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Prevalence and Distribution of E-Cigarette Use Among U.S. Adults: Behavioral Risk Factor Surveillance System, 2016

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Abstract

Background: Contemporary data on the prevalence of e-cigarette use in the United States are limited.

Objective: To report the prevalence and distribution of current e-cigarette use among U.S. adults in 2016.

Design: Cross-sectional.

Setting: Behavioral Risk Factor Surveillance System, 2016.

Participants: Adults aged 18 years and older.

Measurements: Prevalence of current e-cigarette use by sociodemographic groups, comorbid medical conditions, and states of residence.

Results: Of participants with information on e-cigarette use (n = 466 842), 15 240 were current e-cigarette users, representing a prevalence of 4.5%, which corresponds to 10.8 million adult e-cigarette users in the United States. Of the e-cigarette users, 15% were never–cigarette smokers. The prevalence of current e-cigarette use was highest among persons aged 18 to 24 years (9.2% [95% CI, 8.6% to 9.8%]), translating to approximately 2.8 million users in this age range. More than half the current e-cigarette users (51.2%) were younger than 35 years. In addition, the age-standardized prevalence of e-cigarette use was high among men; lesbian, gay, bisexual, and transgender (LGBT) persons; current combustible cigarette smokers; and those with chronic health conditions. The prevalence of e-cigarette use varied widely among states, with estimates ranging from 3.1% (CI, 2.3% to 4.1%) in South Dakota to 7.0% (CI, 6.0% to 8.2%) in Oklahoma.

Limitation: Data were self-reported, and no biochemical confirmation of tobacco use was available.

Conclusion: E-cigarette use is common, especially in younger adults, LGBT persons, current cigarette smokers, and persons with comorbid conditions. The prevalence of use differs across states. These contemporary estimates may inform researchers, health care policymakers, and tobacco regulators about demographic and geographic distributions of e-cigarette use.

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E-cigarettes were introduced in the United States more than a decade ago, with the general population perceiving these products as a safer substitute for combustible cigarettes (1). Subsequently, the prevalence of e-cigarette use has risen, especially among adolescents and younger adults (2). The medical community, however, remains concerned regarding both the safety of e-cigarettes and their utility as smoking cessation devices. In 2015, the American College of Physicians recommended that the U.S. Food and Drug Administration (FDA) provide regulatory oversight of e-cigarettes, citing the lack of conclusive data on their safety and effectiveness as a cessation aid and their potential as a gateway to use of other tobacco products with known harms (3). In 2016, the FDA finalized the “Deeming Rule” that extended its regulatory authority beyond cigarettes and smokeless and roll-your-own tobacco to all tobacco products, including e-cigarettes, cigars, hookahs, and pipes (4). Therefore, the deeming rule gives the FDA authority to regulate e-cigarettes and to place health warnings and age restrictions on their sales.

Given the potential health concerns surrounding e-cigarettes, a detailed analysis of their contemporary use patterns takes on great importance. Although previous research from nationally representative data sets suggested rising e-cigarette prevalence, especially among younger adults, these studies are now outdated, and they were not sufficiently powered to report the prevalence of e-cigarette use among important subgroups (5, 6). Using the largest and most extensive dynamic health survey—the 2016 Behavioral Risk Factor Surveillance System (BRFSS) national survey—we aimed to determine the most up-to-date national and state-level prevalence of current e-cigarette use among U.S. adults. We also examined

the prevalence of e-cigarette use among key demographic subgroups, which included stratification by cigarette smoking status.

These data may help delineate the complex relationship between e-cigarette use patterns and demographic, socioeconomic, and geographic factors and help inform the work of researchers, public health officials, and regulatory authorities seeking to understand current trends in e-cigarette use.

Methods

Data Source

The BRFSS is an extensive, nationally representative, health-related telephone panel survey conducted jointly by the Centers for Disease Control and Prevention (CDC) and all states and participating territories of the United States. In summary, data were collected by landline and cellular telephone from 486 303 noninstitutionalized adults aged 18 years and older regarding risk behaviors, use of preventive services, and chronic health conditions (7).

Study Population and E-Cigarette Use

The BRFSS began collecting data on e-cigarette use in 2016. We included 466 842 persons (96% of the entire survey population) who provided information about e-cigarette use. First, the participants were asked, “Have you ever used an e-cigarette or other electronic ‘vaping’ product, even just one time, in your entire life?” Those who answered yes were asked a second question: “Do you now use e-cigarettes or other electronic ‘vaping’ products every day, some days, or not at all?” We considered participants who answered yes to the first question as ever– e-cigarette users. Of ever– e-cigarette users, we defined daily and occasional e-cigarette use as responding “every day” and “some days,” respectively. We defined current e-cigarette use as either daily or occasional.

In the assessment of prevalence estimates by subgroups, respondents with missing information on the subgroup of interest were excluded. Appendix Table 1 (available at Annals.org) provides information on the size of the study population for each subgroup examined. The sexual orientation and gender identity questions were asked in the following 26 states and territories: California, Connecticut, Delaware, Georgia, Guam, Hawaii, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Massachusetts, Minnesota, Mississippi, Missouri, Nevada, New York, Ohio, Pennsylvania, Rhode Island, Texas, Vermont, Virginia, Washington, and Wisconsin. Response rates in the states that included these modules were 87.4% (sexual orientation) and 86.3% (gender identity).

Combustible Cigarette Smoking

Participants who answered yes to “Have you smoked at least 100 cigarettes in your entire life?” were considered ever– cigarette smokers, whereas those who answered no were considered never–cigarette smokers. Of ever– cigarette smokers, a second question was asked: “Do you now smoke cigarettes every day, some days, or not at all?” Participants who answered “every day” or “some days” were defined as current cigarette smokers, and those who answered “not at all” were defined as former cigarette smokers.

Other Study Measures

Key socioeconomic covariates of our analyses included age, sex (male or female), sexual orientation (heterosexual, lesbian, gay, or bisexual), gender identity (cisgender or transgender), race/ethnicity, educational attainment, relationship status (with partner or without partner), pregnancy, and employment. Household income was reported according to the federal poverty line in 2016 (8). Body mass index was calculated on the basis of self-reported height and weight. Information about lifestyle factors included physical activity (at least 1 exercise session during the past 30 days) and alcohol intake (at least 1 alcoholic drink during the past 30 days). Chronic health conditions included cardiovascular disease, diabetes, cancer (excluding skin cancer), chronic obstructive pulmonary disease, depression, and chronic kidney disease. Participants with cardiovascular disease were defined as those who reported having myocardial infarction, coronary heart disease, or stroke. All variables were self-reported. For categorization of responses, we used BRFSS-defined criteria (9).

Weighting Process

In 2016, 50 states, the District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands collected data via landline and cellular telephone. The BRFSS uses a weighting methodology called raking that allows incorporation of landline and cellular telephone survey data and permits the introduction of additional characteristics that improve the degree to which the BRFSS sample accurately reflects the sociodemographic make-up of the United States as well as the individual states. More details on study design, sampling, data collection, and weighting processes are published elsewhere (10).

Statistical Analysis

We calculated the weighted and direct age-standardized prevalence estimates using BRFSS analytic recommendations published by the CDC (10, 11). Direct age standardization was based on the standard 2000 U.S. Census population using age categories of 18 to 44 years, 45 to 64 years, and 65 years or older. Furthermore, we age standardized the prevalence estimates in each subgroup to account for differences in the age composition of the subgroups. We tested for a linear trend in prevalence of e-cigarette use across 5-year age groups by using logistic regression with age group included as a continuous variable. We compared the prevalence of e-cigarette use by socioeconomic and lifestyle covariates, and chronic health conditions by using logistic regression models adjusted for age group. From these models, we found age-adjusted prevalence values (predicted margins), and we report results as absolute prevalence difference, with 95% CIs. Because of the likely interaction between e-cigarette use and cigarette smoking, as well as the high prevalence of dual use (12), analyses were repeated after stratification by combustible cigarette smoking status (never, former, or current). We estimated the number of e-cigarette users in the United States by applying the nationally representative prevalence estimates to the U.S. Census projection of the number of adults in 2016 (13).

All analyses were performed by using Stata, version 13.1 (StataCorp), and used BRFSS weights to account for the complex survey design, noncoverage, and nonresponse. We used the *svy* command in Stata to account for the complex design of BRFSS; the *tab* command to obtain direct age-standardized, weighted prevalence estimates; and the *logistic* command

in conjunction with *margins*, *nclom*, and *test* postestimation commands to obtain predictive margins and prevalence difference with 95% CIs and *P* values (14).

Role of the Funding Source

This study was funded by the American Heart Association Tobacco Regulation and Addiction Center (A-TRAC), which is one of the Tobacco Centers of Regulatory Science of the FDA and National Heart, Lung, and Blood Institute. The funder had no role in study design, conduct, data collection, trial management, data analysis, manuscript preparation, or the decision to submit the manuscript for publication.

Results

Prevalence of E-Cigarette Use Among All U.S. Adults

The overall prevalence of current e-cigarette use was 4.5% (95% CI, 4.4% to 4.6%). Among current users, 33.5% used e-cigarettes daily. Translating these results to the entire U.S. adult population, the estimated number of current e-cigarette users was 10.8 million (3.6 million daily users).

