HHS Public Access

Author manuscript

Addict Behav. Author manuscript; available in PMC 2020 April 01.

Published in final edited form as:

Addict Behav. 2019 April ; 91: 253–258. doi:10.1016/j.addbeh.2018.11.020.

The Impact of Local Regulation on Reasons for Electronic Cigarette Use among Southern California Young Adults

Hanna Hong[1], **Rob McConnell**[2], **Fei Liu**[2], **Robert Urman**[2], and **Jessica L. Barrington-Trimis, PhD**[2,*]

[1]Division of Pediatric Pulmonary and Sleep Medicine, Department of Pediatrics, Children's Hospital Los Angeles, Los Angeles, California, United States

[2]Department of Preventive Medicine, Keck School of Medicine, University of Southern California, Los Angeles, California, United States

Abstract

OBJECTIVE: Tobacco control policies have decreased tobacco use among youth and young adults. We aimed to identify whether specific local tobacco retail licensing ordinances were associated with reasons for e-cigarette use, in order to examine whether strong local policies may reduce e-cigarette initiation rates by influencing the appeal of these products.

METHODS: Online questionnaires were completed by Southern California Children's Health Study participants in 2015–2016 (mean age=18.9 years). Those who had ever used an e-cigarette (N=614) were asked about reasons for use; additional data were collected on local jurisdiction tobacco sales policy, friends' attitudes toward e-cigarette use, e-cigarette characteristics (level of nicotine, flavorings), and history of tobacco use. Multivariate logistic regression models evaluated associations of reasons for e-cigarette use with each factor, adjusting for gender, ethnicity, highest parental education, tobacco use history and with a random effect of jurisdiction.

RESULTS: The top reason for e-cigarette use was "They come in flavors I like" (56.6%). Using e-cigarettes to quit smoking was uncommon (12.8%). Participants in jurisdictions with weaker tobacco retail licensing ordinances were more likely to report use of e-cigarettes because they are less harmful than cigarettes (50.1% vs. 36.2%), more acceptable to non-tobacco users (38% vs.

[*]**Corresponding author at:** Jessica Barrington-Trimis, PhD; Department of Preventive Medicine; 2001 N. Soto Street, 312G, Los Angeles, CA 90089, United States., jtrimis@usc.edu.

Contributor's Statements

Hanna Hong – Dr. Hong conceptualized and designed the study, assisted in data interpretation, drafted the initial manuscript and approved the final manuscript as submitted.

Rob McConnell – Dr. McConnell reviewed and revised the manuscript and approved the final manuscript as written.

Fei Liu – Ms. Liu carried out the analyses, reviewed the manuscript and approved the final manuscript as written.

Robert Urman – Dr. Urman reviewed and revised the manuscript and approved the final manuscript as written.

Jessica Barrington-Trimis – Dr. Barrington-Trimis conceptualized and designed the study, reviewed and revised the manuscript and approved the final manuscript as submitted.

CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest relevant to this article to disclose.

25%), and because they can use e-cigarettes in places where smoking is prohibited (30.7% vs. 18.3%; all $p<0.05$).

CONCLUSION: Targeted policy to enforce a strong regulatory environment that denormalizes e-cigarette use, conveys the adverse impact of e-cigarettes, and restricts use in public places may reduce e-cigarette use among adolescents and young adults.

Keywords

E-cigarette; young adults; tobacco policy; local regulation

INTRODUCTION

The use of electronic (e-) cigarettes has increased over the past several years among adolescents and young adults. Better understanding of the reasons for e-cigarette use among young adults is needed to identify prevention strategies to reduce nonsmoker initiation of e-cigarettes, given the increased risk of smoking following e-cigarette initiation (Barrington-Trimis et al., 2016a; Barrington-Trimis et al., 2016b; Leventhal et al., 2015; Leventhal et al., 2016; Primack, Soneji, Stoolmiller, Fine, & Sargent, 2015; Soneji et al., 2017; Spindle et al., 2016; Unger, Soto, & Leventhal, 2016; Wills et al., 2016). Young adulthood in particular is a critical period of development, as this time represents a transition from adolescence to the time of financial independence with the ability to legally purchase tobacco products. At this age, nicotine can be particularly hazardous as even trace amounts of nicotine may be enough to cause neurochemical changes (England, Bunnell, Pechacek, Tong, & McAfee, 2015), neuroanatomical changes (Akkermans et al., 2017), and nicotine-induced mis-programming of brain cell development, increasing the risk for addiction (DiFranza et al., 2002). Tobacco companies have identified young adults – and vulnerable subgroups of the young adult population – as an ideal target audience; a report by R.J. Reynolds in 1983 stated, “Younger adults are the only source of replacement smokers…only 5% of smokers start after age 24.” (U.S. Department of Health and Human Services, 2012) While the targeting of young adult populations for e-cigarette use is not well established, there is concern that e-cigarette manufacturers may similarly target young adult populations (Richardson, Ganz, & Vallone, 2015).

