Who is using and why: Prevalence and perceptions of using and not using electronic cigarettes in a statewide survey of adults

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A statewide survey examined prevalence, reasons for using, discontinuing use, and not wanting to try e-cigarettes.

Methods: Participants (n = 6052) were adult Minnesota residents. E-cigarette initiation and current use prevalence rates were calculated for demographic characteristics and smoking status. The percent of respondents endorsing a reason for trying e-cigarettes are reported overall and by smoking status. The percent of respondents endorsing each reason for discontinuing or not using e-cigarettes are reported for daily and occasional smokers.

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ABSTRACT

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Results: Overall, 20.7% of adults reported ever use and 4.6% were current users. Use varied notably by age and smoking status. Only 2.8% of never smokers were current e-cigarette users. Among young adults, 14.6% reported current use but most (70.0%) were never smokers. The reasons given for using e-cigarettes varied by smoking status. Curiosity was the top reason for all groups except recent former smokers, for whom cutting down or quitting other tobacco products was primary. Most smokers discontinuing e-cigarettes preferred cigarettes, and four-fifths of smokers who never tried e-cigarettes lacked interest. From the LCA four profiles were evident: young adult experimenters, curious adults, smokers trying to quit cigarettes, and dual users.

Conclusions: Innovative higher nicotine content devices have sustained interest in e-cigarettes especially among young adults and smokers with a goal of cutting down or quitting smoking. Future regulations and communication should focus on reducing e-cigarette use among young adult nonsmokers.

Electronic cigarettes (e-cigarettes) are an expanding class of nicotine delivery products that use battery power to heat and deliver an inhaled aerosol of nicotine, flavors, and other additives. These products have gained considerable media attention following reports of increased use, especially among young people. In 2018, 21% of U.S. high school students reported recent use of e-cigarettes, a 78% increase from the previous year (Cullen et al., 2018). Alarmed by this dramatic increase, several health and medical groups sued the US Food & Drug Administration (FDA) for delaying the timeline for agency review of e-cigarettes (Wheeler, 2018). On May 15, 2019 a Federal court ruled against the FDA and said they could no longer delay and had to start accepting applications for e-cigarette product premarket review (Perrone, 2019), and a month later the agency issued its final guidance for e-cigarette makers to submit premarket applications (U.S. Food and Drug Administration, 2019a).

In response to the rapid rise in youth e-cigarette use the FDA launched “The Real Cost” media-based education campaign targeted at adolescents (U.S. Food and Drug Administration, 2019b). In addition the agency has taken enforcement actions against retailers found to be selling to underage youth (U.S. Food and Drug Administration, 2019c). States and local municipalities have also taken steps to address e-cigarettes, most notably a complete ban on sales in San Francisco (Sabatini, 2019). Other efforts have included requiring a retail license to sell, enacting tax policies, and banning use in public spaces (American Nonsmokers Rights Foundation, 2019).

Understanding the profiles of who is using e-cigarettes and their motivations can help inform future public policies. These policies should be designed to selectively discourage nonsmokers from starting without unnecessarily restricting smokers from using e-cigarettes to quit smoking (Fairchild, Bayer, & Lee, 2019). Studies of e-cigarette use frequently investigate what interests and motivates smokers to use them (Amato, Boyle, & Levy, 2016; Bauhoff, Montero, & Scharf, 2017;
The current study provides further insight into the time period after the introduction of the higher nicotine prefilled ‘pod’ devices, and it provides perspectives from a representative sample of Minnesota adults. The goals of this paper were to: (1) present the prevalence of ever and current use of e-cigarettes in 2018, (2) report the reasons for trying e-cigarettes and to explore why some smokers report not wanting to try e-cigarettes, (3) classify e-cigarette ever users from latent class analysis into representative profiles.