Patterns of E-Cigarette Use Across Age Groups

The median age category of current e-cigarette users was younger than that of nonusers (40 to 44 vs. 55 to 59 years, respectively [$P < 0.001$]). As shown in Figure 1, the prevalence of current and daily e-cigarette use decreased with increasing age. Across age groups, the prevalence of current e-cigarette use was highest among those aged 18 to 24 years (9.2% [CI, 8.6% to 9.8%]). More than half (51.2%) of all e-cigarette users were younger than 35 years.

The prevalence of current e-cigarette use was highest for those aged 18 to 24 years among both current (27.0% [CI, 24.8% to 29.2%]) and former (23.4% [CI, 20.2% to 26.9%]) combustible cigarette smokers (Figure 2). The same pattern was observed among never-smokers, with the highest prevalence of current e-cigarette use among those aged 18 to 24 years (5.1% [CI, 4.6% to 5.5%]). In the 18- to 24-year age group, 44.3% of current e-cigarette users were never–combustible cigarette smokers, 38.9% were former smokers, and 16.8% were current cigarette smokers. An estimated 2.8 million adults aged 18 to 24 years were current e-cigarette users in 2016. Of these, approximately 1.2 million were never–cigarette smokers, 0.5 million were former cigarette smokers, and 1.1 million were current smokers (Appendix Table 2, available at Annals.org).

Patterns of E-Cigarette Use, by Sociodemographic Group

Table 1 shows the age-standardized prevalence of e-cigarette use across different sociodemographic groups and chronic health conditions, and Table 2 presents the age-adjusted absolute difference across these groups. The age-standardized prevalence of current e-cigarette use was higher in men (5.9% [CI, 5.6% to 6.1%]) than women (3.7% [CI, 3.6% to 3.9%]). Approximately 60.0% of current e-cigarette users were men. The prevalence of current e-cigarette use was high among lesbian or gay (7.0% [CI, 5.5% to 8.8%]), bisexual (9.0% [CI, 7.6% to 10.6%]), and transgender (8.7% [CI, 6.0% to 12.6%]) adults.

Compared with persons without the respective comorbid condition, the absolute difference in age-adjusted prevalence of current e-cigarette use was 3.2% (CI, 2.3% to 4.0%) higher among participants with cardiovascular disease, 1.8% (CI, 1.1% to 2.5%) higher in those with cancer, 1.9% (CI, 1.4% to 2.4%) higher in those with asthma, 7.1% (CI, 6.2% to 8.0%) higher in those with chronic obstructive pulmonary disease, and 4.9% (CI, 4.5% to 5.3%) higher in those with depression.

Patterns of E-Cigarette Use, by Combustible Cigarette Smoking Status

As shown in Table 1, e-cigarette use was consistently more prevalent among former and current cigarette users than never-smokers. Overall, the age-standardized prevalence of current e-cigarette use was 1.4% (CI, 1.3% to 1.5%) among never-, 7.6% (CI, 7.2% to 8.1%) among former, and 14.4% (CI, 13.9% to 14.9%) among current smokers. The prevalence of daily e-cigarette use, however, was highest among former cigarette smokers (5.0% [CI, 4.6% to 5.3%]), followed by current (3.1% [CI, 2.8% to 3.4%]) and never–combustible cigarette smokers (0.2% [CI, 0.2% to 0.3%]). Of the current e-cigarette users, 15% were never–cigarette smokers, 30.4 were former-cigarette smokers, and 54.6% were current-cigarette smokers.

Prevalence of E-Cigarette Use Among U.S. Adults, by State

Figure 3 and Appendix Table 3 (available at Annals.org) show the state-specific, age-standardized prevalence of e-cigarette use. All southern and western states had a high prevalence of current e-cigarette use, except for California (3.3% [CI, 2.9% to 3.8%]). The prevalence of e-cigarette use in the midwest region varied markedly, from 3.0% (CI, 2.3% to 4.0%) in South Dakota to 6.2% (CI, 5.4% to 7.0%) in Ohio. In most northeastern states, the prevalence of current e-cigarette use was low, except in New Hampshire (6.1% [CI, 5.0% to 7.5%]).

Discussion

Here we report the prevalence and distribution of e-cigarette use in a large representative sample of the U.S. population. We provide the first 2016 data regarding the prevalence of e-cigarette use on the national and state levels. We report that 4.5% of U.S. adults (projected to 10.8 million in the total U.S. adult population) were current e-cigarette users in 2016. Of importance, adults younger than 35 years accounted for more than half of all e-cigarette users in the United States. In addition, we observed that current e-cigarette use was highly prevalent among men; lesbian, gay, bisexual, and transgender persons; those who were unemployed; and those with chronic disease.

Our estimates of e-cigarette use differ from those of studies conducted between 2013 and 2014. For example, on the basis of data from the National Health Interview Survey (NHIS), the CDC reported that the prevalence of current e-cigarette use (defined as use every day or some days) among U.S. adults in 2014 was 3.7%, which is about 0.8% lower than our estimate (15). The PATH (Population Assessment of Tobacco and Health) study reported a 5.5% prevalence of current e-cigarette use in 2013 to 2014 (12, 16), whereas the NHANES

(National Health and Nutrition Examination Survey) for 2013 to 2014 reported prevalence estimates of 2.6% (17).

The heterogeneity in prevalence estimates among the U.S. studies is probably the result of differences in data collection methods and classification of current e-cigarette use across these studies. For example, whereas participants in NHANES 2013 to 2014 were asked about the use of e-cigarettes in the past 5 days, the PATH study had a more detailed assessment of product use, including recent use during the past 30 days (12). The lower prevalence estimates in our study versus those of PATH may be a function of differences in the year of collection of surveys, or they may be related to the BRFSS sampling process, which ensured adequate representation of minority groups and older adults, a subgroup with a lower prevalence of e-cigarette use in our study. Given these notable differences in data collection methods and resulting estimates, additional studies using consistent e-cigarette use questions are needed to assess future changes in the prevalence of e-cigarette use in the United States.

Consistent with our findings, data from NHANES and PATH show that e-cigarette use among U.S. adults was most prevalent among younger persons (12, 16, 17). We estimated that 2.8 million younger adults (1.2 million of whom were never-smokers) were current e-cigarette users in 2016. Our data emphasize the high prevalence of e-cigarette use among younger age groups. Particularly notable is the emergence of a high prevalence of e-cigarette use among younger adults who never smoked combustible cigarettes. In addition to the potential health hazard of e-cigarettes, including exposure to volatile organic compounds (18), e-cigarette use in younger ages may serve as a gateway to cigarette smoking (19).

Since the introduction of e-cigarettes in the United States, their potential utility as smoking cessation devices has been at the forefront of public health discussions (20, 21). Our results suggest that persons who never smoked cigarettes use e-cigarettes; we report that 15% of all e-cigarette users (an estimated 1.9 million U.S. adults) were never–cigarette smokers. Detailed data on the characteristics of this population are scarce, and future research is required to understand why e-cigarettes appeal to this tobacco-naive population. Moreover, the size of this population should be monitored over time, given that our study uses only a single time point.

From a research perspective, e-cigarette users who never smoked cigarettes are the only group available in which to study the unique health effects of e-cigarette use (without confounding from combustible cigarette smoking). Furthermore, knowledge of the size of the never-smoking, e-cigarette–using population is especially important for regulatory authorities, in light of the recent FDA decision to decrease the nicotine content of combustible cigarettes. The FDA projects that this decision will lead many persons to switch to noncombustible tobacco products, including e-cigarettes (22). Our study thus provides a benchmark for future studies that aim to assess the effect of these policy changes.

Consistent with previous reports (2, 23), our findings revealed that most e-cigarette users also smoke combustible cigarettes (dual tobacco use). In our analysis, we found that 54.6% of current e-cigarette users also were current combustible cigarette smokers. In agreement

with these findings, PATH, NHANES, and NHIS have indicated that e-cigarette users are more likely to be current or former combustible cigarette smokers (15-17, 23). However, lack of temporality in cross-sectional studies restricts our ability to infer the order in which these tobacco habits were adopted. For example, some studies have suggested that these data support the notion that e-cigarettes are being used as smoking cessation devices (24), whereas others have stated that dual use increases exposure to nicotine and may perpetuate abuse liability instead of encouraging smoking cessation (25, 26).

Our study also reports—for the first time, we believe—the prevalence of e-cigarette use by state of residence in 2016. Previously, the PATH study's results showed that e-cigarette use was more prevalent in midwestern and southern regions (12). Our analyses of the BRFSS survey, however, provide a more extensive assessment of statewide e-cigarette prevalence. We found that the prevalence of e-cigarette use differed among western, midwestern, and eastern states. The reasons for such marked differences remain understudied and may include such factors as socioeconomic status, tobacco laws, and taxation, all warranting further investigation to inform policy and educational initiatives on e-cigarette use.

The primary strength of our study is that, to our knowledge, it is the largest and most current survey to report the nationwide prevalence of e-cigarette use. In addition, our study reports prevalence estimates in different socioeconomic groups, as well as among persons with chronic health conditions. Nonetheless, the study has some notable limitations. First, no standard measurements exist to define the intensity or burden of e-cigarette use. Second, the BRFSS does not have any directly measured risk factor data, because all information was obtained from self-report. For example, the BRFSS lacks information about biochemical measures of tobacco use (namely urinary cotinine); type of e-cigarette delivery mechanism (for example, tank, mod, or voltage pen); and type of e-cigarette liquid, including nicotine dose or flavors. Third, sexual orientation and gender identity were assessed in only a subset of states. However, the BRFSS weighting process was used to ensure that results were nationally representative. Finally, BRFSS data are cross-sectional, so we cannot infer the temporality of association between e-cigarette use and any of the demographic characteristics examined.