Restricting youth access to cigarettes and tobacco has long been recognized as an intervention strategy to decrease the prevalence of cigarette smoking (U.S. Department of Health and Human Services, 1994). Key regulatory features included appropriate fines or penalties for violations and a mandatory tobacco retailer licensing fee sufficient to cover costs of enforcement (DiFranza, 2012). We recently reported that strong local tobacco retail licensing ordinances to reduce sales of tobacco products to minors was associated with lower prevalence of e-cigarette and cigarette initiation, even as these adolescents reached the age at which tobacco products could be legally purchased, despite a relative dearth of policy regarding enforcement of prohibitions on sales of e-cigarettes to minors (Astor et al. 2018, *in press*). The efficacy of enforcement polices in reducing e-cigarette use may occur via general community-level perceptions regarding e-cigarettes, or via individual motivation for e-cigarette use. Understanding the mechanisms through which effective enforcement polices impact initiation of other products not directly covered under enforcement efforts could

provide data to inform complementary interventions that would further reduce rate of e-cigarette use and initiation.

In this study, we investigated the relationship between the strength of the retail licensing ordinance and reasons for e-cigarette use, using data from the Southern California Children's Health Study (CHS). We also examined how reasons for e-cigarette use varied by friend's attitudes towards e-cigarettes (to assess its effect on the differences in e-cigarette appeal and elucidate areas for intervention to prevent social normalization of e-cigarettes), nicotine content in e-liquid solutions, and by previously studied characteristics of participants including gender, ethnicity, parental education, and cigarette use (Berg, 2016; Biener, Song, Sutfin, Spangler, & Wolfson, 2015; Kong, Morean, Cavallo, Camenga, & Krishnan-Sarin, 2015; Patel et al., 2016; Patrick et al., 2016).

METHODS

Study Design and Sample

The CHS is a prospective cohort study of youth in Southern California communities who are followed yearly (Barrington-Trimis et al., 2015; R. McConnell et al., 2006; Peters et al. 1999). A total of 14 jurisdictions comprised our cohort: Alpine, Anaheim, Glendora, Goleta, La Verne, Lake Arrowhead, Lake Elsinore, Mira Loma, Riverside, San Bernardino, San Dimas, Santa Barbara, Santa Maria, and Upland (Astor et al. 2018, *in press*). The current analysis uses data from participants who reported ever having used an e-cigarette (N=614; 39.4% of participants who completed an online questionnaire between January 2015 and July 2016). All participants were 18 years of age or older at this data collection. [mean age = 18.9 years; SD= 0.6).

Ethics Statement

The study was approved by the University of Southern California Institutional Review Board. Written informed consent was obtained prior to data collection.

Measures

Sociodemographic Characteristics—Gender, ethnicity (Hispanic, Non-Hispanic white, other [Asian, Black, other]), and parental education (high school diploma or GED, some college, college degree or higher) were available from previous parent-completed questionnaires (Barrington-Trimis et al., 2015).

E-cigarette and Cigarette Use—Participants were asked to report the age at which they had first used an e-cigarette or cigarette (separately), and the number of days each product was used in the past 30 days. Participants who reported an age of first use but no use in the past 30 days were classified as "prior users." Participants who reported using a product on at least 1 of the past 30 days were classified as "past 30-day users." The analytic sample was restricted to participants who were prior or past 30-day e-cigarette users (ever users of e-cigarettes).

Reasons for E-cigarette Use—Reasons for e-cigarette use were assessed based on response to a check-all-that-apply question, preceded by the statement "I use electronic nicotine devices because…" See Table 2 for a complete list of answer choices.

Evaluation of Local Youth Access Tobacco Policy—The American Lung Association (ALA) in California assesses local tobacco control policies yearly, providing a state, county, and local political jurisdiction grade for each of 5 different domains, including for "Reducing Sales of Tobacco Products to Youth." This grade for "Reducing Sales of Tobacco Products to Youth" was based on tobacco retail licensing ordinances adopted by jurisdictions to reduce availability and sales of tobacco products to minors (American Lung Association, 2016). The grading of the policy provisions for reducing youth access are based on the following requirements: (1) Require tobacco retailers to pay an annual fee that sufficiently covers administration and enforcement efforts, including compliance checks; (2) Requirement that all retailers obtain a license to sell tobacco and renew it annually; (3) Provision that any violation of a local, state or federal tobacco law is considered a violation of the license; and (4) Financial deterrent through fines and penalties for violations that includes suspension and revocation of the license. An "A" grade required compliance with all four policy provisions above, a "D" grade meant only one of the provisions was met, and a "F" grade meant none of the provisions were met. ALA assigned grades to other categories of tobacco policy (smoke free housing policy, smoke free outdoor policy, and overall tobacco policy) were not specific to youth tobacco access and not used for analysis in this study (American Lung Association, 2016).

