



# HHS Public Access

Author manuscript

*J Rural Health*. Author manuscript; available in PMC 2020 June 01.

Published in final edited form as:

*J Rural Health*. 2019 June ; 35(3): 395–404. doi:10.1111/jrh.12333.

## Regional Rural-Urban Differences in E-Cigarette Use and Reasons for Use in the United States

Elizabeth A. Mumford, PhD<sup>1</sup>, Frances A. Stillman, EdD<sup>1</sup>, Erin Tanenbaum, MA<sup>2</sup>, Nathan J. Doogan, PhD<sup>3</sup>, M. E. Roberts, PhD<sup>4</sup>, M. E. Wewers, PhD<sup>4</sup>, Devi Chelluri, MS<sup>2</sup>

<sup>1</sup>Public Health Research, NORC at The University of Chicago, Bethesda, Maryland <sup>2</sup>Statistics and Methodology, NORC at The University of Chicago, Bethesda, Maryland <sup>3</sup>Ohio Colleges of Medicine Government Resource Center, The Ohio State University, Columbus, Ohio <sup>4</sup>Division of Health Behavior & Health Promotion, The Ohio State University College of Public Health, Columbus, Ohio

### Abstract

**Purpose:** To determine whether there are rural/urban differences in e-cigarette use and reasons for use that vary across the 10 Health & Human Services (HHS) regions.

**Methods:** Age-adjusted bivariate and multivariable analyses were conducted for n=225,413 respondents to the 2014–2015 Tobacco Use Supplement-Current Population Survey to estimate the prevalence of e-cigarette use. Reasons for e-cigarette use were collected from n=16,023 self-respondents who reported ever using e-cigarettes.

**Findings:** While nationally rural residents appeared more likely to use e-cigarettes, adjusted results indicated that current e-cigarette use was significantly less likely across the northern and western regions (New England, East North Central, Heartland, North Central Mountain, Northwest, and Southwest Pacific regions). Reasons for e-cigarette use differed by urban/rural status and region; for example, the rationale to use e-cigarettes as a smoking cessation aid was significantly more common among rural compared to urban adults in the New England and New York/New Jersey regions, but less common in the Southeast.

**Conclusions:** For several regions, there were no significant rural/urban differences in e-cigarette use and reasons for use. Yet those regions that present differences face the need to develop public health approaches to minimize urban/rural disparities in health education, services, and outcomes related to tobacco use, particularly where access to health care is limited. Public health campaigns and guidance for clinical care within HHS regions should be tailored to reflect regional differences in beliefs about e-cigarettes.

---

For further information, contact: Elizabeth Mumford, PhD, NORC at the University of Chicago, 4350 East-West Highway, 8th Floor, Bethesda MD 20814; mumford-elizabeth@norc.org.

**Disclosures:** Dr Mumford's spouse is employed by Pinney Associates, which provides consulting services on tobacco harm minimization (including nicotine replacement therapy and vapor products but not on combustible tobacco products) to Nicovum USA, RJ Reynolds Vapor Company, and RAI Services Company, all subsidiaries of Reynolds American Inc. Reynolds American was purchased by British American Tobacco in July 2017. Dr Mumford's spouse also owns an interest in intellectual property for a novel nicotine medication. The other co-authors of this paper reported had no disclosures to report.

## Keywords

e-cigarettes; health beliefs; regional analyses; rural-urban differences; smoking

Smoking rates are disproportionately higher in rural areas in the United States.<sup>1–5</sup> For example, the 2013 Behavioral Risk Factor Surveillance System (BRFSS) data indicate a current *nonsmoking* rate of 83.9% in large metro areas compared to 74.9% in noncore counties,<sup>2</sup> and the 2015 rate of past month tobacco use as measured in the National Survey on Drug Use and Health in large metro areas was 21.4% compared to 34.0% in completely rural areas.<sup>1</sup> This urban-rural disparity has increased in the last decade due to declining urban smoking and stagnant rural rates.<sup>6</sup> Concomitantly, smoking-related diseases in rural areas consistently exceed rates in urban areas.<sup>4,7</sup> Importantly, national rates of tobacco use, even those distinguishing rural-urban differences, mask regional differences. Within the 9 US Census Bureau divisions, rural-urban disparities in tobacco use vary by product category, highlighting the reality that rural regions themselves are not homogenous.<sup>5</sup> Cultural differences and variations in tobacco control policies across the US also inform regional differences in smoking and smoking-related diseases.<sup>8</sup> However, the intersection of rural-urban disparities and regional differences has not been well-studied, despite the importance of understanding population distinctions that would inform prevention, treatment, and policy efforts in an era of increasing barriers to health care in rural areas.<sup>9</sup>

The US Surgeon General references e-cigarettes as one alternative to cigarettes, with concerns about use in vulnerable populations such as youth and pregnant women.<sup>10</sup> Several studies have documented patterns of increasing use of e-cigarettes over time. Chapman and Wu summarized national estimates of ever e-cigarette use from surveys in 2009, 2010, and 2011, reporting a range from 2.9%–6.2% among US adults.<sup>11</sup> Other sources report varying but generally higher estimates of ever use for more recent years. The May 2014 Tobacco Use Supplement to the Current Population Survey (TUS-CPS) estimate of ever use was 7.7%,<sup>12</sup> while the National Health Interview Survey estimated that about 1 in 8 US adults had ever tried an e-cigarette as of 2014.<sup>13</sup> The estimate of ever use of e-cigarettes based on the 2013–2014 Population Assessment of Tobacco and Health (PATH) data was higher (17.7%).<sup>14</sup> Current e-cigarette use among adults defined as any use in the past 30 days was estimated at a higher rate (6.7%) in the 2013–2014 PATH sample<sup>14</sup> than in the 2014 Current Population Survey (2.1%).<sup>12</sup> Current e-cigarette use defined as use every day or some days was estimated to be 3.7% in the 2014 National Health Interview Survey<sup>13</sup> and 5.5% in the 2013–2014 PATH sample.<sup>14</sup> In addition to variations in definition and sample, these studies provide varying estimates of current use by sociodemographic subgroups and smoking status.