In conclusion, we believe our study provides the most up-to-date and detailed national and state-level prevalence estimates of e-cigarette use in a nationally representative survey of the United States. These data will help inform health care policymakers about the size and characteristics of the e-cigarette–using population; facilitate monitoring of temporal trends in use patterns; and guide future research efforts, public education campaigns, and tobacco regulatory policy.

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Appendix

Appendix Table 1.

Study Population for the Whole Population and Each Subgroup, 2016 Behavioral Risk Factor Surveillance System*

Variable	Current (*n* = 15 240)	Daily (*n* = 5021)	Total (*n* = 466 842)
Sex (missing *n* = 51)			
Male	7823	2782	201 991
Female	7414	2236	264 800
Age (missing *n* = 5788)			
18-24 y	2328	642	25 345
25-29 y	1502	513	21 885
30-34 y	1430	517	24 248
35-39 y	1300	459	26 000
40-44 y	1110	409	26 025
45-49 y	1253	402	31 649
50-54 y	1483	480	40 195
55-59 y	1637	497	48 014
60-64 y	1352	451	52 927
65-69 y	940	315	54 048
70-74 y	527	198	42 271
75-79 y	191	67	30 397
≥80 y	85	31	38 050
Sexual orientation (missing *n* = 30 168)†			
Heterosexual	6043	2014	191 247
Lesbian/gay	192	69	3038
Bisexual	304	93	3416
Gender identity (missing *n* = 32 146)†			
Cisgender	6548	2166	201 031
Transgender	54	25	779
Race/ethnicity (missing *n* = 9834)			
White	11 811	4117	355 640
African American	890	173	37 247
Alaskan and Native American	316	87	6854
Asian	275	95	9761
Native Hawaiian or Pacific Islander	83	28	1367
Multiracial	565	161	9104
Hispanic	992	256	37 035
Employment status (missing *n* = 3109)			
Employed for wages	7152	2495	188 107
Self-employed	1242	402	39 871
Out of work for ≥1 y	579	155	9368
Out of work for <1 y	658	179	9114

Variable	Current (*n* = 15 240)	Daily (*n* = 5021)	Total (*n* = 466 842)
Homemaker	611	195	26 087
Student	753	186	11 980
Retired	1780	628	143 704
Unable to work	2359	738	35 502
Education (missing *n* = 1353)			
Less than high school diploma	1556	466	35 839
High school diploma	5448	1800	130 479
Some college	8210	2745	299 171
Exercise during past 30 days (missing *n* = 103 017)			
Yes	10 956	3608	347 656
No	4260	98 042	16 169
Body mass index (missing *n* = 30 067)			
<18.5 kg/m^2	414	130	7311
18.5 to <25 kg/m^2	5134	1586	138 730
25 to <30 kg/m^2	4764	1584	157 618
≥30 kg/m^2	4341	1534	133 116
Alcohol use (missing *n* = 6089)			
Yes	8713	2738	237 262
No	6319	2210	223 491
Income (missing *n* = 8573)			
Below poverty line	2597	723	46 232
Within 100% to 200% of poverty line	4045	1289	98 337
>200% of poverty line	8142	2890	313 700
Relationship status (missing *n* = 2775)			
Without a partner	8667	2642	205 722
With partner	6495	2356	258 345
Pregnant (missing *n* = 211)[ǂ]	40	11	2453
No	13 361	4428	406 482
Yes	1730	555	56 345
Diabetes (missing *n* = 749)			
No	13 443	4462	393 878
Prediabetes	260	76	8549
Diabetes	1502	474	63 666
Cancer (missing *n* = 1051)			
No	14 022	4658	419 933
Yes	1163	350	45 858
Chronic obstructive pulmonary disease (missing *n* = 2046)			
No	12 628	4232	425 527
Yes	2517	765	39 269
Asthma (missing *n* = 1317)			
No	12 142	4089	402 247

Variable	Current (*n* = 15 240)	Daily (*n* = 5021)	Total (*n* = 466 842)
Yes	3043	915	63 278
Depression (missing *n* = 1871)			
No	9770	3179	382 273
Yes	5387	1816	82 698
Chronic kidney disease (missing *n* = 1508)			
No	14 657	4823	447 579
Yes	520	177	17 755

[*] Missing *n* = 19 461. Values are numbers.

[†] Asked in only 26 states (total population = 234 147).

[‡] Asked of those who identified their gender as women and were younger than 44 y.

Appendix Table 2.

Estimated Absolute Number of U.S. Adult E-Cigarette Users, According to Cigarette Smoking Status, Using the U.S. Census Estimates of the Number of U.S. Adults in 2016[*]

Variable	Never-Combustible Cigarette Smoker		Former Combustible Cigarette Smoker		Current Combustible Cigarette Smoker	
	Current E-Cigarette User (*n* = 1 973 051)	Daily E-Cigarette User (*n* = 348 595)	Current E-Cigarette User (*n* = 3 083 815)	Daily E-Cigarette User (*n* = 1 990 254)	Current E-Cigarette User (*n* = 5 714 188)	Daily E-Cigarette User (*n* = 1 219 344)
Sex						
Female	690 684	133 265	1 133 748	699 418	2 485 962	430 401
Male	1 279 210	212 173	1 950 067	1 290 836	3 227 564	788 282
Age group						
18-24 y	1 235 019	196 424	466 788	306 672	1 083 556	255 168
25-44 y	609 956	121 283	1 489 057	979 394	2 479 900	533 844
45-64 y	99 352	22 537	919 728	583 252	1 824 446	348 374
≥65 y	20 535	2023	199 475	115 390	291 318	70 078
Race/ethnicity						
White	1 074 390	226 544	2 393 609	1 607 532	4 156 417	944 900
African American	235 565	21 443	188 136	102 854	505 592	58 520
Alaskan and Native American	20 144	3354	32 565	24 814	106 664	25 707
Asian	134 577	25 351	83 457	49 977	144 033	31 353
Native Hawaiian or Pacific Islander	6222	1551	6697	5615	16 518	3695
Multiracial	57 403	6453	89 214	36 498	185 390	40 478
Hispanic	402 377	53 874	248 611	138 307	489 267	94 103
Employment status						
Employed for wages	1 054 413	208 504	1 810 811	1 225 778	2 887 203	678 839
Self-employed	131 565	22 045	263 459	130 469	536 718	93 332
Out of work for ≥1 y	41 517	2334	72 670	37 284	257 273	50 948

Variable	Never-Combustible Cigarette Smoker		Former Combustible Cigarette Smoker		Current Combustible Cigarette Smoker	
	Current E-Cigarette User (*n* = 1 973 051)	Daily E-Cigarette User (*n* = 348 595)	Current E-Cigarette User (*n* = 3 083 815)	Daily E-Cigarette User (*n* = 1 990 254)	Current E-Cigarette User (*n* = 5 714 188)	Daily E-Cigarette User (*n* = 1 219 344)
Out of work for <1 y	119 208	20 276	108 388	73 929	321 744	48 591
Homemaker	22 635	5247	148 584	101 743	245 932	42 905
Student	480 692	55 224	151 232	105 219	243 886	58 356
Retired	35 532	5279	222 608	128 941	359 823	76 859
Unable to work	64 220	21 845	293 482	178 511	821 394	153 676
Education						
Less than high school diploma	208 827	38 981	296 090	195 327	1 074 624	176 348
High school diploma	762 012	166 748	1 035 525	660 654	2 049 180	455 440
Some college	999 397	142 866	1 748 040	1 131 352	2 586 554	586 542
Exercise during past 30 d						
Yes	1 649 708	270 483	2 422 512	1 573 941	4 170 381	907 165
No	321 067	77 515	658 267	414 860	1 541 719	311 426
Body mass index						
<18.5 kg/m^2	71 021	13 048	71 270	43 401	151 823	33 804
18.5 to <25 kg/m^2	815 044	127 293	1 003 861	621 763	2 018 601	424 533
25 to <30 kg/m^2	595 887	113 370	979 425	627 033	1 733 248	386 234
≥30 kg/m^2	418 308	79 271	935 158	637 640	1 574 489	328 389
Income according to federal poverty line						
Below poverty line	314 056	44 846	343 455	198 074	1 134 676	207 063
100% to 200% of poverty line	355 782	81 282	650 374	417 204	1 504 035	314 512
>200% of poverty line	1 191 488	213 519	2 003 832	1322 183	2 842 240	661 622
Pregnant	11 811	411	12 789	6136	18 280	5189
Alcohol use						
No	639 694	152 893	1 097 976	737 398	2 150 306	472 104
Yes	1 312 789	190 873	1 944 578	1 220 561	3 487 092	730 797
Relationship status						
With partner	1 534 762	269 723	1 390 936	916 567	3 377 407	694 932
Without partner	430 532	75 872	1 678 539	1061 681	2 303 524	518 339
Cardiovascular disease						
No	1 938 057	338 793	2 827 676	1 841 013	5 093 505	1 086 346
Yes	26 540	7144	237 932	139 647	551 279	122 080
Diabetes						

