25.8, 32.1)	<b>0.48 (0.40, 0.58)</b>	20.5 (18.1, 22.9)	<b>0.67 (0.56, 0.80)</b>	31.2 (27.9, 34.4)	<b>0.51 (0.42, 0.62)</b>
Hispanic	29.1 (26.5, 31.8)	<b>1.28 (1.09, 1.51)</b>	44.4 (40.9, 47.9)	1.15 (0.96, 1.39)	30.6 (27.7, 33.5)	<b>1.29 (1.09, 1.54)</b>	46.4 (42.7, 50.1)	1.15 (0.95, 1.41)
Other, non-Hispanic	29.4 (24.7, 34.2)	1.00 (0.79, 1.28)	45.2 (38.9, 51.4)	0.89 (0.67, 1.19)	31.0 (25.9, 36.2)	1.00 (0.77, 1.30)	46.7 (40.0, 53.3)	0.88 (0.65, 1.19)
<b>Educational attainment</b>								
Less than high school	18.6 (16.6, 20.7)	1.00 (ref)	33.3 (30.1, 36.5)	1.00 (ref)	19.7 (17.5, 21.8)	1.00 (ref)	35.1 (31.8, 38.5)	1.00 (ref)
High school	21.7 (20.1, 23.3)	<b>1.24 (1.04, 1.47)</b>	36.5 (33.9, 39.1)	1.22 (1.00, 1.50)	23.2 (21.5, 24.9)	<b>1.23 (1.03, 1.48)</b>	38.3 (35.7, 41.0)	1.18 (0.95, 1.46)
Some college	27.5 (25.7, 29.3)	<b>1.67 (1.40, 1.99)</b>	42.5 (39.9, 45.1)	<b>1.61 (1.31, 1.97)</b>	28.8 (27.0, 30.6)	<b>1.63 (1.36, 1.95)</b>	43.8 (41.2, 46.5)	<b>1.53 (1.25, 1.88)</b>
Bachelor's degree or higher	36.1 (33.4, 38.8)	<b>2.25 (1.85, 2.74)</b>	53.4 (50.1, 56.8)	<b>2.25 (1.79, 2.82)</b>	37.8 (34.9, 40.8)	<b>2.28 (1.86, 2.79)</b>	55.3 (51.7, 59.0)	<b>2.24 (1.76, 2.84)</b>
<b>Region</b>								
Northeast	24.9 (22.3, 27.5)	1.00 (ref)	39.4 (35.8, 43.0)	1.00 (ref)	26.0 (23.3, 28.6)	1.00 (ref)	40.7 (36.9, 44.6)	1.00 (ref)
Midwest	23.1 (21.1, 25.0)	0.95 (0.80, 1.14)	38.1 (34.8, 41.5)	0.99 (0.80, 1.23)	24.1 (22.0, 26.3)	0.96 (0.79, 1.16)	39.6 (36.1, 43.1)	1.00 (0.79, 1.26)
South	25.1 (23.6, 26.6)	1.15 (0.98, 1.35)	41.1 (39.0, 43.2)	<b>1.27 (1.05, 1.52)</b>	26.7 (25.1, 28.3)	1.17 (0.99, 1.39)	42.8 (40.5, 45.1)	<b>1.29 (1.06, 1.57)</b>
West	28.5 (26.3, 30.7)	<b>1.24 (1.04, 1.48)</b>	44.8 (42.3, 47.4)	<b>1.37 (1.13, 1.67)</b>	30.3 (27.9, 32.7)	<b>1.26 (1.04, 1.53)</b>	47.1 (44.4, 49.9)	<b>1.40 (1.13, 1.73)</b>
<b>Health insurance</b>								
Yes	27.0 (25.8, 28.2)	<b>1.75 (1.50, 2.04)</b>	42.9 (41.2, 44.7)	<b>1.65 (1.39, 1.96)</b>	28.4 (27.2, 29.7)	<b>1.79 (1.52, 2.11)</b>	44.5 (42.7, 46.4)	<b>1.65 (1.38, 1.98)</b>

	GROUP 1 <sup>b</sup> n=15,532	GROUP 2 <sup>c</sup> n=9,483	GROUP 3 <sup>d</sup> n=13,381	GROUP 4 <sup>e</sup> n=8,280
	Prevalence (95% CI)	aPR (95% CI)	Prevalence (95% CI)	aPR (95% CI)
No	17.4 (15.5, 19.3)	1.00 (ref)	18.5 (16.5, 20.6)	1.00 (ref)
<b>Serious psychological distress<sup>f</sup></b>				
Yes	14.3 (11.6, 17.0)	<b>0.54 (0.42, 0.69)</b>	16.1 (12.8, 19.3)	<b>0.56 (0.43, 0.73)</b>
No	26.2 (25.1, 27.2)	1.00 (ref)	27.6 (26.4, 28.7)	1.00 (ref)
<b>E-cigarette use</b>				
Daily	52.2 (47.3, 57.2)	<b>3.18 (2.67, 3.79)</b>	55.7 (50.2, 61.2)	<b>3.36 (2.79, 4.04)</b>
Some day	12.1 (9.5, 14.6)	<b>0.38 (0.32, 0.47)</b>	13.6 (10.6, 16.5)	<b>0.41 (0.33, 0.50)</b>
Former trier <sup>g</sup>	20.2 (18.5, 21.8)	<b>0.67 (0.61, 0.75)</b>	21.6 (19.7, 23.4)	<b>0.66 (0.58, 0.74)</b>
Never	28.2 (26.7, 29.6)	1.00 (ref)	28.9 (27.4, 30.4)	1.00 (ref)
<b>Year</b>				
2014	22.6 (21.3, 23.9)	1.00 (ref)	24.1 (22.6, 25.6)	1.00 (ref)
2015	27.8 (26.3, 29.2)	<b>1.36 (1.22, 1.52)</b>	28.9 (27.4, 30.4)	<b>1.33 (1.19, 1.49)</b>
<b>Overall</b>	25.2 (24.2, 26.1)		26.6 (25.5, 27.6)	

<sup>a</sup>Recent smokers<sup>h</sup>: current smokers and former smokers who quit since 2010;

<sup>b</sup>No sample restrictions;

<sup>c</sup>First restriction: includes former smokers and current smokers who made a past-year quit attempt;

<sup>d</sup>Second restriction: includes former smokers and current smokers who do not currently use any of the following tobacco products: smokeless tobacco, cigars, little cigars, cigarillos, pipes, or hookah;

<sup>e</sup>Third restriction: includes former smokers and current smokers who have made a past-year quit attempt and are not currently using other tobacco products;

<sup>f</sup>measured by a score of 13 or greater on the Kessler 6 (K6) nonspecific distress scale;

<sup>g</sup>Ever tried but not currently using e-cigarettes;

Bold values represent statistical significance