A number of studies have assessed individual reasons for use of e-cigarettes. Focus groups highlighted beliefs about relative safety (vs. combustible cigarettes) and the potential for smoking cessation support, as well as appreciation for accessibility and options for use indoors,<sup>15</sup> social/recreational reasons,<sup>16</sup> and positive feedback from family and friends.<sup>17</sup> Online samples endorsed similar reasons for e-cigarette use, highlighting health and cessation, but also referencing convenience, a less aversive smell, cost, and curiosity.<sup>18–20</sup>

Importantly, reasons for use may vary by demographic characteristics. For example, young adults may be more likely to focus on their enjoyment than on cessation<sup>21</sup> and female users may feel motivated by family recommendations and weight control whereas male users may report they are motivated by health and smoking cessation goals.<sup>22–24</sup> We did not find studies examining different motivations by geographic region.

Given the salience of health motivations for e-cigarette use and concerns about both tobacco-related health disparities and potential health risks of e-cigarettes,<sup>25</sup> several studies have sought to track beliefs about e-cigarettes in terms of perceived health risks relative to combustible cigarettes as well as perceptions of e-cigarettes as a method to support quitting smoking. In a systematic review of 49 studies examining e-cigarette beliefs and use, individuals tended to endorse use of e-cigarettes based on beliefs that they would be healthier than conventional smoking and that they would support smoking cessation.<sup>26</sup> Although studies of US adults indicate increasing concerns about the relative harmfulness of e-cigarettes,<sup>26–30</sup> both smoking status and e-cigarette use appear to be associated with a belief that e-cigarette use supports smoking cessation.<sup>31</sup>

Few studies have directly examined beliefs about the potential for harm to others through secondhand exposure to e-cigarette aerosol. Tan and associates assessed beliefs that personally breathing secondhand e-cigarette vapors would be less harmful to one's own health than secondhand smoke exposure (39% agreed, 34% had no opinion, 22% disagreed).<sup>31</sup> Still, banning e-cigarette use in public spaces has been supported by a majority (60%–74%) of US adults.<sup>32–34</sup> Less consistent support (37% opposed, 40% uncertain) was found when adults were asked whether e-cigarettes should be banned in places where cigarettes are already banned,<sup>28</sup> highlighting more uncertainty in perceptions of relative risks.

While there has been increasing attention to measuring beliefs about e-cigarettes and use of these products, no studies have examined these questions in light of regional and rural-urban disparities in smoking behavior. This study highlights the potential disparities in e-cigarette use and investigates differences in beliefs and risk perceptions about this product across the 10 Health & Human Services (HHS) regions with the purpose of supporting public health prevention, cessation, and policy goals.

## Methods

### Data

The study data were from the 2014–2015 Tobacco Use Supplement (TUS) to the Current Population Survey (CPS), fielded in July 2014, January 2015, and May 2015 by telephone for two-thirds of the households and in-person interviews for the remaining third. The TUS-CPS queried approximately 240,000 non-institutionalized current civilian US adults 18 years and older, including 50 states and the District of Columbia, about their tobacco product use with demographic measures available from the core CPS. A complex sample design was used to select respondents.<sup>35</sup> All adults within sampled households were eligible for interview and households with 2 or fewer eligible adults provided responses for themselves. Large households with 3 or more eligible adults were interviewed through a combination of self-respondent and proxy interviews through random selection. The prevalence of ever and

of current e-cigarette use, and of current smoking, was estimated based on both self-respondents and proxies for a sample size of n=47,109 rural and n=178,304 urban respondents. Reasons for e-cigarette use were collected from those self-respondents who reported ever e-cigarette use (n=16,023 of whom 3,877 are rural residents and 12,146 are urban residents). Regional sample size limitations precluded comparisons between exclusive e-cigarette users and dual users of e-cigarettes and combustible cigarettes.

**Geography.**—Respondent households were geocoded by rural-urban status and geographic region by the Census Bureau. Respondents were classified as either urban (metropolitan areas of 50,000 or more people) or rural (micropolitan and non-core areas of fewer than 50,000 people) using the OMB county-level definition. Respondents were further classified into 10 HHS regions to allow for a comparison between rural and urban residents at a more granular level that aligns with regionally available HHS funding. HHS regions cluster groups of states together as follows (regional labels in italics are added for the purposes of discussion, see Figure 1)<sup>36</sup>: region 1 (*New England*: CT, ME, MA, NH, RI, VT); region 2 (*NY/NJ*); region 3 (*Mid-Atlantic*: DE, DC, MD, PA, VA, WV); region 4 (*Southeast*: AL, FL, GA, KY, MS, NC, SC, TN); region 5 (*East North Central*: IL, IN, MI, MN, OH, WI); region 6 (*South Central*: AR, LA, NM, OK, TX); region 7 (*Heartland*: IA, KS, MO, NE); region 8 (*North Central Mountain*: CO, MT, ND, SD, UT, WY); region 9 (*Southwest Pacific*: AZ, CA, HI, NV); and region 10 (*Northwest*: AK, ID, OR, WA).

## Measures

**E-cigarette use.**—E-cigarette use history was assessed of adults with the screener item “have you ever used e-cigarettes even one time?” A follow-up question about current use was then asked of ever users to determine whether they “now use an e-cigarette every day, some days or not at all.” Respondents who had ever used e-cigarettes and reported a current frequency of “every day” or “some days” were categorized as current e-cigarette users.

**Reasons for e-cigarette use.**—Self-respondent adults who ever used e-cigarettes were asked about the “reasons [why] people use e-cigarettes” and directed to “select which reasons apply to you.” The first possible reason for use specified: I can use e-cigarettes at times when or in places where smoking cigarettes isn’t allowed, or as a *substitute tobacco product*. Three additional reasons revolved around risk perception including: they might be *less harmful to me* than cigarettes; they might be *less harmful to people around me* than cigarettes; and using e-cigarettes *helps people to quit* smoking cigarettes. All items were asked with a yes/no response option and were coded 1=yes.

**Smoking status.**—Adults who reported having smoked more than 100 lifetime cigarettes and a current smoking frequency of “every day” or “some days” were categorized as current smokers. Those who had smoked more than 100 cigarettes in their lifetime but did not currently smoke every day or some days were categorized as former smokers. All others were categorized as never smokers.

**Demographic characteristics.**—Respondent socioeconomic and demographic characteristics included in the multivariate models were sex (male, female), age (18–24, 25–

44, 45–64, and 65+), race/ethnicity (Hispanic, non-Hispanic white, non-Hispanic black, and non-Hispanic other), and education (less than a high school diploma, high school graduate or holds a GED, some college or has an associate's degree, and bachelor's degree or more).