Variable	Never-Combustible Cigarette Smoker		Former Combustible Cigarette Smoker		Current Combustible Cigarette Smoker	
	Current E-Cigarette User (*n* = 1 973 051)	Daily E-Cigarette User (*n* = 348 595)	Current E-Cigarette User (*n* = 3 083 815)	Daily E-Cigarette User (*n* = 1 990 254)	Current E-Cigarette User (*n* = 5 714 188)	Daily E-Cigarette User (*n* = 1 219 344)
Normal	1 891 495	326 336	2 854 213	1 839 856	5 083 686	1 088 900
Prediabetes	17 488	5 887	24 773	11 020	103 366	19 726
Diabetes	61 957	15 924	203 293	138 460	505 672	108 592
Cancer						
No	1 955 647	345 235	2 927 648	1 900 068	5 327 109	1 139 086
Yes	14 045	3360	147 043	86 500	363 567	78 308
Asthma						
No	1 724 006	293 297	2 800 233	1 810 535	4 778 410	1 045 479
Yes	237 709	51 364	246 245	160 757	863 635	155 611
Chronic obstructive pulmonary disease						
No	1 909 455	329 469	2 778 662	1 818 287	4 822 017	1 051 734
Yes	58 113	18 334	292 194	161 953	852 527	163 040
Depression						
No	1 573 950	255 906	2 155 048	1 340 416	3 482 858	732 147
Yes	393 128	90 946	903 447	630 020	2 204 346	483 828
Chronic kidney disease						
No	1 945 621	336 392	298 6416	1 921 698	5 514 183	1 164 221
Yes	24 753	9955	86 934	60 018	175 669	53 884

*Values are numbers.

Appendix Table 3.

State-Specific, Age-Standardized Prevalence of E-Cigarette Use Among U.S. Adults, According to the 2016 Behavioral Risk Factor Surveillance System

State/Territory	Weighted and Age-Standardized Prevalence, %	
	Current E-Cigarette Use	Daily E-Cigarette Use
Guam	7.2 (5.5-9.4)	2.8 (1.8-4.4)
Oklahoma	7.0 (6.0-8.2)	2.9 (2.2-3.6)
Nevada	6.4 (5.2-7.7)	2.6 (1.9-3.5)
Arkansas	6.2 (4.9-7.8)	2.2 (1.5-3.2)
Tennessee	6.2 (5.2-7.3)	2.3 (1.7-3.1)
Ohio	6.2 (5.4-7.0)	1.8 (1.4-2.3)
New Hampshire	6.1 (5.0-7.5)	2.1 (1.4-2.9)
Louisiana	6.1 (4.9-7.5)	1.9 (1.2-2.7)
Wyoming	5.9 (4.8-7.5)	2.1 (1.4-3.1)

State/Territory	Weighted and Age-Standardized Prevalence, %	
	Current E-Cigarette Use	Daily E-Cigarette Use
Kentucky	5.9 (5.2-6.8)	2.3 (1.8-2.8)
Wisconsin	5.9 (4.8-7.1)	1.7 (1.2-2.4)
Arizona	5.7 (4.9-6.6)	2.5 (1.9-3.1)
Washington	5.6 (5.1-6.2)	1.9 (1.6-2.3)
Alabama	5.5 (4.7-6.5)	1.7 (1.3-2.2)
Colorado	5.5 (4.9-6.1)	1.6 (1.3-1.9)
Michigan	5.4 (4.8-6.1)	1.1 (0.8-1.3)
Florida	5.3 (4.8-5.9)	1.9 (1.6-2.2)
New Mexico	5.3 (4.3-6.6)	1.6 (1.0-2.5)
Virginia	5.3 (4.6-6.0)	1.6 (1.3-2.0)
Missouri	5.3 (4.4-6.3)	1.4 (0.9-1.9)
Nebraska	5.2 (4.6-6.0)	1.5 (1.2-1.9)
West Virginia	5.2 (4.5-6.1)	2.0 (1.6-2.5)
Kansas	5.2 (4.6-5.8)	1.8 (1.5-2.1)
South Carolina	5.1 (4.5-5.9)	2.1 (1.6-2.6)
Indiana	5.0 (4.4-5.8)	1.8 (1.4-2.2)
Georgia	5.0 (4.2-6.0)	1.4 (1.0-2.0)
Mississippi	4.9 (4.1-6.0)	1.1 (0.7-1.6)
Oregon	4.9 (4.1-5.8)	1.2 (0.9-1.6)
Utah	4.8 (4.3-5.5)	2.2 (1.8-2.6)
Idaho	4.8 (3.9-6.0)	1.9 (1.3-2.7)
Rhode Island	4.8 (3.9-6.1)	1.1 (0.7-1.7)
Texas	4.8 (4.0-5.6)	1.9 (1.4-2.4)
Massachusetts	4.7 (4.0-5.6)	1.8 (1.3-2.5)
North Carolina	4.7 (4.0-5.5)	1.5 (1.1-2.0)
Iowa	4.6 (3.9-5.5)	1.6 (1.2-2.1)
Connecticut	4.6 (3.9-5.5)	1.2 (0.8-1.7)
Hawaii	4.6 (3.9-5.4)	1.8 (1.4-2.4)
Pennsylvania	4.5 (3.9-5.3)	1.4 (1.0-1.9)
Maine	4.5 (3.8-5.4)	1.0 (0.7-1.6)
Illinois	4.5 (3.7-5.5)	1.8 (1.3-2.5)
Montana	4.4 (3.5-5.5)	1.1 (0.7-1.7)
New York	4.3 (3.9-4.9)	1.2 (0.9-1.5)
Delaware	4.3 (3.5-5.5)	1.9 (1.2-2.8)
Alaska	4.1 (3.1-5.5)	1.3 (0.7-2.4)
Minnesota	4.0 (3.6-4.5)	1.4 (1.1-1.6)
New Jersey	4.0 (3.2-4.9)	0.9 (0.6-1.4)
Vermont	3.9 (3.1-5.0)	1.1 (0.7-1.7)
North Dakota	3.8 (3.1-4.8)	0.9 (0.6-1.5)

State/Territory	Weighted and Age-Standardized Prevalence, %	
	Current E-Cigarette Use	Daily E-Cigarette Use
Maryland	3.4 (2.9-3.9)	1.0 (0.7-1.4)
California	3.3 (2.9-3.8)	1.0 (0.8-1.4)
South Dakota	3.0 (2.3-4.0)	0.7 (0.3-1.3)
District of Columbia	2.3 (1.7-3.0)	0.4 (0.1-0.7)
Virgin Islands	1.7 (0.6-4.7)	0 (0-0.1)
Puerto Rico	0.7 (0.4-1.2)	0 (0-0.2)

References

1. Bhatnagar A, Whitsel LP, Ribisl KM, Bullen C, Chaloupka F, Piano MR, et al. ; American Heart Association Advocacy Coordinating Committee, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. Electronic cigarettes: a policy statement from the American Heart Association. Circulation. 2014;130:1418–36. doi:10.1161/CIR.0000000000000107 [PubMed: 25156991]
2. Wackowski OA, Delnevo CD, Steinberg MB. Perspectives for clinicians on regulation of electronic cigarettes. Ann Intern Med. 2016;165:665–6. doi:10.7326/M16-1345 [PubMed: 27571380]
3. Crowley RA; Health Public Policy Committee of the American College of Physicians. Electronic nicotine delivery systems: executive summary of a policy position paper from the American College of Physicians. Ann Intern Med. 2015;162:583–4. doi:10.7326/M14-2481 [PubMed: 25894027]
4. Food and Drug Administration; HHS. Deeming tobacco products to be subject to the Federal Food, Drug, and Cosmetic Act, as amended by the Family Smoking Prevention and Tobacco Control Act; restrictions on the sale and distribution of tobacco products and required warning statements for tobacco products. Final rule. Fed Regist 2016;81:28973–9106. [PubMed: 27192730]
5. U.S. Department of Health and Human Services. E-cigarette use among youth and young adults: a report of the surgeon general. Accessed at https://e-cigarettes.surgeongeneral.gov/documents/2016_sgr_full_report_non-508.pdf on 8 August 2018.
6. Murthy VH. E-cigarette use among youth and young adults: a major public health concern. JAMA Pediatr. 2017;171:209–10. doi:10.1001/jamapediatrics.2016.4662 [PubMed: 27928577]
7. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System overview: BRFSS 2016. 2017. Accessed at www.cdc.gov/brfss/annual_data/2016/pdf/overview_2016.pdf on 3 June 2018.
8. Centers for Medicare & Medicaid Services. Federal poverty line. 2018. Accessed at www.healthcare.gov/glossary/federal-poverty-level-FPL on 8 August 2018.
9. Centers for Disease Control and Prevention. LLCP 2016 codebook report, Behavioral Risk Factor Surveillance System. 3 August 2017. Accessed at www.cdc.gov/brfss/annual_data/2016/pdf/codebook16_llcp.pdf on 1 January 2017.
10. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System: weighting BRFSS data. BRFSS 2016. 2017. Accessed at www.cdc.gov/brfss/annual_data/2016/pdf/weighting_the-data_webpage_content.pdf on 3 June 2018.
11. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System, direct age adjustment, 2016. 2017. Accessed at www.cdc.gov/brfss/annual_data/2016/pdf/2016_DirAgeAdjDUsrsGde.pdf on 1 January 2017.
12. Kasza KA, Ambrose BK, Conway KP, Borek N, Taylor K, Goniewicz ML, et al. Tobacco-product use by adults and youths in the United States in 2013 and 2014. N Engl J Med. 2017;376:342–53. doi:10.1056/NEJMsa1607538 [PubMed: 28121512]

13. U.S. Census Bureau. Quick facts: United States. 2017. Accessed at www.census.gov/quickfacts/fact/table/US/PST045216 on 12 December 2017.