1. Methods

Using a statewide tobacco use survey, we had an opportunity to ask adult Minnesota residents about their use and perceptions of e-cigarettes. Data were collected as part of the 2018 Minnesota Adult Tobacco Survey (MATS). MATS has been conducted as a series of repeated cross-sectional telephone surveys to collect general health and tobacco-related information from a random sample of Minnesota adults aged 18 and older. The survey was conducted between February and July 2018 using a random digit dialing (RDD) sampling method for landlines and cellular telephones and the final analytic sample (N = 6052) was weighted to represent the entire civilian, non-institutionalized adult population in Minnesota. The RDD response rates, which reflect the net response across both the household screener and the questionnaire, were 17.5% for the landline sample and 13.4% for the cell phone sample. MATS was conducted in collaboration with the Minnesota Department of Health (MDH), and the survey instrument and methods were reviewed and approved by the MDH Institutional Review Board (IRB). More methodological detail is available at http://www.clearwaymn.org/MATS.

1.1. Measures

Current smokers were defined as those who had smoked at least 100 cigarettes and reported smoking every day (‘daily’) or some days (‘occasional’) at the time of survey. Former smokers were defined as those who have smoked at least 100 cigarettes and reported smoking not at all. In addition, former smokers were asked how long since they had stopped smoking. We classified ‘recent’ as within the past 5 years, and ‘long-term’ as 5 or more years, or unknown (unspecified). Anyone who had smoked 0 to 99 cigarettes were classified as never smokers, while ‘former casual smokers’ had smoked 100 cigarettes but had never smoked regularly and currently did not smoke. Demographic factors included age, race, sex, household income, and highest completed level of education.

All MATS respondents were read a preamble: “The next questions are about electronic cigarettes or vaping devices, often called e-cigarettes. These products are battery powered and produce a vapor instead of smoke”, and were then asked if they had “ever used an electronic cigarette or vaping device even just one time.” Then from a second question, current e-cigarette use was using them every day or some days.

All respondents who reported ever using e-cigarettes were read a randomized list of 10 common reasons people use e-cigarettes including an ‘other reason’ option, and then asked for each reason whether or not it was a reason they have used or use an e-cigarette. The list of reasons was generated from a review of previously published papers on the topic (Pepper et al., 2014; Zhu et al., 2013). Current smokers who reported never trying an e-cigarette were asked why they had not tried an e-cigarette or vaping device. The randomized list of 7 reasons were generated from a similar review of other papers (Bauhoff et al., 2017). Finally, current smokers with no recent use of e-cigarettes were presented a randomized list of 12 reasons for no longer using e-cigarettes and asked to indicate which reasons applied to them.

1.2. Statistical analysis

Prevalence of trying e-cigarettes and current use of e-cigarettes were calculated for each demographic characteristic and smoking status. The percent of respondents endorsing each reason for trying e-cigarettes is reported overall and by smoking status. The percent of respondents endorsing each reason for discontinuing or never trying e-cigarettes is reported for daily and occasional smokers. Corresponding 95% confidence intervals were calculated and chi-square tests were conducted to compare groups; all descriptive analyses used survey weights.

To classify profiles of e-cigarette ever users, a latent class analysis (LCA) was undertaken. Variables in the LCA included e-cigarette current use, smoking status, and the reasons for e-cigarette use described above. The questions about using e-cigarettes to quit or cut down were highly correlated (rho = 0.79), and were combined into one goal-oriented reason to reduce tobacco use based on previous research (Amato et al., 2016; Pepper et al., 2014). Reasons that were endorsed by fewer than 10% of respondents were excluded (i.e. using for menthol flavor). Models with two to eight classes were assessed. Model fit criteria including AIC, BIC, adjusted BIC, and G-squared were examined as well as class membership probabilities and contextual interpretation of item response probabilities in determining the best model. After considering a full model with all reasons for use, reasons that were correlated with other reasons and not providing any additional discrimination in the classes were removed (e.g. affordability, using e-cigarettes in places where other tobacco is not allowed, and thinking that e-cigarettes are less harmful).

Statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC). Descriptive analyses were conducted using PROC SURVEYFREQ; and the latent class analysis using PROC LCA (PROC LCA & PROC LTA, 2015). Results for subgroups that included unweighted sample sizes of less than ten were not reported.