## Analyses

Following recommendations from the National Center for Health Statistics, the estimated prevalence of combustible cigarette smoking and reasons for e-cigarette usage among ever e-cigarette users were age-adjusted within each HHS region and rural-urban status to the 2000 US standard population.<sup>37</sup> Next, a Chi-square analysis was used to determine whether there were significant differences in estimates of e-cigarette use and reasons for use across 10 rural regions. A similar Chi-square analysis was also performed across urban regions. Statistically significant results would indicate that estimates were not equal across HHS regions and ought to be separated in our multivariable analysis. Two-sided t-tests compared rural and urban estimates of e-cigarette use and reasons for use both nationally as well as within each specific socioeconomic or demographic group. Two-sided t-tests also compared rural and urban region-specific estimates as well as within each specific socioeconomic and demographic group. Logistic regression analyses for each of 10 HHS regions and measures were performed to compare rural and urban e-cigarette behaviors and reasons for use while controlling for age, sex, race/ethnicity, education, and smoking status. Models of the reasons for e-cigarette use further controlled for current e-cigarette use. Across all statistical tests, corrected standard errors were calculated based on the CPS sample weight for self-report interviews and the appropriate CPS replicate weights. Associations and covariates were considered significant across all statistical tests at the  $P < .05$  level. The data analysis for this paper was generated using SAS<sup>®</sup> 9.4 software (SAS Institute, Inc., Cary, North Carolina).

## Results

### Rural/Urban Ever E-Cigarette Use

Table 1 describes rural and urban ever e-cigarette use nationally and by HHS region as well as by socioeconomic and demographic characteristics, defining the sample for further analyses. Nationally, ever e-cigarette use was greater among rural residents than urban residents (9.4% vs. 7.0%, respectively;  $P < .001$ ).

Region-specific rural-urban results mimicked national results for 9 out of 10 regions. The largest rural disparities in ever e-cigarette use were seen in New York-New Jersey (region 2, 10.4% rural vs. 5% urban,  $P < .001$ ), New England (region 1, 9.2% vs. 5.6% urban,  $P < .001$ ), North Central Mountain (region 8, 10.6% vs. 7.7% urban,  $P < .001$ ), and Southwest Pacific (region 9, 7.8% vs. 5.6%,  $P < .001$ ). The exception was the Heartland (region 7) where higher prevalence of ever e-cigarette use was reported among urban respondents (8.6% rural vs. 9.9% urban,  $P < .001$ ).

### Rural/Urban Current E-Cigarette Use and Reasons for Ever Use

Table 2 presents rural and urban current e-cigarette use and smoking rates as well as reasons for e-cigarette use nationally and by HHS region. At the national level, current adult rural e-cigarette use was greater among rural (2.8%) than urban ever e-cigarette users (2.1%,  $P < .$

001). A similar tendency was seen across most HHS regions; for example, Southeast (region 4) rural adults' current e-cigarette use (3.2%) was 33% greater (0.8 percentage points) than current e-cigarette use by urban neighbors (2.4%,  $P < .001$ ). Four regions diverged from this pattern, reporting results that do not have enough evidence to be considered different from one another: the Heartland (region 7), North Central Mountain (region 8), Southwest Pacific (region 9), and Northwest (region 10). Current smoking prevalence among ever e-cigarette users was greater among rural respondents both nationally (71.1% vs. 60.3% urban prevalence,  $P < .001$ ) as well as within each of the 10 HHS regions.

Nationally, rural ever e-cigarette users (63.9%) more often than urban ever e-cigarette users (62.2%,  $P = .013$ ) believed e-cigarettes might be less harmful to the people around them. All other national e-cigarette perceptions and beliefs did not have enough evidence to report a difference between rural and urban respondents.

Within each HHS region, however, findings varied. For example, rural ever users in NY/NJ reported e-cigarettes might be useful when and where smoking is not allowed, useful to quit smoking cigarettes, and less harmful to themselves than cigarettes, with differences greater than 5 percentage points. By contrast in the Southeast, Heartland, North Central Mountain, and Southwest Pacific (regions 4, 7, 8, and 9), significantly fewer rural ever users endorsed the reasoning that e-cigarettes were less harmful to their health compared to urban ever users, with differences greater than 5 percentage points in regions 7, 8, and 9.

### Multivariable Regression Models

In Table 3, adjusted odds ratios (ORs) display the odds of rural current e-cigarette use and endorsement of reasons for ever e-cigarette use when compared to urban residents within the same HHS region. In regions 1, 5, 7, 8, 9, and 10, rural respondents were significantly less likely to currently use e-cigarettes than urban respondents. Findings regarding reported reasons for use were mixed. For example, rural ever e-cigarette users in region 1 (OR = 1.61,  $P = .003$ ) and region 2 (OR = 2.54,  $P = .026$ ) were more likely to believe e-cigarettes may help them quit when compared with urban residents, whereas the reverse was true for users in region 4 (OR = 0.82,  $P = .003$ ). Rural ever users in region 7 (OR = 0.69,  $P = .015$ ), region 8 (OR = 0.72,  $P = .029$ ), and region 9 (OR = 0.58,  $P = .003$ ) were less likely to believe e-cigarettes might be less harmful to themselves than cigarettes when compared to urban adults within each region.

### Discussion

This study presents nationally representative estimates of ever and current e-cigarette use, risk perceptions and beliefs about e-cigarettes, highlighting rural-urban differences at the national level and disaggregated by HHS region. Previous research analyzing 2013–2014 data from the PATH Study found no national or regional (Northeast, South, Midwest, West) rural-urban differences in past month e-cigarette use.<sup>38</sup> Age-adjusted estimates from the slightly more recent TUS-CPS in the current study, by contrast, showed that e-cigarette use tended to be marginally higher among rural residents than urban residents; this was the case for ever use in 9 out of 10 regions and current e-cigarette use in 6 out of 10 regions. However, in models adjusting for a range of socioeconomic and demographic characteristics,



rural adults' current e-cigarette use was less than urban adult use in most northern and western regions (1, 5, 7, 8, 9, and 10). Moreover, ever users of e-cigarettes in rural areas held different beliefs about the harms and benefits of e-cigarette use in different regions of the country.