14. Muller CJ, MacLehose RF. Estimating predicted probabilities from logistic regression: different methods correspond to different target populations. Int J Epidemiol. 2014;43:962–70. doi:10.1093/ije/dyu029 [PubMed: 24603316]

15. Schoenborn CA, Gindi RM. Electronic cigarette use among adults: United States, 2014. NCHS Data Brief. 2015:1–8.

16. Coleman BN, Rostron B, Johnson SE, Ambrose BK, Pearson J, Stanton CA, et al. Electronic cigarette use among US adults in the Population Assessment of Tobacco and Health (PATH) study, 2013-2014. Tob Control. 2017;26:e117–26. doi:10.1136/tobaccocontrol-2016-053462 [PubMed: 28624763]

17. Jaber RM, Mirbolouk M, DeFilippis AP, Maziak W, Keith R, Payne T, et al. Electronic cigarette use prevalence, associated factors, and pattern by cigarette smoking status in the United States from NHANES (National Health and Nutrition Examination Survey) 2013-2014. J Am Heart Assoc. 2018;7. doi:10.1161/JAHA.117.008178

18. Shahab L, Goniewicz ML, Blount BC, Brown J, McNeill A, Alwis KU, et al. Nicotine, carcinogen, and toxin exposure in long-term E-cigarette and nicotine replacement therapy users: a cross-sectional study. Ann Intern Med. 2017;166:390–400. doi:10.7326/M16-1107 [PubMed: 28166548]

19. Glasser AM, Collins L, Pearson JL, Abudayyeh H, Niaura RS, Abrams DB, et al. Overview of electronic nicotine delivery systems: a systematic review. Am J Prev Med. 2017;52:e33–66. doi:10.1016/j.amepre.2016.10.036 [PubMed: 27914771]

20. Rigotti NA, Chang Y, Tindle HA, Kalkhoran SM, Levy DE, Regan S, et al. Association of E-cigarette use with smoking cessation among smokers who plan to quit after a hospitalization: a prospective study. Ann Intern Med. 2018;168:613–20. doi:10.7326/M17-2048 [PubMed: 29582077]

21. Rigotti NA. Balancing the benefits and harms of E-cigarettes: A national academies of science, engineering, and medicine report. Ann Intern Med. 2018;168:666–667. doi:10.7326/M18-0251 [PubMed: 29435573]

22. Apelberg BJ, Feirman SP, Salazar E, Corey CG, Ambrose BK, Paredes A, et al. Potential public health effects of reducing nicotine levels in cigarettes in the United States. N Engl J Med. 2018;378: 1725–33. doi:10.1056/NEJMsr1714617 [PubMed: 29543114]

23. Delnevo CD, Giovenco DP, Steinberg MB, Villanti AC, Pearson JL, Niaura RS, et al. Patterns of electronic cigarette use among adults in the United States. Nicotine Tob Res. 2016;18:715–9. doi:10.1093/ntr/ntv237 [PubMed: 26525063]

24. Zhu SH, Zhuang YL, Wong S, Cummins SE, Tedeschi GJ. E-cigarette use and associated changes in population smoking cessation: evidence from US current population surveys. BMJ. 2017;358:j3262. doi:10.1136/bmj.j3262 [PubMed: 28747333]

25. Cobb NK, Abrams DB. E-cigarette or drug-delivery device? Regulating novel nicotine products. N Engl J Med. 2011;365:193–5. doi:10.1056/NEJMp1105249 [PubMed: 21774706]

26. Kalkhoran S, Glantz SA. E-cigarettes and smoking cessation in real-world and clinical settings: a systematic review and meta-analysis. Lancet Respir Med. 2016;4:116–28. doi:10.1016/S2213-2600(15)00521-4 [PubMed: 26776875]

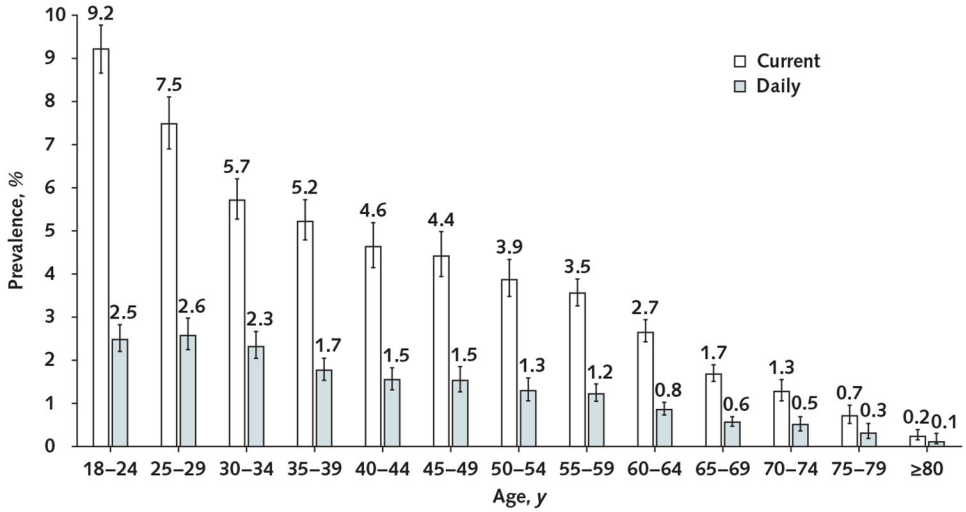

Figure 1. Prevalence of e-cigarette use among U.S. adults, according to age group, 2016 Behavioral Risk Factor Surveillance System survey.

P values for trends <0.001. Error bars represent 95% CIs.

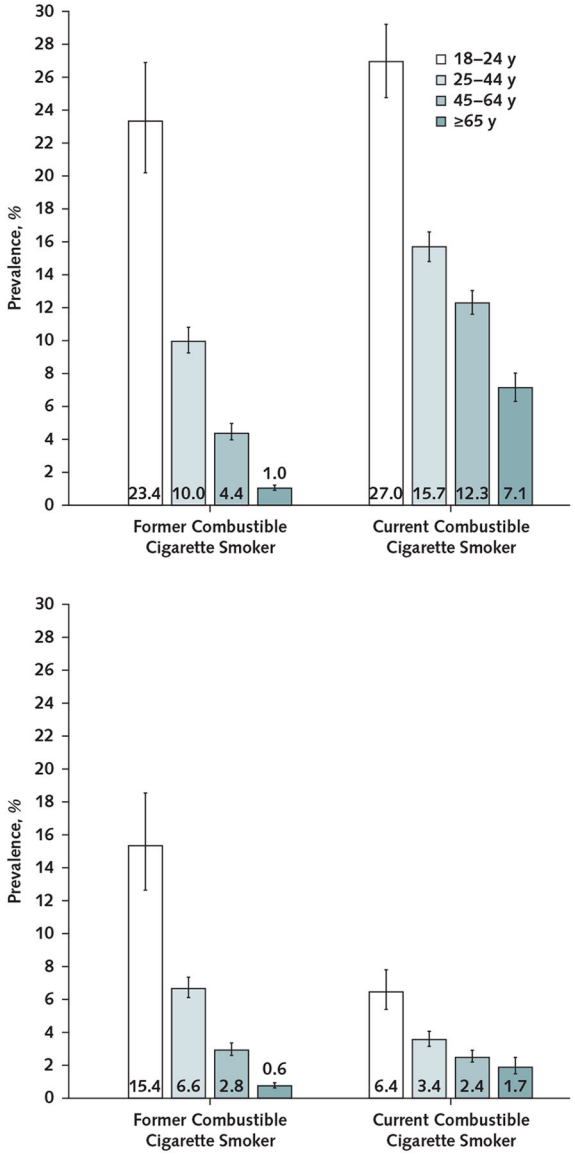

Figure 2. Prevalence of current (*top*) and daily (*bottom*) e-cigarette use among former and current combustible cigarette smokers, stratified by age, 2016 Behavioral Risk Factor Surveillance System survey.

Error bars represent 95% CIs.