The ALA local jurisdiction grade in 2014 – the last year participants were in high school – was assigned to each of the 14 political jurisdictions where participants resided; there were four "A" grade jurisdictions (Alpine, Lake Elsinore, Mira Loma, Riverside), one "D" (Santa Barbara) and nine "F" grade jurisdictions (La Verne, Goleta, Santa Maria, Lake Arrowhead, San Dimas, San Bernardino, Anaheim, Upland, Glendora) (Astor et al., 2018, *in press*). No study jurisdiction in our cohort had "B" or "C" grades corresponding to policies of intermediate quality. Communities with a "D" or "F" grade were combined for analysis because the insufficient annual fee was a central feature of regulation to reduce youth access and it was determined that our single "D" community had an insufficient fee similar to the "F" communities.

Nicotine—Nicotine concentration of the e-liquid was assessed by the question "in the past 30 days, what amount of nicotine did you usually use in your electronic nicotine device?" Response options were 0mg, 1–3mg, 4–6mg, 7–12mg, 13–17mg, 18mg or higher, or don't know, and were dichotomized for analysis according to whether their e-cigarette contained any nicotine (yes/no).

Friends' attitudes toward e-cigarettes—Participants were asked "How would your best friends act toward you if you used [e-cigarettes]?"; answer choices included "Very Friendly," "Friendly," "Unfriendly," or "Very Unfriendly." Responses were dichotomized as "Friendly" versus "Unfriendly" for the analysis.

Flavors—E-liquid flavors used by participants were determined by the question “during the past 30 days, which types of flavoring have you used?” Multiple flavors could be selected and responses included flavorless, tobacco, menthol/mint/wintergreen, creamy/buttery/custard-like, coffee, cinnamon, fruit, or other.

Statistical Analysis

Each reason for use of e-cigarettes was treated as an independent outcome variable in analyses. Prevalence estimates were reported by local tobacco policy, use of nicotine in e-cigarettes, prior history of cigarette use, friends’ attitudes towards e-cigarettes, and sociodemographic characteristics (in separate models, missing data were excluded). To evaluate whether reasons for e-cigarette use were different by each factor, we conducted multivariate logistic regression models adjusted for gender, ethnicity, and highest parental education (factors that have been associated both with e-cigarette use and other tobacco product use in previous studies) (National Center for Chronic Disease Prevention and Health Promotion Office on Smoking and, 2012), with a random effect for jurisdiction. In sensitivity analyses, we additionally assessed confounding of the associations of local tobacco policy and friends’ attitudes toward e-cigarette use with reasons for e-cigarette use by cigarette use and by prior or past-30-day e-cigarette use, using a change in beta of greater than 15% to establish confounding. Associations of nicotine content in e-liquid with reasons for e-cigarette use were further adjusted for cigarette use (never, prior, past-30-day use). All statistical analyses were based on two-sided hypotheses tested at a 0.05 level of significance using SAS 9.4.

RESULTS

E-cigarette users were approximately evenly distributed by gender. Almost half (49.7%) of participants were Hispanic White, and 41.7% were Non-Hispanic White; the sample consisted of similar proportions of users whose parents had a high school diploma or lower, some college, or a college degree or higher (Table 1). Approximately 75% of the sample resided in a community that received a grade of “D” or “F” for local policies for “Reducing Sales of Tobacco Products to Youth” (ALA).

Among all e-cigarette users, the most common reason for e-cigarette use was “they come in flavors I like” (56.6%), followed by “they taste better” (51.0%) and “they are less harmful to [me] or [people around me] than cigarettes” (46.7%, 43.7%, respectively) (Table 2). Few adolescents reported use of e-cigarettes “to help me quit smoking cigarettes” (12.8%). Fruit flavors (77.7%) were most commonly used by all participants, followed by creamy (29.3%), other flavors (26.8%) and menthol (26.1%) (Supplemental Figure 1). The least popular flavors were tobacco flavors (4.5%) and flavorless (3.8%).