2. Results

The prevalence of ever and current (every day or some days) e-cigarette use among Minnesota adults is presented in Table 1. Overall, 20.7% of adults reported ever using e-cigarettes and 4.6% were current users. Of current users, 44.7% were using every day and 55.3% some days. Ever use and current use varied most notably by age. Very few retirement-aged adults (65+) reported ever trying e-cigarettes (3.7%) and even fewer were current users (0.3%). In contrast, 44.6% of young adults had tried e-cigarettes and many were current users (14.6%). There was an inverse gradient of e-cigarette use with income and education. College educated adults and those with higher household incomes were less likely to try or currently use e-cigarettes. As expected, current smokers had the highest rates of ever use, with 63.4% of daily smokers reporting they had tried e-cigarettes. Among former smokers, ever use was more likely among those who quit smoking in the last 5 years compared to longer-term former smokers (5+ years) (55.1% vs 11.1%, p < 0.0001). About 11.1% of never smokers had tried an e-cigarette. The highest prevalence of current use (16.4%) was among occasional smokers. Low rates of use were observed among longer-term former smokers (1.7%) and never smokers (2.8%). Among all current e-cigarette users, 63.3% were current
smokers or former smokers, and 36.7% were never smokers. The percentage of e-cigarette users who were never smokers varied dramatically by age group: 70.0% of current e-cigarette using young adults (18–24 years) had never smoked cigarettes compared to 15.9% of 24–44 year olds, 19.1% of 45–64 year olds, and 7.4% of those aged 64+.

Respondents reporting ever use of e-cigarettes were asked about reasons they use or had used. Overall, 19.1% reported a single reason for trying e-cigarettes, 15.9% reported 2 reasons, and 65.0% reported more than 2 reasons. As presented in Table 2, the reasons for using e-cigarettes varied by current smoking status. The most consistent top reasons reported were lack of trust in the product and lack of knowledge about e-cigarettes. Other reasons included the expense, perceived difficulty of use, and safety risk. From analyses of demographic differences in never trying e-cigarettes, women were significantly more likely than men to endorse health concerns (34.7% vs 15.8%, p = 0.0075). Disapproval from friends or family was rarely endorsed (3.5%).

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The reasons smokers stopped using e-cigarettes were reported in Table 3. Both daily and occasional smokers endorsed a similar pattern for discontinuing. The top 3 reasons were related to cigarettes – they prefer cigarettes (67.3%), e-cigarettes were not as satisfying (50.5%), and did not help them quit smoking (34.8%). The next top reason was health concerns with using e-cigarettes (27.8%). Other reasons for stopping included disliking the taste (25.4%) and concerns with device safety (21.4%).

In general, daily and occasional smokers endorsed similar reasons for never trying e-cigarettes (Table 3). The top reason was a lack of interest in the products (80.7%), followed by health concerns from using them (24.7%). Other reasons included the expense, perceived difficulty of use, and safety risk. From analyses of demographic differences in never trying e-cigarettes, women were significantly more likely than men to endorse health concerns (34.7% vs 15.8%, p = 0.0075). Disapproval from friends or family was rarely endorsed (3.5%). The open-ended ‘Other’ responses were tabulated and the most common reasons reported were lack of trust in the product and lack of knowledge.

2.1. E-cigarette user profiles

The final latent class model included four latent classes and was chosen based on its contextual interpretation and similar fit to models with five latent classes. The final model included four latent classes and was chosen based on its contextual interpretation and similar fit to models with five latent classes. The latent classes were defined based on age, sex, education level, and years since quitting smoking. The latent classes were defined based on age, sex, education level, and years since quitting smoking. The latent classes were defined based on age, sex, education level, and years since quitting smoking.
### Table 2