E-cigarettes as a product category are yet to be fully regulated,<sup>39</sup> and clinicians must rely on limited population health outcomes research in advising their patients who smoke.<sup>25,40</sup> Clinical recommendations suggest that physicians should counsel patients who are seeking to quit smoking to use FDA-approved cessation aids and to avoid dual use of e-cigarettes and combustible cigarettes; those smokers who choose to switch to e-cigarettes for smoking cessation purposes should be advised that long-term health risks of e-cigarettes are unknown.<sup>41,42</sup> Based on the current study, moreover, clinical advice and public health efforts to reduce illness related to smoking may need to be aware of different beliefs in different parts of the country so as to be able to effectively tailor messages. A national online study of smokers conducted in a similar timeframe as the 2015 TUS-CPS data collection found that 15% of respondents discussed e-cigarettes with their physicians, among whom 61% were advised to try e-cigarettes as a smoking cessation aid.<sup>43</sup> With reduced access to health care in rural areas,<sup>9</sup> the burden for education<sup>25</sup> falls more heavily on public health and policy advocates, distinguishing messages for never, current, and former smokers to maximize public health benefits.<sup>44</sup>

There are several important factors that may affect developing patterns of e-cigarette use and beliefs in rural regions. The FDA Center for Tobacco Products' August 2016 deeming rule to bring e-cigarette products under FDA regulation (through submission of pre-market tobacco product applications for e-cigarettes and other noncombustible newly deemed products) has been delayed until August 2022. Independent of FDA regulation, the tobacco industry has pushed growth in new product development in the last decade. Thus, product advertising as well as industry lobbying, often targeting different communities<sup>45</sup> and regions of the country,<sup>8</sup> may contribute to further regional and rural/urban differences.<sup>46</sup> Along with industry developments, as state and local policies change over time, there will be a concomitant impact on public opinion and behavior. Further, while this study draws on adult behavior and beliefs, current youth patterns, themselves not immune to regulatory and market developments, will have an impact on rural e-cigarette use, and this may differ from youth patterns in urban areas. Over the period 2013–2014, for example, rural youth use doubled, from 2.1% to 4.3%, whereas urban youth e-cigarette use showed a nearly fourfold increase from 2.4% to 8.6%.<sup>47</sup>

## Limitations

Interpretation of results in the current study must account for limitations in the design. The reasons for use data are self-reported and analyses are cross-sectional. Further, sample size limitations at the state level restricted urban-rural comparisons to the regional level or between the most rural areas (non-core and micropolitan) and metropolitan areas, per the available rural-urban status on the Census public use data file. The regional sample size limitations that precluded comparisons between exclusive e-cigarette users and dual users of e-cigarettes and combustible cigarettes leaves for further investigation the question of

differences in motivations to use e-cigarettes according to dual use status. Many e-cigarette ever users discontinue use after their first trial, thus highlighting the importance of further research to investigate varying reasons for continuing e-cigarette use across different geographic and demographic subgroups. E-cigarette ever and current use responses were collected from self- as well as proxy respondents; in a sensitivity analysis, we compared the mean current e-cigarette use prevalence by rural-urban status according to proxy and self-response status. Including proxy respondents in our analysis likely resulted in an underestimate of the national rate of current e-cigarette use by 0.4 percentage points. As such, further research to investigate the impact of including proxy responses is warranted. Importantly, although a small national underestimate was observed, rural e-cigarette use exceeded urban in both proxy and self-respondents by more than 0.5 percentage points, thus leading us to believe our results remain applicable with the inclusion of proxy respondents. Further work within regions might also look at young adult behavior, the impact of other combustible product use, and subgroups defined in greater detail by race/ethnicity, analyses which were precluded by sample size limitations in our study. Additionally, future local and state-level analyses would be strengthened by the inclusion of local clean air laws, which were not possible to examine at the regional level. National TUS-CPS prevalence estimates may not equal those published by other researchers. Variations are due in part to age-adjusting within each region-rural-urban status combination. Respondents' reasons for using e-cigarettes were limited to 4 items, leaving several areas of motivation undetected, such as flavor preferences, cost, and social norms in their community. Moreover, these data do not reveal if higher use in rural areas was because rural providers were recommending e-cigarettes as a cessation tool. Focused assessment of rural provider behavior relative to individual e-cigarette use behavior is necessary to answer this question. While the US Department of Health & Human Services does administer public health services by region and the results from the current study may be constructive for leadership within those regions, tobacco control policies are primarily decided at the state level and inferences from the current regional analyses may be biased for a given state. However, this is a large nationally representative sample and the current findings present a novel perspective on the rural/urban divide through attention to regional differences.

## Conclusion

The current results indicate that the profile of rural ever users of e-cigarettes varies by region of the country, most importantly in terms of their beliefs associated with e-cigarette use. Further research to examine e-cigarette use patterns in terms of the frequency and intensity of use, use as a result of a provider's recommendation, and dual use with conventional cigarettes is warranted to inform public health and policy directions, with particular relevance to smokers with limited access to health services.

## Acknowledgments

**Funding:** This study was funded by the National Cancer Institute (1R21CA205589-01). NCI was not involved in the study design, analyses or interpretation of results; in the writing of the article; nor in the decision to submit it for publication.