Participants from jurisdictions with a weaker tobacco retail licensing policy (D/F grade) for reduced tobacco sales (compared to A grade) were more likely to report every reason for using e-cigarettes (Table 3). Multivariate logistic regression models adjusted for gender, ethnicity, and highest parental education with a random effect for jurisdiction showed larger, statistically significant differences between jurisdictions with an A vs. D/F grade were observed for reported reasons of “they come in flavors I like” (58.9% vs. 49.6%), were “less

harmful to me than cigarettes" (50.1% vs. 36.2%), because "they don't smell" (44.6% vs. 32.5%), "they are more acceptable to non-tobacco users" (38% vs. 25%), because "I can use them in places where smoking cigarettes isn't allowed" (30.7% vs. 18.3%; all P<0.05).

Males were more likely to endorse the majority of reasons for use compared to females, with statistically significant differences from the adjusted logistic regression models were observed for use of e-cigarettes because "they come in flavors I like" (62.3% vs. 50.8%), thinking "they taste better" (58.4% vs. 43.5%), thinking "they might be less harmful to me than cigarettes" (52.5% vs. 40.8%) and "they might be less harmful to people around me than cigarettes" (49.6% vs. 37.6%), "I can use them in places where smoking cigarettes isn't allowed" (34.0% vs. 20.9%), and thinking "they are affordable" (22.1% vs. 13.4%; all P<0.05, Supplemental Table 1). Reported reasons for use of e-cigarettes were generally similar by ethnicity, though non-Hispanic White adolescents were more likely than Hispanic White participants to report using e-cigarettes because "they are more affordable than other tobacco products" (17.9% vs. 10.4%; P<0.05, Supplemental Table 1). Reasons for use also differed little by parental education, though adolescents whose parents had a college degree or higher were less likely to report "using [e-cigarettes] helps me quit smoking cigarettes" (14.7% high school diploma/GED/or lower vs. 14.9% with some college vs. 5.9% with college degree or higher; all P<0.05; Supplemental Table 1).

In our sample of ever e-cigarette users, 126 (20.5%) were past 30-day cigarette users, 219 (35.7%) were prior cigarette users, and 256 (41.7%) had never tried a cigarette before (Supplemental Table 2). Past 30-day cigarette smokers were significantly more likely than never cigarette smokers to report using e-cigarettes because "they don't smell" (55.1% vs. 36.6%), "I like the smell" of e-cigarettes (57.6% vs. 36.3%), "I can use them in places where smoking cigarettes isn't allowed" (42.7% vs. 21.2%), because "they are more affordable than other tobacco products" (26.2% vs. 12.2%), because "people who are important to me use them" (26.0% vs. 11.0%), "using them helps me quit smoking cigarettes" (28.9% vs. 7.5%), and because "using them feels like smoking regular cigarettes" (18.3% vs. 7.2%; all P<0.05). The majority of past-30-day e-cigarette users used e-liquid with nicotine (55.7%, N=107; Supplemental Table 2). Subjects who used nicotine containing e-liquid versus no nicotine e-liquid reported larger proportions for all reasons except because "people in the media or other public figures use them," with significant differences observed for report of using e-cigarettes for "they come in flavors I like" (86.1% vs. 72.0%), "they taste better" (83.0% vs. 58.3%), "they might be less harmful to me than cigarettes" (77.7% vs. 56.5%) and "they might be less harmful to people around me than cigarettes" (77.4% vs. 45.5%), "they don't smell" (72.2% vs. 33.3%), that "they are more acceptable to non-tobacco users" (54.8% vs. 31.8%), and that "using them helps me quit smoking cigarettes" (29.0% vs. 4.8%; all P<0.05). Among ever e-cigarette users, those who had friends with a friendly attitude towards e-cigarettes were significantly more likely to report use because of "they come in flavors I like" (63.1% vs. 27.4%), "they taste better" (55.8% vs. 27.2%), "they might be less harmful to me than cigarettes" (52.5% vs. 20.9%), "they might less harmful to people around me than cigarettes" (49.0% vs. 20.9%), "they don't smell" (44.4% vs. 23.7%), and because "I like the smell" (45.1% vs. 21.7%; all P<0.05; Supplemental Table 2).