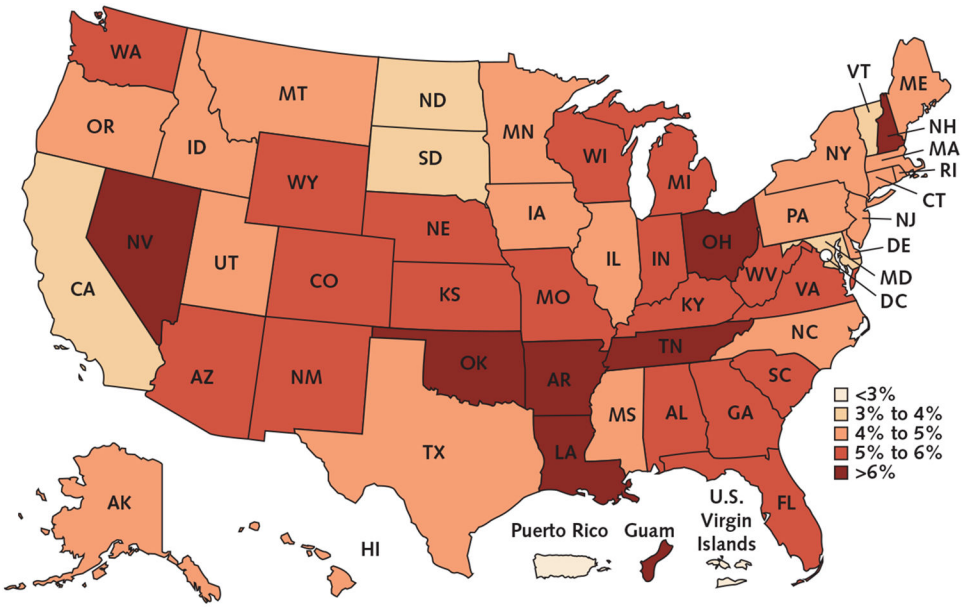

Figure 3. State-specific, age-standardized prevalence of current e-cigarette use among U.S. adults: results of the 2016 Behavioral Risk Factor Surveillance System survey.

Table 1.

Age-Standardized Prevalence (95% CI) of E-Cigarette Use, Overall and by Cigarette Smoking Status (n = 466 842)*

Variable	Overall U.S. Adult Population		Never-Smoker of Combustible Cigarettes ($n \cong$ 140 Million Adults [59.3% of the U.S. Adult Population])		Former Smoker of Combustible Cigarettes ($n \cong$ 59 Million Adults [24.4% of the U.S. Adult Population])		Current Smoker of Combustible Cigarettes ($n \cong$ 39 Million Adults [16.3% of the U.S. Adult Population])	
	Current E-Cigarette User (n = 15 240)	Daily E-Cigarette User (n = 5021)	Current E-Cigarette User (n = 1879)	Daily E-Cigarette User (n = 375)	Current E-Cigarette User (n = 4502)	Daily E-Cigarette User (n = 2883)	Current E-Cigarette User (n = 8785)	Daily E-Cigarette User (n = 1742)
Total population	4.5 (4.4–4.6)	1.5 (1.4–1.6)	1.4 (1.3–1.5)	0.2 (0.2–0.3)	7.6 (7.2–8.1)	5.0 (4.6–5.3)	14.4 (13.9–14.9)	3.1 (2.8–3.4)
Sex								
Female	3.7 (3.6–3.91)	1.1 (1.0–1.2)	0.9 (0.8–1.0)	0.2 (0.1–0.2)	6.1 (5.6–6.7)	3.8 (3.4–4.3)	14.1 (13.4–14.8)	2.4 (2.1–2.7)
Male	5.9 (5.6–6.1)	2.1 (1.9–2.2)	2.0 (1.8–2.2)	0.3 (0.3–0.4)	8.6 (7.9–9.2)	5.7 (5.2–6.3)	14.5 (13.8–15.3)	3.6 (3.2–4.0)
Sexual orientation†								
Heterosexual	4.6 (4.4–4.8)	1.5 (1.4–1.6)	1.3 (1.2–1.5)	0.2 (0.2–0.3)	7.2 (6.6–7.9)	4.7 (4.2–5.3)	13.9 (13.2–14.8)	2.9 (2.6–3.3)
Lesbian/gay	7.0 (5.5–8.8)	2.2 (1.4–3.4)	2.6 (1.6–4.3)	0.2 (0–1.2)	9.7 (5.4–16.8)	6.3 (2.9–13.3)	15.5 (11.2–21.1)	3.6 (1.9–6.6)
Bisexual	9.0 (7.6–10.6)	3.2 (2.3–4.4)	3.6 (2.5–5.1)	1.0 (0.5–2.0)	10.5 (7.0–15.5)	7.7 (4.5–12.8)	19.3 (15.5–23.7)	4.1 (2.6–6.4)
Gender identity†								
Cisgender	4.7 (4.5–4.9)	1.5 (1.4–1.7)	1.4 (1.2–1.5)	0.2 (0.2–0.3)	7.4 (6.7–8.1)	4.8 (4.3–5.4)	14.3 (13.5–15.0)	3.0 (2.6–3.3)
Transgender	8.7 (6.0–12.6)	3.5 (1.9–6.3)	6.7 (3.7–11.9)	2.4 (0.8–6.7)	10.6 (4.8–21.9)	9.3 (3.8–20.6)	13.8 (7.6–23.6)	2.2 (0.8–5.9)
Race/ethnicity								
White	5.9 (5.7–6.1)	2.1 (2.0–2.3)	1.5 (1.4–1.7)	0.3 (0.3–0.4)	8.4 (7.9–8.9)	5.7 (5.3–6.2)	15.9 (15.3–16.6)	3.7 (3.3–4.0)
African American	3.4 (3.1–3.8)	0.6 (0.5–0.8)	1.2 (1.0–1.5)	0.1 (0.1–0.2)	7.3 (5.4–9.7)	3.6 (2.4–5.1)	9.6 (8.4–10.9)	1.0 (0.7–1.6)
Alaskan and Native American	7.4 (6.0–9.0)	2.5 (1.7–3.7)	2.0 (1.2–3.3)	0.3 (0.1–0.8)	7.0 (4.7–10.2)	5.3 (3.2–8.4)	17.4 (13.6–21.9)	4.6 (2.4–8.7)
Asian	2.8 (2.3–3.4)	0.8 (0.6–1.2)	1.2 (0.8–1.7)	0.2 (0.1–0.6)	7.2 (4.9–10.4)	4.2 (2.5–7.0)	17.4 (13.4–22.1)	3.5 (2.2–5.7)
Native Hawaiian or Pacific Islander	6.5 (4.2–10.0)	2.1 (1.2–3.8)	1.7 (0.8–3.3)	0.3 (0.1–0.7)	9.8 (4.5–20.0)	8.2 (3.3–19.1)	21.9 (14.4–32.1)	4.7 (1.9–11.0)
Multiracial	9.3 (7.4–11.6)	2.4 (1.7–3.3)	2.6 (1.8–3.8)	0.3 (0.2–0.7)	12.7 (7.8–19.8)	5.6 (4.0–7.8)	20.5 (17.0–24.6)	4.5 (2.5–7.9)
Hispanic	2.6 (2.4–2.9)	0.7 (0.5–0.8)	1.2 (1.0–1.4)	0.2 (0.1–0.3)	4.1 (3.3–5.2)	2.3 (1.7–3.1)	9.2 (7.9–10.7)	1.8 (1.3–2.5)
Employment status								
Employed for wages	4.6 (4.4–4.8)	1.7 (1.6–1.8)	1.3 (1.2–1.4)	0.2 (0.2–0.3)	7.7 (7.1–8.3)	5.2 (4.7–5.7)	13.9 (13.2–14.7)	3.3 (2.9–3.7)
Self-employed	4.8 (4.3–5.3)	1.3 (1.1–1.5)	1.2 (0.9–1.6)	0.2 (0.1–0.3)	6.3 (5.2–7.5)	3.2 (2.6–4.0)	14.3 (12.5–16.3)	2.5 (2.0–3.2)
Out of work for ≥1 y	6.0 (5.2–7.0)	1.5 (1.1–2.1)	1.3 (0.9–2.0)	0.1 (0–0.3)	8.2 (5.5–12.1)	4.2 (2.9–6.1)	13.6 (11.3–16.3)	3.0 (1.8–5.1)