## References

1. Center for Behavioral Health Statistics and Quality. 2015 National Survey on Drug Use and Health: Detailed Tables Rockville, MD: Substance Abuse and Mental Health Services Administration; 2016.
2. Matthews KA, Croft JB, Liu Y, et al. Health-Related Behaviors by Urban-Rural County Classification — United States, 2013. *MMWR Surveill Summ* 2017;66(No. SS-5):1–8.
3. Vander Weg MW, Cunningham CL, Howren MB, Cai X. Tobacco use and exposure in rural areas: Findings from the Behavioral Risk Factor Surveillance System. *Addict Behav* 2011;36(3):231–236. [PubMed: 21146318]
4. Meit M, Knudson A, Gilbert T, et al. The 2014 Update of the Rural-Urban Chartbook Bethesda, MD: Rural Health Reform Policy Research Center; 2014.
5. Roberts ME, Doogan NJ, Kurti AN, et al. Rural tobacco use across the United States: How rural and urban areas differ, broken down by census regions and divisions. *Health & place* 2016;39:153–159. [PubMed: 27107746]
6. Doogan NJ, Roberts ME, Wewers ME, et al. A growing geographic disparity: Rural and urban cigarette smoking trends in the United States. *Preventive medicine* 2017;104:79–85. [PubMed: 28315761]
7. Eberhardt MS, Pamuk ER. The importance of place of residence: examining health in rural and nonrural areas. *Am J Public Health* 2004;94(10):1682–1686. [PubMed: 15451731]
8. Truth Initiative. Tobacco Nation: The deadly state of smoking disparity in the U.S 2017 Washington, DC: The Truth Initiative Available at <https://truthinitiative.org/sites/default/files/Tobacco-Nation-FINAL.pdf>. Accessed October 17, 2018.
9. Kaufman BG, Thomas SR, Randolph RK, et al. The Rising Rate of Rural Hospital Closures. *J Rural Health* 2016;32(1):35–43. [PubMed: 26171848]
10. U.S. Department of Health and Human Services. E-Cigarette Use Among Youth and Young Adults: A Report of the Surgeon General Washington, DC: Centers for Disease Control and Prevention Office on Smoking and Health; 2016.
11. Chapman SLC, Wu L-T. E-Cigarette Prevalence and Correlates of Use among Adolescents versus Adults: A Review and Comparison. *Journal of psychiatric research* 2014;54:43–54. [PubMed: 24680203]
12. Levy D, Yuan Z, Li Y. The Prevalence and Characteristics of E-Cigarette Users in the U.S. *International Journal of Environmental Research and Public Health* 2017;14(10):1200.
13. Schoenborn CA, Gindi RM. Electronic Cigarette Use Among Adults: United States, 2014 Vol No. 217 Hyattsville, MD: National Center for Health Statistics; 2015.
14. Kasza KA, Ambrose BK, Conway KP, et al. Tobacco-product use by adults and youths in the United States in 2013 and 2014. *New England Journal of Medicine* 2017;376(4):342–353. [PubMed: 28121512]
15. Kim H, Davis AH, Dohack JL, Clark PI. E-Cigarettes Use Behavior and Experience of Adults: Qualitative Research Findings to Inform E-Cigarette Use Measure Development. *Nicotine & Tobacco Research* 2017;19(2):190–196. [PubMed: 27613944]
16. Pokhrel P, Herzog TA, Muranaka N, Fagan P. Young adult e-cigarette users' reasons for liking and not liking e-cigarettes: A qualitative study. *Psychology & Health* 2015;30(12):1450–1469. [PubMed: 26074148]
17. Coleman BN, Johnson SE, Tessman GK, et al. “It’s not smoke. It’s not tar. It’s not 4000 chemicals. Case closed”: Exploring attitudes, beliefs, and perceived social norms of e-cigarette use among adult users. *Drug & Alcohol Dependence* 2016;159:80–85. [PubMed: 26708706]
18. Rutten LJF, Blake KD, Agunwamba AA, et al. Use of E-Cigarettes Among Current Smokers: Associations Among Reasons for Use, Quit Intentions, and Current Tobacco Use. *Nicotine & Tobacco Research* 2015;17(10):1228–1234. [PubMed: 25589678]
19. Patel D, Davis KC, Cox S, et al. Reasons for current E-cigarette use among U.S. adults. *Preventive medicine* 2016;93:14–20. [PubMed: 27612572]

20. Berg CJ. Preferred flavors and reasons for e-cigarette use and discontinued use among never, current, and former smokers. *International Journal of Public Health* 2016;61(2):225–236. [PubMed: 26582009]
21. Saddleson ML, Kozlowski LT, Giovino GA, et al. Enjoyment and other reasons for electronic cigarette use: Results from college students in New York. *Addictive Behaviors* 2016;54:33–39. [PubMed: 26704429]
22. Piñeiro B, Correa JB, Simmons VN, et al. Gender differences in use and expectancies of e-cigarettes: Online survey results. *Addictive Behaviors* 2016;52:91–97. [PubMed: 26406973]
23. Baggett TP, Campbell EG, Chang Y, Rigotti NA. Other tobacco product and electronic cigarette use among homeless cigarette smokers. *Addictive Behaviors* 2016;60:124–130. [PubMed: 27128808]
24. Fallin A, Miller A, Assef S, Ashford K. Perceptions of Electronic Cigarettes Among Medicaid-Eligible Pregnant and Postpartum Women. *Journal of Obstetric, Gynecologic & Neonatal Nursing* 2016;45(3):320–325.
25. National Academies of Sciences Engineering and Medicine. *Public health consequences of e-cigarettes* Washington, DC: The National Academies Press; 2018.
26. Pepper JK, Brewer NT. Electronic nicotine delivery system (electronic cigarette) awareness, use, reactions and beliefs: a systematic review. *Tobacco Control* 2014;23(5):375–384. [PubMed: 24259045]
27. Tan ASL, Bigman CA. E-Cigarette Awareness and Perceived Harmfulness: Prevalence and Associations with Smoking-Cessation Outcomes. *American Journal of Preventive Medicine* 2014;47(2):141–149. [PubMed: 24794422]
28. Majeed BA, Dube SR, Sterling K, Whitney C, Eriksen MP. Opinions About Electronic Cigarette Use in Smoke-Free Areas Among U.S. Adults, 2012. *Nicotine & Tobacco Research* 2015;17(6):675–681. [PubMed: 25358659]
29. Majeed BA, Weaver SR, Gregory KR, et al. Changing Perceptions of Harm of E-Cigarettes Among U.S. Adults, 2012–2015. *American Journal of Preventive Medicine* 2017;52(3):331–338. [PubMed: 28341303]
30. Huerta TR, Walker DM, Mullen D, Johnson TJ, Ford EW. Trends in E-Cigarette Awareness and Perceived Harmfulness in the US. *American journal of preventive medicine* 2017;52(3):339–346. [PubMed: 27890516]
31. Tan AS, Lee C-j, Bigman CA. Comparison of beliefs about e-cigarettes' harms and benefits among never users and ever users of e-cigarettes. *Drug and alcohol dependence* 2016;158:67–75. [PubMed: 26621550]
32. STAT/Harvard T.H. Chan School of Public Health. *Americans' perspectives on e-cigarettes* Cambridge, MA: Harvard University School of Public Health; 2015.
33. Mumford EA, Pearson JL, Villanti AC, Evans WD. Nicotine and E-Cigarette Beliefs and Policy Support among US Smokers and Nonsmokers. *Tobacco Regulatory Science* 2017;3(3):293–304.
34. Davis A, Liu D. Americans Say E-Cigs Should Be Regulated Like Tobacco Cigs. Gallup-Healthways Well-Being Index; 2016 Available at [https://news.gallup.com/poll/189716/americans-say-cigs-regulated-tobacco-cigs.aspx?g\\_source=CATEGORY\\_WELLBEING&g\\_medium=topic&g\\_campaign=tiles2016](https://news.gallup.com/poll/189716/americans-say-cigs-regulated-tobacco-cigs.aspx?g_source=CATEGORY_WELLBEING&g_medium=topic&g_campaign=tiles2016). Accessed October 17, 2018.
35. Bureau of Labor Statistics. *Redesign of the Sample for the Current Population Survey 2014:1–4*. Available at [https://www.bls.gov/cps/sample\\_redesign\\_2014.pdf](https://www.bls.gov/cps/sample_redesign_2014.pdf). Accessed October 17, 2018.
36. U.S. Department of Health & Human Services Regions. *U.S. Department of Health & Human Services: Regional Offices: Office of Intergovernmental and External Affairs (IEA)* Washington, DC: U.S. Department of Health & Human Services; 2014.
37. Anderson RN, Rosenberg HM. Report of the second workshop on age adjustment. *Vital and health statistics Ser 4, Documents and committee reports* 1998(30):I–VI, 1–37.
38. Roberts ME, Doogan NJ, Stanton CA, et al. Rural Versus Urban Use of Traditional and Emerging Tobacco Products in the United States, 2013–2014. *Am J Pub Health* 2017;107(10):1554–1559. [PubMed: 28817323]