DISCUSSION

Common reasons for e-cigarette use included availability in a variety of appealing flavors, liking the smell, and the perception that e-cigarettes were less harmful than cigarettes. We found associations of the strength of local tobacco retail licensing environment with almost all reasons for e-cigarette use and of the e-cigarette social environment with several reasons for use. Previous cigarette users found it appealing that e-cigarettes were more acceptable to others, that they can be used where cigarettes are not allowed, and that they are more affordable than other tobacco products. Overall, young adults were more similar to adolescents in their reported reasons for e-cigarette use than to previously studied older adults (Evans-Polce et al.; Kong et al., 2015; Patel et al., 2016); the most popular reason for e-cigarette use among our cohort was flavorings (56.6%) and few participants reported using e-cigarettes to quit smoking (12.8%), although those who identified cessation as a reason for e-cigarette use were more likely to be current smokers (28.9%). This is consistent with previous studies of adolescents which found that they were more likely to use e-cigarettes because of curiosity, for experimentation, availability of flavors, the perception that e-cigarettes are less harmful than traditional cigarettes and because friends use e-cigarettes (Kong et al., 2015; Patrick et al., 2016). In contrast, previous studies with older adults have largely shown a greater proportion of participants who reported use of e-cigarettes for smoking cessation and health reasons (Berg, 2016; Biener et al., 2015; Patel et al., 2016). A recent systematic review of consumer preference for e-cigarette attributes reported consistent findings that adolescents and young adults enjoy and consider flavor an important factor in trying e-cigarettes (Zare, Nemati & Zheng, 2018). In our cohort, the most popular flavor by far was “fruit” flavored e-liquids and these sweet-flavored solutions have been found to produce greater appeal (Goldenson et al., 2016).

Those who lived in D/F grade jurisdictions had increased frequency of reporting all reasons for e-cigarette use, with statistically significant differences observed for many common reasons for e-cigarette use. These findings suggest that jurisdictions with poorer enforcement for reduced tobacco sales may create an environment of “acceptance” for tobacco products (including e-cigarettes), which may lead to an increased social perception across the community that e-cigarettes would be more acceptable, less harmful and perhaps that users can easily circumvent the regulatory policies on traditional combustible cigarettes. There is some evidence that tobacco retail licensing can be an effective method of reducing youth tobacco use (DiFranza, 2012), including in our cohort (Astor et al., 2018, in press), and we found in a previous paper that stronger enforcement polices for combustible tobacco products also reduced the likelihood of e-cigarette initiation. Our results suggest that there is an effect of better tobacco retail licensing policies that can alter the appeal of e-cigarettes to young adults and may partially explain why rates of use are lower in stronger regulated communities. Thus, the continuation of support and enforcement of such regulatory policies is an important strategy to decrease e-cigarette use. The temporal sequence of effects is not possible to determine in a cross-sectional study, but further study is warranted to help identify targets for public service advertising or other interventions to influence the appeal of e-cigarettes.

Best friends' attitudes (friendliness or unfriendliness) towards use of e-cigarettes had an influence on the pattern of reasons reported for e-cigarette use. Those with close friends who feel more positively toward e-cigarette use were more likely to report use because of flavors, better taste and smell, and decreased perception of harm compared to cigarettes. More US youth, up to 73% from the 2014 National Youth Tobacco Survey (NYTS) believed that e-cigarettes were less harmful than cigarettes, and 47.1% believed that e-cigarettes were less addictive than cigarettes (Amrock, Lee, & Weitzman, 2016). A likely explanation for this is that youth are sharing information about e-cigarettes with their friends, whether it may be from accurate sources or not, that are influencing their perceptions.

Among past 30-day users, participants using e-liquid with nicotine were more likely to report all reasons for e-cigarette use. It is possible that nicotine generally enhances the appeal of e-cigarettes. While some studies have found that a sizable proportion of adolescent e-cigarette users use nicotine containing e-liquid, some have noted users have used "just flavouring" or no-nicotine (Miech, Patrick, O'Malley, & Johnston, 2016), and many others report not knowing the nicotine content (Miech et al., 2016; Morean, Kong, Cavallo, Camenga, & Krishnan-Sarin, 2016). However, in our study over sixty percent of participants reported using e-cigarettes with nicotine and therefore are at risk of developing dependence (DiFranza et al., 2002). A recent study has shown that users of e-cigarettes with higher nicotine concentration may increase subsequent frequency and intensity of smoking and vaping (Goldenson et al., 2017). In addition, there is little regulation of e-cigarette nicotine content or labeling, and evidence has shown both that the labeled concentration may not be accurate and that e-liquids reported to be nicotine free may not be (Goniewicz, Kuma, Gawron, Knysak, & Kosmider, 2013). Even trace amounts of nicotine can be harmful, and in addition to the neurochemical and neuroanatomical changes it can have, studies have shown the effect of nicotine on critical components of the reward pathways and circuits involved in learning, memory, and mood were likely to contribute to increased addictive properties and long-term behavioral problems seen in youth smokers (Slotkin, 2002).