| Reason for using e-cigarettes among those who have tried them by smoking status. | Overall | Daily Smoker | Occasional Smoker | Recent Former Smoker | Long-term Former Smoker | Never Smoker |
|---|---|---|---|---|---|---|
| To cut down on other tobacco products | 47.8 | 41.1 | 64.8 | 69.4 | 69.2 | 77.1 |
| Use them in places other tobacco products are not allowed | 28.5 | 29.4 | 33.2 | 36.7 | 41.4 | 38.0 |
| Because you are curious about e-cigarettes | 37.0 | 37.1 | 33.2 | 37.0 | 35.2 | 38.1 |
| Because they might be less harmful than other tobacco products | 26.5 | 26.8 | 31.4 | 29.4 | 38.2 | 38.8 |
| Because you enjoy them | 20.6 | 21.6 | 25.2 | 20.9 | 41.4 | 28.6 |
| Because they come in flavors you like | 14.0 | 14.3 | 18.0 | 13.3 | 41.4 | 26.4 |

Weights for Minnesota Adult Tobacco Survey, 2018. Weighted percent; 95% CI; Unweighted sample sizes less than 10 are not reported. Occasional smoker use on some days; Former smokers quit in the last 5 years (recent) or more than 5 years (long-term). Proposed policy options to reduce use among young people include retail sales restrictions (increasing the age of sale to 21) and increasing the price. Based on current research, increasing the minimum sale age of tobacco products to 21 is expected to reduce adolescent smoking and vaping (Abouk & Adams, 2017; Meernik, Baker, Lee, & Goldstein, 2017). However, the relationship between higher tobacco taxes and use of e-cigarettes is less clear. For example, some have found higher cigarette taxes lead to increased sales of e-cigarettes (as a substitution product) (Stoklosa, Drope, & Chaloupka, 2016), whereas others have not found a similar relationship (Huang, Tauras, & Chaloupka, 2014), or have found higher cigarette taxes reduce e-cigarette purchases (Cotti, Nesson, & Tefft, 2018). Overall, studies have found increased taxes on e-cigarettes reduce sales of e-cigarettes (Amato & Boyle, 2016; Huang et al., 2014; Stoklosa et al., 2016). Curiosity as a common reason to use has been reported by others (Amato et al., 2016; Li et al., 2015; Pepper et al., 2014; Schmidt et al., 2014). But the current, sustained interest in e-cigarettes likely reflects the industry’s continuing innovation and successful use of social media platforms and other marketing (Huang et al., 2019). In addition to the novelty factor (curiosity) as a reason never smokers tried e-cigarettes, flavors, enjoyment, and lower perceived harm were common reasons. The endorsement of flavors has been reported previously (Coleman et al., 2017; Patel et al., 2016), and flavors are consistently considered a risk factor for youth initiation (U.S. Department of Health and Human Services, 2016).
planned FDA restriction of sweet-flavored products on the uptake of e-cigarettes.

A unique finding from this study was the four profiles of e-cigarette users identified in the latent class analysis. These profiles revealed the complicated influence of age, smoking status, flavors, and quitting smoking motivations for e-cigarette use. The two largest classes were smokers who were trying to quit or cut back on smoking, and smokers and nonsmokers who were curious and tried them but are not currently using. In addition, there was a substantial group using both cigarettes and e-cigarettes concurrently. In a recent paper, Borland et al. (2019) identified a typology of 8 groups who were vaping and/or smoking. They had a large enough sample across multiple countries to discern exclusive and concurrent, daily and nondaily vaping and smoking.

Very few studies have examined why smokers have not tried e-cigarettes (Bauhoff et al., 2017; McKeganey & Dickson, 2017), and reasons have included seeing them as quitting devices, safety concerns, and disinterest. Among smokers in the current study, there was an apparent dichotomy of beliefs with disinterest on one side and concerns with the product on the other. Some of these concerns are reflected in social media discussions of e-cigarette battery malfunctions that have been increasing over time (Trigger & Coleman, 2019). Similarly, concerns with e-cigarettes as harmful have increased between 2012 and 2017 (Huang et al., 2019).