39. Gottlieb S, Zeller M. A nicotine-focused framework for public health. *New England Journal of Medicine* 2017;377(12):1111–1114. [PubMed: 28813211]
40. Fiore MC, Schroeder SA, Baker TB. Smoke, the Chief Killer — Strategies for Targeting Combustible Tobacco Use. *New England Journal of Medicine* 2014;370(4):297–299. [PubMed: 24450888]
41. Douglas CE, Henson R, Drope J, Wender RC. The American Cancer Society public health statement on eliminating combustible tobacco use in the United States. *CA: A Cancer Journal for Clinicians* 2018;68:240–245. [PubMed: 29889305]
42. Rigotti NA. Balancing the Benefits and Harms of E-cigarettes: A National Academies of Science, Engineering, and Medicine Report. *Annals of internal medicine* 2018;168(9):666–667. [PubMed: 29435573]
43. Kollath-Cattano C, Thrasher JF, Osman A, Andrews JO, Strayer SM. Physician Advice for e-Cigarette Use. *The Journal of the American Board of Family Medicine* 2016;29(6):741–747. [PubMed: 28076257]
44. Levy DT, Cummings KM, Villanti AC, et al. A framework for evaluating the public health impact of e-cigarettes and other vaporized nicotine products. *Addiction* 2017;112(1):8–17. [PubMed: 27109256]
45. Barbeau EM, Wolin KY, Naumova EN, Balbach E. Tobacco advertising in communities: associations with race and class. *Preventive medicine* 2005;40(1):16–22. [PubMed: 15530576]
46. Rodriguez D, Carlos HA, Adachi-Mejia AM, Berke EM, Sargent JD. Predictors of tobacco outlet density nationwide: a geographic analysis. *Tobacco Control* 2013;22(5):349–355. [PubMed: 22491038]
47. Pesko MF, Robarts AM. Adolescent Tobacco Use in Urban Versus Rural Areas of the United States: The Influence of Tobacco Control Policy Environments. *Journal of Adolescent Health* 2017;61(1):70–76. [PubMed: 28363718]



**Figure 1. U.S. Department of Health & Human Service Regions**

Region 1 - [*New England*] Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

Region 2 - [*NY/NJ*] New Jersey, New York.

Region 3 - [*Mid-Atlantic*] Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia.

Region 4 - [*Southeast*] Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee.

Region 5 - [*East North Central*] Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

Region 6 - [*South Central*] Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

Region 7 - [*Heartland*] Iowa, Kansas, Missouri, and Nebraska.

Region 8 - [*North Central Mountain*] Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

Region 9 - [*Southwest Pacific*] Arizona, California, Hawaii, Nevada.

Region 10 - [*Northwest*] Alaska, Idaho, Oregon, and Washington.

NOTE: Puerto Rico, U.S. Virgin Islands, and U.S. territories in the Pacific are covered by HHS regions but not included in the TUS-CPS data collection.