The study has some limitations. The responses were self-reported and subject to under-or misreporting. We had a "mark all that apply" question for reasons for e-cigarette use that did not include information on curiosity, experimentation, or to do vape tricks, which have been shown to be popular reasons for e-cigarette use in other studies (Biener et al., 2015; Kong et al., 2015; Patrick et al., 2016). Self-reporting of nicotine levels may also be subject to misreporting, in addition, even if the participants were correctly self-reporting the content of e-liquid they bought, it may not have correlated to the true levels of nicotine in the product (Goniewicz et al., 2015). We also did not have data on how local regulation impacts community-level norms regarding e-cigarette and other tobacco product use, which would be informative in understanding the underlying mechanisms in the association between regulatory policy and reasons for e-cigarette use. Although the assessment of local policy was conducted prior to the assessment of reasons for e-cigarette use, other aspects of the study were cross-sectional (e.g., in assessing differences in reasons for use by individual level e-cigarette characteristics), so it was not possible to determine the temporal sequence of associations. For example, it would be useful to know whether nicotine and concentration of nicotine enhanced the appeal of e-cigarettes or whether users who are more likely to report specific reasons for e-cigarette use are then more likely to use nicotine. If the former,

then regulation of nicotine in e-cigarettes might reduce e-cigarette appeal. If the latter, then targeting appealing features of e-cigarettes in media or other interventions might reduce use of e-cigarettes and of nicotine.

Longitudinal studies could help determine whether the impact of tobacco retail licensing on rates of e-cigarette and cigarette use are mediated through the impact on the appeal of e-cigarette, or whether reasons for use of e-cigarettes might be targets for prevention that would be complementary to licensing ordinances. These studies could also provide a template for examining how other regulatory measures such as the California Tobacco Tax Increase Initiative (California Prop 56) or banning of flavored products by city localities such as San Francisco (Scutti, 2017) can alter the appeal of e-cigarettes and rates of use of e-cigarettes and other tobacco products.

CONCLUSION

Understanding the appeal of e-cigarettes in young adults, a vulnerable population, is important to determining the causes of e-cigarette and other tobacco product use. We have identified novel associations of the local tobacco retail licensing environment with reasons for e-cigarette use and that the enforcement difference may impact e-cigarette initiation rate. We suggest that enforcement of local regulation may be a more immediate and attainable area for policy change while awaiting federal regulations. Further investigation of the role of the regulatory environment and other potential determinants of the appeal of e-cigarettes is warranted to help develop and prioritize regulatory interventions to reduce rates of young adult e-cigarette use and transitions to cigarette use.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

FINANCIAL DISCLOSURE

The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING SOURCE

Research reported in this publication was supported by grant number P50CA180905 from the National Cancer Institute at the National Institutes of Health and the Food and Drug Administration (FDA) Center for Tobacco Products (CTP), grant number R21HD084812 from the National Institute for Child Health and Development, grant number 1K01DA042950-01 from the National Institutes of Health, National Institute on Drug Abuse, and the Hastings Foundation. The funders had no role in the design and conduct of the study; collection, management, analysis, or interpretation of the data; or preparation, review, or approval of the manuscript.

REFERENCES

Akkermans SEA, van Rooij D, Rommelse N, Hartman CA, Hoekstra PJ, Franke B,… Buitelaar JK (2017). Effect of tobacco smoking on frontal cortical thickness development: A longitudinal study in a mixed cohort of ADHD-affected and -unaffected youth. Eur Neuropsychopharmacol, 27(10), 1022–1031. [PubMed: 28764867]

American Lung Association. (2016). State of Tobacco Control California Local Grades http://www.lung.org/localcontent/california/documents/state-of-tobacco-control/2016/2016-sotc__california-full.pdf. Accessed 8 August 2018.

Amrock SM, Lee L, & Weitzman M (2016). Perceptions of e-Cigarettes and Noncigarette Tobacco Products Among US Youth. Pediatrics 138(5).

Astor R, Urman R, Barrington-Trimis J, Steinberg J, Cousineau M, Leventhal AM,… McConnell R (2018). Relationship of Tobacco Retail Licensing to Prevalence and New Initiation of Tobacco Product Use in Southern California Youth and Young Adults. Pediatrics In press.

Barrington-Trimis JL, Berhane K, Unger JB, Cruz TB, Huh J, Leventhal AM,… McConnell R (2015). Psychosocial Factors Associated With Adolescent Electronic Cigarette and Cigarette Use. Pediatrics, 136(2), 308–317. [PubMed: 26216326]

Barrington-Trimis JL, Urman R, Berhane K, Unger JB, Cruz TB, Pentz MA, … McConnell R (2016a). E-Cigarettes and Future Cigarette Use. Pediatrics 138(1).