The perceived benefits of quitting or cutting down on cigarettes were the top reasons cited by smokers and recent quitters. This has been found consistently in other population-based studies (Coleman et al., 2017; Dockrell, Morrison, Bauld, & McNeill, 2013; Patel et al., 2016; Yong et al., 2019), and in surveys of convenience samples, such as primary care patients (Kalkhoran et al., 2017). The challenge for public health messaging, is to communicate that using e-cigarettes to cut down on cigarette use is progress but only if the outcome is smoking cessation. Especially as early evidence suggests simultaneously smoking cigarettes and using e-cigarettes is associated with greater exposure to harmful toxicants compared to only smoking (Goniewicz et al., 2018).

There are several limitations that should be considered when interpreting the results. As the survey relied on self-reported information, there could be a misrepresentation of retrospective variables. In particular, respondents’ recall of reasons for using e-cigarettes could be subject to recall bias. The design also prevents analyses of causal associations or trends over time. As a state-wide survey there is a restriction on the questions that can be asked, for example, respondents were not asked the brand and types of e-cigarettes they were using or had used.

3.1. Conclusions

This study identified interest in e-cigarettes among smokers, former smokers and never smokers that likely reflects the continuing innovation in the marketing of new products, and in particular the introduction of higher nicotine content devices. This has led to considerable experimentation and some regular use by nonsmoking young adults, but smokers with a goal of quitting or cutting down on smoking were the largest use group. Future public policy has to address the challenges of smokers using concurrently and young adults taking up use of e-cigarettes.

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Contributors

RB designed the study and led the writing of the manuscript. SR conducted the analyses. SH interpreted the analysis. All authors contributed to the writing.
Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jarep.2019.100227.

References

Abouk, R., & Adams, S. (2017). Bans on electronic cigarette sales to minors and smoking among high school students. Journal of Health Economics, 54, 17–24. https://doi.org/10.1016/j.jhealeco.2017.03.003.

Amato, M., & Boyle, R. G. (2016). Evaluating an Excise tax on electronic cigarette consumption: Early results. Tobacco Regulatory Science, 2(2), 123–132. https://doi.org/10.18010/TRS.223.

Amato, M. S., Boyle, R. G., & Levy, D. (2016). How to define e-cigarette prevalence? Finding clues in the use frequency distribution. Tobacco Control, 25(1), e24–e29. https://doi.org/10.1136/tobaccocontrol-2015-052256.

American Nonsmokers Rights Foundation (2019). States and municipalities with laws regulating use of electronic cigarettes. June 20, 2019. Retrieved from: http://nonsmokers.org/wp-content/uploads/pdf/ecligable-politics-for-cities-for-current-e-cigarette-use-among-US-adults. https://doi.org/10.1136/tobaccocontrol-2019-054842.

Bauhoff, S., Montero, A., & Scharf, D. (2017). Perceptions of e-cigarettes: A comparison of adult smokers and non-smokers in a Mechanical Turk sample. American Journal of Drug and Alcohol Abuse, 43(3), 311–323. https://doi.org/10.1080/00952990.2016.1207954.

Borland, R., Murray, K., Gravely, S., Fong, G. T., Thompson, M. E., McNeill, A., et al. (2019). A new classification system for describing concurrent use of nicotine vaping products alongside cigarettes (so-called ‘dual use’): Findings from the IT4-C country smoking and vaping wave 1 survey. Addiction. https://doi.org/10.1111/add.14570.

Coley, B. N., Rostron, B., Johnson, S. E., Ambrose, B. K., Pearson, J., Stanton, C. A., et al. (2017). Electronic cigarette use among US adults in the Population Assessment of Tobacco and Health (PATH) Study, 2013–2014. Tobacco Control, 26(2), e117–e126. https://doi.org/10.1136/tobaccocontrol-2016-053462.

Gotti, C., Nesson, E., & Tefft, N. (2018). The relationship between cigarettes and electronic cigarettes: Evidence from household panel data. Journal of Health Economics, 61, 205–219. https://doi.org/10.1016/j.jhealeco.2018.08.001. Epub 2018 Aug 20.

Kalen, R. A., Ambrose, B. K., Gentzke, A. S., Apelgren, B. J., Jamal, A., & King, B. A. (2018). Notes from the Field: Increase in use of electronic cigarettes and any tobacco product among middle and high school students—United States, 2011–2018. Morbidity and Mortality Weekly Report, 67(45), 1276–1277.