**Table 1.** Ever E-Cigarette Use, by HHS Region and Rural-Urban Status (age-adjusted, replicate weighted)

|                                   | HHS Region <sup>a</sup>  |        |        |        |        |        |        |       |        |        | National |         |
|-----------------------------------|--------------------------|--------|--------|--------|--------|--------|--------|-------|--------|--------|----------|---------|
|                                   | 1                        | 2      | 3      | 4      | 5      | 6      | 7      | 8     | 9      | 10     |          |         |
| Sample Size                       | rural, n                 | 5,732  | 568    | 3,986  | 9,076  | 6,152  | 4,598  | 4,149 | 8,198  | 1,718  | 2,932    | 47,109  |
|                                   | urban, n                 | 14,827 | 12,697 | 22,556 | 28,158 | 23,441 | 20,847 | 8,650 | 10,461 | 26,317 | 10,350   | 178,304 |
| Ever e-cigarette use <sup>b</sup> |                          |        |        |        |        |        |        |       |        |        |          |         |
|                                   | Rural, % (n=3,877)       | 9.2    | 10.4   | 9.5    | 8.7    | 10.6   | 8.7    | 8.6   | 10.6   | 7.8    | 10.9     | 9.4     |
|                                   | Urban, % (n=12,146)      | 5.6    | 5.0    | 7.2    | 6.9    | 8.4    | 7.1    | 9.9   | 7.7    | 5.6    | 9.7      | 7.0     |
| Ever e-cigarette use by:          |                          |        |        |        |        |        |        |       |        |        |          |         |
| Gender <sup>b</sup>               |                          |        |        |        |        |        |        |       |        |        |          |         |
|                                   | Female rural             | 8.2    | 10.2   | 10.0   | 8.6    | 10.2   | 8.4    | 7.2   | 8.0    | 6.8    | 10.1     | 8.9     |
|                                   | Female urban             | 4.8    | 4.4    | 6.1    | 6.2    | 7.3    | 6.4    | 8.9   | 6.8    | 4.2    | 8.3      | 6.0     |
|                                   | Male rural               | 10.1   | 10.7   | 8.9    | 8.8    | 11.1   | 9.0    | 9.9   | 13.0   | 8.8    | 11.7     | 10.0    |
|                                   | Male urban               | 6.4    | 5.8    | 8.4    | 7.6    | 9.6    | 7.9    | 10.9  | 8.6    | 7.1    | 11.1     | 8.0     |
| Race-Ethnicity <sup>b</sup>       |                          |        |        |        |        |        |        |       |        |        |          |         |
|                                   | White Non-Hispanic rural | 9.3    | 10.7   | 9.8    | 10.5   | 10.8   | 10.7   | 8.8   | 10.2   | 8.7    | 11.3     | 10.3    |
|                                   | White Non-Hispanic urban | 6.0    | 6.5    | 7.9    | 8.9    | 9.3    | 9.6    | 10.6  | 7.8    | 7.7    | 10.0     | 8.5     |
|                                   | All Other rural          | 6.3    | 5.6    | 6.5    | 4.5    | 9.1    | 5.1    | 6.1   | 12.7   | 6.5    | 9.8      | 6.0     |
|                                   | All Other urban          | 4.2    | 3.2    | 5.8    | 3.8    | 5.8    | 4.7    | 7.2   | 7.4    | 3.9    | 8.6      | 4.5     |
| Age <sup>b</sup>                  |                          |        |        |        |        |        |        |       |        |        |          |         |
|                                   | 18-44 rural              | 13.1   | 15.6   | 12.9   | 11.1   | 13.4   | 10.9   | 10.9  | 14.6   | 11.4   | 15.0     | 12.3    |
|                                   | 18-44 urban              | 7.3    | 6.4    | 9.5    | 8.9    | 11.1   | 9.1    | 13.1  | 10.6   | 7.6    | 13.6     | 9.2     |
|                                   | 45+ rural                | 4.7    | 4.6    | 5.5    | 6.0    | 7.6    | 6.1    | 5.9   | 6.0    | 3.7    | 6.3      | 6.1     |
|                                   | 45+ urban                | 3.6    | 3.5    | 4.7    | 4.7    | 5.4    | 4.9    | 6.3   | 4.5    | 3.4    | 5.2      | 4.5     |
| Education <sup>b</sup>            |                          |        |        |        |        |        |        |       |        |        |          |         |
|                                   | <=HS rural               | 11.5   | 14.7   | 9.9    | 9.3    | 12.4   | 8.8    | 8.8   | 11.8   | 8.2    | 12.7     | 10.3    |
|                                   | <=HS urban               | 6.9    | 5.4    | 8.4    | 7.8    | 10.2   | 7.5    | 12.1  | 9.9    | 5.5    | 12.4     | 7.9     |
|                                   | Beyond HS rural          | 7.5    | 6.3    | 8.8    | 8.0    | 9.1    | 8.5    | 8.4   | 9.8    | 7.5    | 9.3      | 8.5     |

|                 | <b>HHS Region<sup>a</sup></b> |          |          |          |          |          |          |          |          |           |                 |
|-----------------|-------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------------|
|                 | <b>1</b>                      | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> | <b>National</b> |
| Beyond HS urban | <i>4.9</i>                    | 4.8      | 6.6      | 6.3      | 7.4      | 6.9      | 8.8      | 6.7      | 5.6      | 8.4       | 6.4             |

<sup>a</sup>Chi-square test comparing estimates across HHS Regions were all statistically significant at  $P < .01$ .

<sup>b</sup>Two-sided t-tests comparing rural and urban prevalence and reasons for e-cigarette use within each HHS Region were calculated. Statistically significant comparisons at  $P < .05$  are italicized.



**Table 2.** Current Tobacco Use and Reasons for E-Cigarette Use, by HHS Region and Rural-Urban Status (age adjusted, replicate weighted)

|  | HHS Region |        |        |        |        |        |       |        |        |        | National |       |
|--|------------|--------|--------|--------|--------|--------|-------|--------|--------|--------|----------|-------|
|  | 1          | 2      | 3      | 4      | 5      | 6      | 7     | 8      | 9      | 10     | n        |       |
| Rural, n   | 5,732      | 568    | 3,986  | 9,076  | 6,152  | 4,598  | 4,149 | 8,198  | 1,718  | 2,932  | 47,109   | Rural |
| Urban, n   | 14,827     | 12,697 | 22,556 | 28,158 | 23,441 | 20,847 | 8,650 | 10,461 | 26,317 | 10,350 | 178,304  | Urban |
| <b>Current e-cigarette use</b>   |            |        |        |        |        |        |       |        |        |        |          |       |
| Rural, %   | 2.0        | 3.4    | 2.8    | 3.2    | 2.8    | 2.9    | 3.0   | 2.5    | 1.7    | 2.8    | 1,166    | 2.8   |
| Urban, %   | 1.6        | 1.3    | 2.2    | 2.4    | 2.5    | 2.5    | 3.2   | 2.5    | 1.5    | 2.9    | 3,819    | 2.1   |
| <b>Prevalence among ever e-cigarette users<sup>a,b</sup>:</b>                  |            |        |        |        |        |        |       |        |        |        |          |       |
| Current smoking  |            |        |        |        |        |        |       |        |        |        |          |       |
| Rural, %   | 70.5       | 69.6   | 76.6   | 75.6   | 69.7   | 67.7   | 69.7  | 64.4   | 71.2   | 64.9   | 2,737    | 71.1  |
| Urban, %   | 60.6       | 60.3   | 62.3   | 66.4   | 63.4   | 58.9   | 63.9  | 52.3   | 48.9   | 57.8   | 7,455    | 60.3  |
| Former smoking   |            |        |        |        |        |        |       |        |        |        |          |       |
| Rural, %   | 22.6       | 16.2   | 13.8   | 16.9   | 20.4   | 22.9   | 18.8  | 21.9   | 21.4   | 24.3   | 800      | 16.2  |
| Urban, %   | 25.8       | 23.8   | 23.3   | 23.5   | 24.5   | 24.1   | 24.9  | 30.2   | 26.0   | 26.5   | 3,037    | 23.8  |
| Never smoking  |            |        |        |        |        |        |       |        |        |        |          |       |
| Rural, %   | 6.9        | 14.3   | 9.6    | 7.5    | 9.9    | 9.4    | 11.5  | 13.7   | 7.4    | 10.8   | 335      | 9.6   |
| Urban, %   | 13.5       | 15.9   | 14.4   | 10.1   | 12.1   | 17.0   | 11.2  | 17.6   | 25.1   | 15.7   | 1,628    | 15.1  |
| <b>Reasons for e-cigarette use among ever e-cigarette users<sup>a,b</sup>:</b> |            |        |        |        |        |        |       |        |        |        |          |       |
| When/where smoking is not allowed  |            |        |        |        |        |        |       |        |        |        |          |       |
| Rural, %   | 38.1       | 56.1   | 43.1   | 45.4   | 37.3   | 42.1   | 41.7  | 44.8   | 36.4   | 39.1   | 3,123    | 41.8  |
| Urban, %   | 40.8       | 37.4   | 40.0   | 42.6   | 41.2   | 43.2   | 41.1  | 40.6   | 39.1   | 38.3   | 9,471    | 40.8  |
| To quit smoking cigarettes   |            |        |        |        |        |        |       |        |        |        |          |       |
| Rural, %   | 63.9       | 80.6   | 61.3   | 60.1   | 56.9   | 59.7   | 58.8  | 46.8   | 51.5   | 48.5   | 3,069    | 58.2  |
| Urban, %   | 51.5       | 58.2   | 56.2   | 63.5   | 57.7   | 61.0   | 61.0  | 54.4   | 50.1   | 50.6   | 9,311    | 57.6  |
| Less harmful to me than cigarettes   |            |        |        |        |        |        |       |        |        |        |          |       |
| Rural, %   | 57.6       | 77.5   | 57.9   | 59.1   | 58.2   | 64.3   | 54.6  | 46.8   | 46.2   | 58.8   | 3,078    | 58.1  |
| Urban, %   | 59.8       | 60.5   | 57.2   | 61.3   | 58.0   | 60.9   | 61.5  | 55.6   | 58.5   | 55.7   | 9,372    | 59.2  |
| Less harmful to people around me than cigarettes                               |            |        |        |        |        |        |       |        |        |        |          |       |