Variable	Overall U.S. Adult Population		Never-Smoker of Combustible Cigarettes (*n* ≅ 140 Million Adults [59.3% of the U.S. Adult Population])		Former Smoker of Combustible Cigarettes (*n* ≅ 59 Million Adults [24.4% of the U.S. Adult Population])		Current Smoker of Combustible Cigarettes (*n* ≅ 39 Million Adults [16.3% of the U.S. Adult Population])	
	Current E-Cigarette User (*n* = 15 240)	Daily E-Cigarette User (*n* = 5021)	Current E-Cigarette User (*n* = 1879)	Daily E-Cigarette User (*n* = 375)	Current E-Cigarette User (*n* = 4502)	Daily E-Cigarette User (*n* = 2883)	Current E-Cigarette User (*n* = 8785)	Daily E-Cigarette User (*n* = 1742)
Out of work for <1 y	7.2 (6.3–8.1)	1.8 (1.4–2.3)	2.5 (1.8–3.5)	0.4 (0.2–0.8)	9.3 (7.3–11.8)	6.4 (4.7–8.5)	15.7 (13.2–18.6)	2.2 (1.5–3.3)
Homemaker	2.7 (2.4–3.2)	1.0 (0.8–1.3)	0.2 (0.1–0.3)	0.1 (0–0.1)	6.1 (4.8–7.9)	4.1 (3.0–5.7)	12.4 (10.5–14.7)	2.1 (1.4–3.2)
Student	5.2 (3.9–6.7)	1.7 (0.8–3.4)	2.1 (1.8–2.5)	0.3 (0.2–0.4)	13.0 (9.4–17.8)	9.2 (5.9–13.9)	16.9 (13.5–20.8)	3.6 (2.5–5.3)
Retired	4.6 (2.8–7.6)	1.1 (0.5–2.2)	3.5 (1.2–9.4)	0.5 (0.1–3.3)	2.9 (1.3–6.6)	2.2 (0.8–6.2)	10.2 (6.6–15.6)	1.5 (0.7–3.0)
Unable to work	7.9 (7.2–8.7)	2.2 (1.9–2.6)	1.5 (1.0–2.2)	0.5 (0.3–1.0)	8.3 (6.7–10.3)	5.0 (3.8–6.5)	15.6 (14.1–17.3)	2.7 (2.2–3.4)
Highest education level								
Less than high school diploma	5.2 (4.8–5.7)	1.3 (1.1–1.6)	1.3 (1.0–1.6)	0.2 (0.1–0.4)	5.9 (4.6–7.6)	4.3 (3.2–5.7)	12.6 (11.4–13.9)	2.0 (1.6–2.5)
High school diploma	6.3 (6.0–6.6)	2.1 (1.9–2.2)	2.2 (1.9–2.47)	0.5 (0.4–0.6)	9.3 (8.4–10.3)	5.9 (5.2–6.6)	14.3 (13.5–15.1)	3.2 (2.8–3.6)
Some college	4.0 (3.9–4.2)	1.4 (1.3–1.5)	1.1 (1.0–1.3)	0.2 (0.1–0.2)	7.1 (6.6–7.7)	4.7 (4.2–5.1)	15.4 (14.7–16.3)	3.6 (3.1–4.0)
Exercise during the past 30 d								
Yes	4.7 (4.6–4.9)	1.6 (1.5–1.7)	1.4 (1.3–1.6)	0.2 (0.1–0.3)	7.6 (7.1–8.1)	5.0 (4.6–5.4)	15.4 (14.7–16.0)	3.3 (3.0–3.7)
No	5.0 (4.7–5.3)	1.5 (1.4–1.7)	1.3 (1.1–1.5)	0.3 (0.2–0.4)	7.7 (6.7–8.9)	4.7 (4.0–5.6)	12.1 (11.3–13.0)	2.5 (2.1–2.9)
Body mass index								
<18.5 kg/m^2	6.6 (5.6–7.7)	2.1 (1.6–2.7)	2.0 (1.4–2.9)	0.4 (0.2–0.9)	13.8 (9.9–18.9)	8.2 (5.8–11.5)	15.4 (12.6–18.8)	3.4 (2.1–5.6)
18.5–24.9 kg/m^2	5.2 (5.0–5.5)	1.6 (1.5–1.7)	1.6 (1.4–1.8)	0.2 (0.2–0.3)	9.0 (8.2–9.9)	5.7 (5.0–6.4)	15.2 (14.4–16.2)	3.2 (2.8–3.7)
25–29.9 kg/m^2	4.7 (4.5–5.0)	1.6 (1.4–1.7)	1.5 (1.3–1.7)	0.3 (0.2–0.4)	6.8 (6.1–7.5)	4.4 (3.8–4.9)	13.8 (13.0–14.8)	3.2 (2.7–3.7)
≥30 kg/m^2	4.9 (4.6–5.2)	1.8 (1.6–1.9)	1.3 (1.1–1.5)	0.2 (0.1–0.4)	7.7 (6.9–8.7)	5.3 (4.6–6.1)	14.2 (13.2–15.2)	3.1 (2.6–3.6)
Federal poverty line ratio of household income								
<1	5.0 (4.7–5.4)	1.3 (1.1–1.4)	1.4 (1.1–1.6)	0.2 (0.1–0.3)	6.6 (5.5–7.9)	3.9 (3.3–4.6)	12.8 (11.8–13.9)	2.4 (1.9–2.9)
1–2	5.8 (5.4–6.1)	1.8 (1.7–2.0)	1.4 (1.2–1.7)	0.3 (0.2–0.5)	8.6 (7.6–9.8)	5.6 (4.7–6.5)	14.6 (13.7–15.7)	3.1 (2.6–3.6)
>2	4.4 (4.3–4.6)	1.6 (1.5–1.7)	1.4 (1.3–1.5)	0.2 (0.2–0.3)	7.6 (7.0–8.1)	5.1 (4.6–5.5)	14.8 (14.1–15.6)	3.5 (3.1–3.9)
Pregnant	1.9 (1.2–2.9)	0.5 (0.2–1.1)	0.7 (0.2–1.9)	0 (0–0.2)	3.1 (1.4–6.6)	1.5 (0.6–3.8)	11.1 (6.2–19.2)	3.1 (0.9–10.4)
Consumption of ≥1 alcoholic drink during the past 30 d								
No	3.9 (3.7–4.2)	1.4 (1.3–1.5)	1.0 (0.9–1.1)	0.2 (0.1–0.3)	7.6 (6.8–8.3)	5.3 (4.7–5.9)	14.2 (13.3–15.1)	3.1 (2.7–3.5)
Yes	5.5 (5.3–5.7)	1.7 (1.6–1.8)	1.8 (1.7–2.0)	0.3 (0.2–0.3)	7.6 (7.1–8.2)	4.8 (4.4–5.3)	14.6 (13.9–15.3)	3.1 (2.7–3.4)
Relationship status								

Variable	Overall U.S. Adult Population		Never-Smoker of Combustible Cigarettes (*n* ≅ 140 Million Adults [59.3% of the U.S. Adult Population])		Former Smoker of Combustible Cigarettes (*n* ≅ 59 Million Adults [24.4% of the U.S. Adult Population])		Current Smoker of Combustible Cigarettes (*n* ≅ 39 Million Adults [16.3% of the U.S. Adult Population])	
	Current E-Cigarette User (*n* = 15 240)	Daily E-Cigarette User (*n* = 5021)	Current E-Cigarette User (*n* = 1879)	Daily E-Cigarette User (*n* = 375)	Current E-Cigarette User (*n* = 4502)	Daily E-Cigarette User (*n* = 2883)	Current E-Cigarette User (*n* = 8785)	Daily E-Cigarette User (*n* = 1742)
Not partnered	6.0 (5.8–6.3)	1.8 (1.7–1.9)	2.2 (2.0–2.3)	0.4 (0.3–0.5)	9.4 (8.6–10.2)	6.2 (5.5–6.9)	15.0 (14.3–15.7)	3.1 (2.8–3.5)
Partnered	3.7 (3.5–3.9)	1.4 (1.3–1.5)	0.6 (0.5–0.7)	0.1 (0.1–0.1)	6.5 (5.9–7.0)	4.2 (3.8–4.6)	13.5 (12.8–14.3)	3.0 (2.6–3.5)
Cardiovascular disease								
No	4.7 (4.5–4.8)	1.5 (1.4–1.6)	1.4 (1.3–1.5)	0.2 (0.2–0.3)	7.6 (7.1–8.0)	5.0 (4.6–5.3)	14.2 (13.7–14.8)	3.0 (2.8–3.3)
Yes	7.0 (6.0–8.2)	2.0 (1.6–2.6)	0.9 (0.6–1.6)	0.3 (0.1–1.0)	7.2 (5.3–9.7)	4.5 (3.1–6.3)	15.7 (13.2–18.7)	2.9 (2.1–4.1)
Diabetes status								
No	4.8 (4.7–5.0)	1.6 (1.5–1.7)	1.4 (1.3–1.5)	0.2 (0.2–0.3)	7.8 (7.4–8.3)	5.1 (4.7–5.5)	14.3 (13.7–14.8)	3.1 (2.8–3.3)
Prediabetes	4.9 (3.8–6.4)	1.3 (0.8–2.0)	1.3 (0.6–2.5)	0.4 (0.1–1.9)	2.9 (1.6–5.2)	2.0 (0.9–4.3)	17.7 (13.4–23.1)	3.1 (1.8–5.6)
Diabetes	5.0 (4.4–5.7)	1.6 (1.2–2.0)	1.3 (0.8–1.9)	0.5 (0.2–1.0)	4.5 (3.5–5.7)	2.8 (2.1–3.8)	15.2 (13.2–17.5)	3.1 (2.2–4.3)
Cancer								
No	4.8 (4.6–4.9)	1.6 (1.5–1.7)	1.4 (1.3–1.5)	0.2 (0.2–0.3)	7.6 (7.2–8.1)	5.0 (4.6–5.4)	14.2 (13.7–14.8)	3.1 (2.8–3.3)
Yes	6.5 (5.6–7.5)	1.7 (1.3–2.4)	0.5 (0.3–1.0)	0.2 (0–0.7)	7.7 (5.4–10.8)	4.2 (2.4–7.2)	17.4 (15.2–19.9)	3.0 (2.2–4.1)
Asthma								
No	4.6 (4.5–4.8)	1.5 (1.4–1.6)	1.4 (1.3–1.5)	0.2 (0.1–0.3)	7.6 (7.2–8.1)	5.0 (4.6–5.4)	13.7 (13.2–14.3)	3.0 (2.7–3.3)
Yes	6.7 (6.2–7.2)	1.8 (1.5–2.1)	2.1 (1.7–2.5)	0.5 (0.3–0.7)	6.6 (5.4–8.0)	4.4 (3.3–5.7)	19.1 (17.6–20.8)	3.5 (2.8–4.4)
Chronic obstructive pulmonary disease								
No	4.5 (4.4–4.6)	1.5 (1.4–1.6)	1.4 (1.3–1.5)	0.2 (0.2–0.3)	7.5 (7.0–7.9)	4.9 (4.5–5.3)	13.9 (13.4–14.5)	3.0 (2.8–3.3)
Yes	10.2 (9.2–11.2)	2.6 (2.2–3.1)	2.3 (1.6–3.4)	0.7 (0.3–1.6)	9.1 (6.7–12.2)	4.9 (3.4–6.9)	16.8 (15.2–18.6)	3.1 (2.5–3.8)
Depression								
No	3.9 (3.8–4.1)	1.3 (1.1–1.3)	1.3 (1.2–1.4)	0.2 (0.1–0.3)	6.8 (6.3–7.3)	4.3 (3.9–4.7)	12.5 (11.9–13.2)	2.7 (2.3–2.9)
Yes	9.1 (8.7–9.5)	3.1 (2.9–3.4)	2.3 (2.04–2.7)	0.5 (0.4–0.7)	10.5 (9.5–11.6)	7.3 (6.5–8.2)	19.0 (18.0–20.1)	4.3 (3.7–4.9)
Chronic kidney disease								
No	4.8 (4.6–4.9)	1.6 (1.5–1.6)	1.4 (1.3–1.5)	0.2 (0.2–0.3)	7.6 (7.1–8.0)	4.9 (4.5–5.3)	14.3 (13.8–14.9)	3.1 (2.8–3.3)
Yes	6.5 (5.3–8.0)	3.1 (2.2–4.5)	1.5 (0.7–2.9)	0.6 (0.2–1.9)	10.2 (6.5–15.6)	8.4 (5.0–14.0)	15.5 (12.7–18.9)	4.3 (2.8–6.7)