Craplicki, L., Kostyginia, G., Kim, Y., Perks, S. N., Szczypka, G., Emery, S. L., & Hair, E. C. (2019). Characterising JUUL-related posts on Instagram. Tobacco Control. https://doi.org/10.1136/tobaccocontrol-2018-054824.

Delneo, C. D., Giovenco, D. P., Steinberg, M. B., Villanti, A. C., Pearson, J. L., Naura, R. S., & Abumrad, D. B. (2016). Patterns of electronic cigarette use among adults in the United States. Nicotine & Tobacco Research, 18(5), 715–719. https://doi.org/10.1093/ntr/ntw237.

Dockrell, M., Morrison, R., Bauld, L., & McNeill, A. (2013). E-cigarettes: Prevalence and attitudes in Great Britain. Nicotine & Tobacco Research, 15(10), 1737–1744. https://doi.org/10.1093/ntr/ntn057.

Fairchild, A. L., Bayer, R., & Lee, J. S. (2019). The e-cigarette debate: What counts as evidence? American Journal of Public Health, 109(7), 1000–1006. https://doi.org/10.2105/AJPH.2019.305107.

Geier, W. M., Smith, D. M., Edwards, K. C., Blount, B. C., Caldwell, K. L., Feng, J., et al. (2018). Comparison of nicotine and toxicant exposure in users of electronic cigarettes and combustible cigarettes. JAMA Network Open, 1(8), e185937. https://doi.org/10.1001/jamanetworkopen.2018.5937.

Huang, J., Buan, Z., Kwo, J., Bians, L. E., Kim, Y., … Emery, S. L. (2019). Vaping versus JUULing: how the extraordinary growth and marketing of JUUL transformed the US retail e-cigarette market. Tobacco control, 28(2), 146–151.

Huang, J., Feng, B., Weaver, S. R., Pechacek, T. F., Slovic, P., & Eriksen, M. P. (2019). Changing perceptions of harm of e-cigarettes versus cigarette use among adults in 2 U.S. national surveys from 2012 to 2017. AMA Network Open, 2(3), e190147. https://doi.org/10.1001/jamanetworkopen.2019.19047.

Huang, J., Tauras, J., & Chaloupka, F. J. (2014). The impact of price and tobacco control policies on the demand for electronic nicotine delivery systems. Tobacco Control, 23(suppl 3), iii41–iii47. https://doi.org/10.1136/tobaccocontrol-2013-051515.

Kalkhoran, S., Alvarado, N., Vijayaraghavan, M., Lum, P. J., Yuan, P., & Satterfield, J. M. (2017). Patterns and reasons of electronic cigarette use in primary care patients. Journal of General Internal Medicine, 32(10), 1122–1129. https://doi.org/10.1007/s11606-017-4123-x.

Li, J., Newcombe, R., & Walton, D. (2015). The prevalence, correlates and reasons for using electronic cigarettes among New Zealand adults. Addictive Behaviors, 45, 245–251. https://doi.org/10.1016/j.addbeh.2015.02.006.

McKeganey, N., & Dickson, T. (2017). Why don’t more smokers switch to using e-cigarettes: The views of confirmed smokers. International Journal of Environmental Research and Public Health, 14(6), 647. https://doi.org/10.3390/ijerph14060647.

Meereik, C., Baker, H. M., Lee, J. G. L., & Goldstein, A. O. (2017). The tobacco 21 movement and electronic nicotine delivery system use among youth. Pediatrics, 139(1), https://doi.org/10.1542/peds.2016-2216 e20162216. Epub 2016 Dec 6.

Pate, J. D., Davis, K. C., Cox, S., Bradfield, B., King, B. A., Shafer, P., et al. (2017). national estimates for current e-cigarette use among U.S. adults. Preventive Medicine, 93, 14–20. https://doi.org/10.1016/j.ypmed.2016.09.011.