|          | HHS Region |      |      |      |             |             |      |      |      |             | National |             |
|----------|------------|------|------|------|-------------|-------------|------|------|------|-------------|----------|-------------|
|          | 1          | 2    | 3    | 4    | 5           | 6           | 7    | 8    | 9    | 10          |          | n           |
| Rural, % | 63.5       | 63.9 | 57.1 | 65.4 | <i>65.3</i> | <i>69.5</i> | 63.1 | 56.6 | 59.3 | <i>64.6</i> | 3,090    | <i>63.9</i> |
| Urban, % | 60.2       | 61.8 | 58.9 | 65.3 | <i>61.5</i> | 66.0        | 65.0 | 57.5 | 60.1 | <i>59.2</i> | 9,408    | <i>62.2</i> |

<sup>a</sup>Chi-square test comparing estimates across HHS Regions were statistically significant at  $P < .05$ .

<sup>b</sup>Two-sided t-tests comparing rural and urban prevalence and reasons for e-cig use within each HHS Region were calculated. Statistically significant comparisons at  $P < .05$  are italicized.

Table 3.

Adjusted Odds-Ratios for E-Cigarette Prevalence and Reasons for Use (age adjusted, replicate weighted, rural compared with urban) within Region.<sup>c</sup>

| HHS Region | Current e-cigarette use prevalence | Reasons for e-cigarette use          |   |   |   |             |             |
|------------|------------------------------------|--------------------------------------|---|---|---|-------------|-------------|
|            |                                    | When or where smoking is not allowed | Helps people to quit smoking cigarettes | Might be less harmful to me than cigarettes | Might be less harmful to the people around me than cigarettes | OR (95% CI) | OR (95% CI) |
| 1          | 0.75 (0.57, 0.98) <sup>a</sup>     | 0.85 (0.60, 1.21)                    | 1.61 (1.18, 2.20) <sup>b</sup>          | 0.94 (0.69, 1.27)                           | 1.21 (0.87, 1.68)   |             |             |
| 2          | 1.40 (0.66, 2.98)                  | 1.84 (1.01, 3.35) <sup>a</sup>       | 2.54 (1.11, 5.80) <sup>a</sup>          | 2.03 (1.06, 3.90) <sup>a</sup>              | 0.94 (0.38, 2.35)   |             |             |
| 3          | 0.87 (0.61, 1.23)                  | 1.07 (0.72, 1.61)                    | 1.23 (0.81, 1.84)                       | 0.97 (0.75, 1.26)                           | 0.83 (0.58, 1.21)   |             |             |
| 4          | 0.92 (0.77, 1.11)                  | 1.01 (0.83, 1.23)                    | 0.82 (0.68, 0.98) <sup>a</sup>          | 0.88 (0.72, 1.08)                           | 0.92 (0.73, 1.16)   |             |             |
| 5          | 0.79 (0.64, 0.97) <sup>a</sup>     | 0.82 (0.64, 1.03)                    | 0.91 (0.75, 1.12)                       | 1.02 (0.82, 1.25)                           | 1.18 (0.94, 1.49)   |             |             |
| 6          | 0.82 (0.66, 1.02)                  | 0.92 (0.69, 1.23)                    | 0.81 (0.59, 1.12)                       | 1.16 (0.89, 1.51)                           | 1.17 (0.86, 1.58)   |             |             |
| 7          | 0.74 (0.57, 0.96) <sup>a</sup>     | 0.91 (0.66, 1.24)                    | 0.87 (0.64, 1.20)                       | 0.69 (0.51, 0.93) <sup>a</sup>              | 0.85 (0.64, 1.15)   |             |             |
| 8          | 0.75 (0.58, 0.97) <sup>a</sup>     | 1.26 (0.83, 1.91)                    | 0.76 (0.56, 1.05)                       | 0.72 (0.54, 0.97) <sup>a</sup>              | 1.06 (0.74, 1.50)   |             |             |
| 9          | 0.61 (0.37, 1.00) <sup>a</sup>     | 0.79 (0.48, 1.30)                    | 0.93 (0.61, 1.41)                       | 0.58 (0.41, 0.84) <sup>b</sup>              | 0.96 (0.69, 1.34)   |             |             |
| 10         | 0.66 (0.48, 0.91) <sup>a</sup>     | 0.89 (0.64, 1.24)                    | 0.78 (0.53, 1.14)                       | 1.08 (0.80, 1.47)                           | 1.09 (0.77, 1.53)   |             |             |

<sup>a</sup>Wald Chi-Square *P*-value is significant at the .05 level.

<sup>b</sup>Wald Chi-Square *P*-value is significant at the .01 level.

<sup>c</sup>Models adjusted for age, sex, race/ethnicity, rural-urban status, education status, and smoking status. Reasons for use also adjust for current e-cigarette use.