*Values are prevalences (95% CIs) presented as percentages.

† Asked in the following states and territories: California, Connecticut, Delaware, Georgia, Guam, Hawaii, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Massachusetts, Minnesota, Mississippi, Missouri, Nevada, New York, Ohio, Pennsylvania, Rhode Island, Texas, Vermont, Virginia, Washington, and Wisconsin.

Table 2.

Age-Adjusted Absolute Prevalence Difference (95% CI) for E-Cigarette Use Among Demographic and Socioeconomic Groups *

Variable	Current E-Cigarette User	Daily E-Cigarette User
Combustible cigarette smoking status		
Never	0.0 (reference)	0.0 (reference)
Current	12.8 (12.3 to 13.3)	2.8 (2.5 to 3.0)
Former	6.6 (6.1 to 7.0)	4.9 (4.5 to 5.3)
Sex		
Male	0.0 (reference)	0.0 (reference)
Female	−1.8 (−2.1 to −1.6)	−0.9 (−0.1 to −0.7)
Age †		
18–24 y	0.0 (reference)	0.0 (reference)
25–29 y	−1.7 (−2.5 to −0.9)	0.1 (−0.4 to 0.6)
30–34 y	−3.5 (−4.2 to −2.7)	−0.2 (−0.6 to 0.3)
35–39 y	−4.0 (−4.7 to −3.2)	−0.7 (−1.1 to −0.3)
40–44 y	−4.6 (−5.3 to −3.8)	−0.9 (−1.3 to −0.5)
45–49 y	−4.8 (−5.5 to −4.0)	−1.0 (−1.4 to −0.5)
50–54 y	−5.2 (−6.0 to −4.6)	−1.2 (−1.6 to −0.8)
55–59 y	−5.6 (−6.3 to −5.0)	−1.3 (−1.6 to −0.9)
60–64 y	−6.5 (−7.1 to −5.9)	−1.6 (−2.0 to −1.3)
65–69 y	−7.5 (−8.1 to −6.9)	−1.9 (−2.2 to −1.6)
70–74 y	−7.9 (−8.5 to −7.3)	−2.0 (−2.3 to −1.6)
75–79 y	−8.5 (−9.1 to −7.9)	−2.2 (−2.5 to −1.8)
≥80 y	−9.0 (−9.5 to −8.4)	−2.4 (−2.7 to −2.1)
Sexual orientation ‡		
Heterosexual	0.0 (reference)	0.0 (reference)
Lesbian/gay	1.9 (0.4 to 3.4)	0.6 (−0.3 to 1.4)
Bisexual	3.6 (2.2 to 4.9)	1.5 (0.5 to 2.5)
Gender identity ‡		
Cisgender	0.0 (reference)	0.0 (reference)
Transgender	3.2 (0.38 to 6.1)	1.7 (−0.2 to 3.5)
Race/ethnicity		
White	0.0 (reference)	0.0 (reference)
African American	−2.3 (−2.7 to −1.9)	−1.4 (−1.6 to −1.8)
Alaskan and Native American	1.3 (0 to 2.7)	0.3 (−0.5 to 1.2)
Asian	−2.9 (−3.5 to −2.4)	−1.2 (−1.6 to −0.9)
Native Hawaiian or Pacific Islander	−0.1 (−2.0 to 1.8)	0.1 (−1.2 to 1.1)
Multiracial	2.8 (0.1 to 4.6)	0.1 (−0.6 to 0.8)
Hispanic	−3.0 (−3.4 to −2.7)	−1.4 (−1.5 to −1.2)

Variable	Current E-Cigarette User	Daily E-Cigarette User
Employment status		
Employed forwages	0.0 (reference)	0.0 (reference)
Self-employed	0.4 (−0.1 to 0.9)	−0.4 (−0.6 to −0.1)
Out of work for ≥1 y	1.4 (0.5 to 2.2)	−0.2 (−0.6 to 0.2)
Out of work for <1 y	1.9 (1.1 to 2.7)	0.1 (−0.3 to 0.5)
Homemaker	−1.4 (−1.9 to −1.0)	−0.6 (−0.9 to −0.3)
Student	−1.4 (−1.8 to −0.9)	−0.7 (−1.0 to −0.5)
Retired	0.9 (0.2 to 1.5)	0 (−0.4 to 0.3)
Unable to work	4.5 (3.8 to 5.3)	1.0 (0.7 to 1.4)
Income		
Below the poverty line	0.0 (reference)	0.0 (reference)
Within 100%–200% of the poverty line	0.8 (0.3 to 1.2)	0.6 (0.3 to 0.8)
>200% of the poverty line	−0.5 (−0.9 to −0.1)	0.3 (0.1 to 0.5)
Highest education level		
Less than high school diploma	0.0 (reference)	0.0 (reference)
High school diploma	0.6 (0 to 1.1)	0.6 (0.4 to 0.9)
Some college	−1.3 (−1.8 to −0.8)	0 (−0.2 to 0.2)
Exercise during the past 30 d		
No	0.0 (reference)	0.0 (reference)
Yes	−0.6 (−1.0 to −0.3)	−0.1 (−0.3 to 0.1)
Body mass index		
<18.5 kg/m^2	0.0 (reference)	0.0 (reference)
18.5–24.9 kg/m^2	−0.7 (−1.6 to 0.2)	−0.3 (−0.8 to 0.2)
25–29.9 kg/m^2	−0.9 (−1.8 to 0)	−0.2 (−0.7 to 0.3)
≥30 kg/m^2	−0.7 (−1.6 to 0.2)	−0.1 (−0.6 to 0.4)
Relationship status		
Not partnered	0.0 (reference)	0.0 (reference)
Partnered	−1.8 (−2.1 to −1.5)	−0.3 (−0.5 to −0.2)
Consumption of 1 alcoholic drink during the past 30 d		
No	0.0 (reference)	0.0 (reference)
Yes	1.3 (1.1 to 1.6)	0.3 (0.1 to 0.4)
Cardiovascular disease		
No	0.0 (reference)	0.0 (reference)
Yes	3.2 (2.3 to 4.0)	0.9 (0.5 to 1.4)
Diabetes status		
No	0.0 (reference)	0.0 (reference)
Prediabetes	0 (−1.0 to 1.0)	−0.4 (−0.8 to 0.1)
Diabetes	0.6 (0.1 to 1.2)	0.2 (−0.2 to 0.5)
Cancer		
No	0.0 (reference)	0.0 (reference)
Yes	1.8 (1.1 to 2.5)	0.4 (0 to 0.9)

Variable	Current E-Cigarette User	Daily E-Cigarette User
Asthma		
No	0.0 (reference)	0.0 (reference)
Yes	1.9 (1.4 to 2.4)	0.2 (0 to 0.5)
Chronic obstructive pulmonary disease		
No	0.0 (reference)	0.0 (reference)
Yes	7.1 (6.2 to 8.0)	0.2 (0.1 to 0.2)
Depression		
No	0.0 (reference)	0.0 (reference)
Yes	4.9 (4.5 to 5.3)	1.8 (1.5 to 2.0)
Chronic kidney disease		
No	0.0 (reference)	0.0 (reference)
Yes	1.9 (0.9 to 3.0)	1.2 (0.4 to 2.0)

*Values are prevalence differences (95% CIs) presented as percentage points.

†Values were not adjusted with age.

‡Asked in the following states and territories: California, Connecticut, Delaware, Georgia, Guam, Hawaii, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Massachusetts, Minnesota, Mississippi, Missouri, Nevada, New York, Ohio, Pennsylvania, Rhode Island, Texas, Vermont, Virginia, Washington, and Wisconsin.