Pepper, J. K., Ribisl, K. M., Emery, S. L., & Brewer, N. T. (2014). Reasons for starting and stopping electronic cigarette use. International Journal of Environmental Research and Public Health, 11(10), 10345–10361. https://doi.org/10.3390/ijerph111010345.

Perrone, M. (2019). Judge orders FDA to speed up review of e-cigarettes. Retrieved from: Washington Post, May 15, 2019.

PROC LCA & PROC LTA (Version 1.3.2) [Software]. (2015). University Park: The Methodology Center, Penn State. Retrieved from: http://methodology.psu.edu.

Sabatini, J. (2019). SF becomes first U.S. city to ban sale of e-cigarettes. https://www.sfgate.com/sf-city/sf-becomes-first-city-to-ban-sale-of-e-cigarettes/acces (accessed 8 June 2019).

Schmidt, L., Reimohr, A., Harwell, T. S., & Helgeson, S. D. (2014). Prevalence and reasons for initiating use of electronic cigarettes among adults in Montana, 2013. Preventing Chronic Disease, 11(4), e204. https://doi.org/10.5888/pcd11.140283.

Simonavicius, E., McNeill, A., Arnett, D., & Brose, L. S. (2017). What factors are associated with current smokers using or stopping e-cigarette use? Drug and Alcohol Depend, 173(1), 139–143. https://doi.org/10.1016/j.drugalcdep.2017.01.002.

Stoklosa, M., Drope, J., & Chaloupka, F. J. (2016). Prices and E-cigarette demand: Evidence from the European Union. Nicotine & Tobacco Research, 18(10), 1973–1980. https://doi.org/10.1093/ntr/ntw109.

Trigger, S., & Coleman, B. (2019). Social media mentions of electronic nicotine delivery systems (ENDS) battery-related overheating, fires, and explosions: Findings from a pilot study. International Journal of Environmental Research and Public Health, 16(4), e1108. https://doi.org/10.3390/ijerph16081108.

U.S. Department of Health and Human Services (2016). E-cigarette use among youth and young adults: A report of the surgeon general—executive summary. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

U.S. Food and Drug Administration (2019a). FDA finalizes guidance for premarket.
tobacco product applications for electronic nicotine delivery systems as part of commitment to continuing a strong oversight of e-cigarettes. https://www.fda.gov/news-events/press-announcements/fda-finalizes-guidance-premarket-tobacco-product-applications-electronic-nicotine-delivery-systems (accessed 12 June 2019).

U.S. Food and Drug Administration (2019b). FDA launches new campaign: “The Real Cost” youth e-cigarette prevention campaign. https://www.fda.gov/tobacco-products/real-cost-campaign/fda-launches-new-campaign-real-cost-youth-e-cigarette-prevention-campaign.

U.S. Food and Drug Administration (2019c). FDA takes new steps to address epidemic of youth e-cigarette use, including a historic action against more than 1300 retailers and 5 major manufacturers for their roles perpetuating youth access. https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm620184.htm (accessed 30 May 2019).

Wang, T. W., Coats, E. M., Gammon, D. G., Loomis, B. R., Kuiper, N. M., Rogers, T., & King, B. A. (2018). National and state-specific unit sales and prices for electronic cigarettes, United States, 2012–2016. Preventing Chronic Disease, 15, E99. https://doi.org/10.5888/pcd15.170555.

Wheeler, L. (2018). Public health groups sue FDA. Retrieved from: TheHill.com.

Yong, H. H., Borland, R., Cummings, K. M., Gravely, S., Thrasher, J. P., McNeill, A., ... Fong, G. T. (2019). Reasons for regular vaping and for its discontinuation among smokers and recent ex-smokers: Findings from the 2016 ITC four country smoking and vaping survey. Addiction. https://doi.org/10.1111/add.14593.

Zhu, S. H., Gamst, A., Lee, M., Cummins, S., Yin, L., & Zorel, L. (2013). The use and perception of electronic cigarettes and snus among the US population. PloS One, 8(10), https://doi.org/10.1371/journal.pone.0079332.