Barrington-Trimis JL, Urman R, Leventhal AM, Gauderman WJ, Cruz TB, Gilreath TD,… McConnell R (2016b). E-cigarettes, Cigarettes, and the Prevalence of Adolescent Tobacco Use. Pediatrics, 138(2).

Berg CJ (2016). Preferred flavors and reasons for e-cigarette use and discontinued use among never, current, and former smokers. Int J Public Health, 61(2), 225–236. [PubMed: 26582009]

Biener L, Song E, Sutfin EL, Spangler J, & Wolfson M (2015). Electronic Cigarette Trial and Use among Young Adults: Reasons for Trial and Cessation of Vaping. Int J Environ Res Public Health, 12(12), 16019–16026. [PubMed: 26694438]

DiFranza JR, Savageau JA, Rigotti NA, Fletcher K, Ockene JK, McNeill AD,… Wood C (2002). Development of symptoms of tobacco dependence in youths: 30 month follow up data from the DANDY study. Tob Control, 11(3), 228–235. [PubMed: 12198274]

DiFranza JR (2012). Which interventions against the sale of tobacco to minors can be expected to reduce smoking? Tob Control, 21(4), 436–442. [PubMed: 21994275]

England LJ, Bunnell RE, Pechacek TF, Tong VT, & McAfee TA (2015). Nicotine and the Developing Human: A Neglected Element in the Electronic Cigarette Debate. Am J Prev Med, 49(2), 286–293. [PubMed: 25794473]

Evans-Polce RJ, Patrick ME, Lanza ST, Miech RA, O'Malley PM, & Johnston LD (2018) Reasons for Vaping among U.S. 12th Graders. Journal of Adolescent Health 62(4):457–462. [PubMed: 29273302]

Goldenson NI, Kirkpatrick MG, Barrington-Trimis JL, Pang RD, McBeth JF, Pentz MA,… Leventhal AM (2016). Effects of sweet flavorings and nicotine on the appeal and sensory properties of e-cigarettes among young adult vapers: Application of a novel methodology. Drug Alcohol Depend, 168, 176–180. [PubMed: 27676583]

Goldenson NI, Leventhal AM, Stone MD, McConnell RS, & Barrington-Trimis JL (2017). Associations of Electronic Cigarette Nicotine Concentration With Subsequent Cigarette Smoking and Vaping Levels in Adolescents. JAMA Pediatr. 1;171(12):1192–1199.

Goniewicz ML, Kuma T, Gawron M, Knysak J, & Kosmider L (2013). Nicotine levels in electronic cigarettes. Nicotine Tob Res, 15(1), 158–166. [PubMed: 22529223]

Goniewicz ML, Gupta R, Lee YH, Reinhardt S, Kim S, Kim B,… Sobczak A (2015). Nicotine levels in electronic cigarette refill solutions: A comparative analysis of products from the U.S., Korea, and Poland. Int J Drug Policy, 26(6), 583–588. [PubMed: 25724267]

Kong G, Morean ME, Cavallo DA, Camenga DR, & Krishnan-Sarin S (2015). Reasons for Electronic Cigarette Experimentation and Discontinuation Among Adolescents and Young Adults. Nicotine Tob Res, 17(7), 847–854. [PubMed: 25481917]

Leventhal AM, Strong DR, Kirkpatrick MG, Unger JB, Sussman S, Riggs NR,… Audrain-McGovern J (2015). Association of Electronic Cigarette Use With Initiation of Combustible Tobacco Product Smoking in Early Adolescence. JAMA, 314(7), 700–707. [PubMed: 26284721]

Leventhal AM, Stone MD, Andrabi N, Barrington-Trimis J, Strong DR, Sussman S, & Audrain-McGovern J (2016). Association of e-Cigarette Vaping and Progression to Heavier Patterns of Cigarette Smoking. JAMA, 316(18), 1918–1920. [PubMed: 27825000]

McConnell R, Berhane K, Yao L, Jerrett M, Lurmann F, Gilliland F,… Peters J (2006). Traffic, susceptibility, and childhood asthma. Environ Health Perspect, 114(5), 766–772. [PubMed: 16675435]

Miech R, Patrick ME, O'Malley PM, & Johnston LD (2016). What are kids vaping? Results from a national survey of US adolescents. Tob Control 26(4):386–391. [PubMed: 27562412]

Morean ME, Kong G, Cavallo DA, Camenga DR, & Krishnan-Sarin S (2016). Nicotine concentration of e-cigarettes used by adolescents. Drug Alcohol Depend 1;167:224–7.

Patel D, Davis KC, Cox S, Bradfield B, King BA, Shafer P,… Bunnell R (2016). Reasons for current E-cigarette use among U.S. adults. Prev Med 93:14–20. [PubMed: 27612572]

Patrick ME, Miech RA, Carlier C, O'Malley PM, Johnston LD, & Schulenberg JE (2016). Self-reported reasons for vaping among 8th, 10th, and 12th graders in the US: Nationally-representative results. Drug Alcohol Depend, 165, 275–278. [PubMed: 27286951]

Peters JM, Avol E, Navidi W, London SJ, Gauderman WJ, Lurmann F,… Thomas DC (1999). A study of twelve Southern California communities with differing levels and types of air pollution. I. Prevalence of respiratory morbidity. Am J Respir Crit Care Med, 159(3), 760–767. [PubMed: 10051248]

Primack BA, Soneji S, Stoolmiller M, Fine MJ, & Sargent JD (2015). Progression to Traditional Cigarette Smoking After Electronic Cigarette Use Among US Adolescents and Young Adults. JAMA Pediatr, 1–7.

Richardson A, Ganz O, & Vallone D (2015). Tobacco on the web: surveillance and characterisation of online tobacco and e-cigarette advertising. Tob Control, 24(4), 341–347. [PubMed: 24532710]

Scutti S (6 22, 2017). San Francisco moves to ban sales of vaping flavors, menthol cigarettes https://www-m.cnn.com/2017/06/22/health/san-francisco-vaping-menthols-ban-bn/index.html. Accessed 8 August 2018. C

Slotkin TA (2002). Nicotine and the adolescent brain: Insights from an animal model. Neurotoxicology and Teratology, 24(3), 369–384. [PubMed: 12009492]

Soneji S, Barrington-Trimis JL, Wills TA, Leventhal AM, Unger JB, Gibson LA,… Sargent JD (2017). Association Between Initial Use of e-Cigarettes and Subsequent Cigarette Smoking Among Adolescents and Young Adults: A Systematic Review and Meta-analysis. JAMA Pediatr, 171(8), 788–797. [PubMed: 28654986]

Spindle TR, Hiler MM, Cooke ME, Eissenberg T, Kendler KS, & Dick DM (2016). Electronic cigarette use and uptake of cigarette smoking: A longitudinal examination of U.S. college students. Addict Behav, 67, 66–72. [PubMed: 28038364]

U.S. Department of Health and Human Services. (1994). Preventing Tobacco Use Among Young People: A Report of the Surgeon General, Executive Summary

U.S. Department of Health and Human Services. (2012). Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General

Unger JB, Soto DW, & Leventhal A (2016). E-cigarette use and subsequent cigarette and marijuana use among Hispanic young adults. Drug Alcohol Depend, 163, 261–264. [PubMed: 27141841]

Wills TA, Knight R, Sargent JD, Gibbons FX, Pagano I, & Williams RJ (2016). Longitudinal study of e-cigarette use and onset of cigarette smoking among high school students in Hawaii. Tob Control 26(1):34–39. [PubMed: 26811353]

Zare S, Nemati M, & Zheng Y (2018). A systematic review of consumer preference for e-cigarette attributes: Flavor, nicotine strength, and type. PLoS One, 13(3), e0194145. [PubMed: 29543907]

Highlights:

- The impact of local tobacco licensing policies on e-cigarette use has not been studied.
- Reasons for e-cigarette use differed by the strength of local policy enforcement.
- Weakly enforced localities reported greater use of e-cigarettes for the following reasons: less harm, more acceptability, ability to use in cigarette-prohibited areas.
- Reasons for e-cigarette use in relation to local policy environment may be important in developing effective interventions and policies to reduce use.

TABLE 1.

Demographics of Ever E-cigarette Users (N=614).

		N(%)
Gender	Male	316 (51.5)
	Female	298 (48.5)
Ethnicity	Hispanic White	305 (49.7)
	Non-Hispanic White	256 (41.7)
	Other	53 (8.6)
Parental Education[a]	High school diploma or GED or lower	186 (31.8)
	Some college	224 (38.3)
	College degree or higher	175 (29.9)
2014 American Lung Association Reduce Sale Tobacco Town	A	156 (25.4)
Grade	D or F	458 (74.6)
Cigarette History[a]	No cigarette use	256 (42.6)
	Ever cigarette use	219 (36.4)
	Past 30-day cigarette use	126 (21.0)
Past 30-day E-cigarette Use	No	422 (68.7)
	Yes	192 (31.3)
Used Nicotine Containing Eliquid in Past 30 days[b]	No	26 (16.5)
	Yes	107 (67.6)
	Don't know	25 (15.8)

[a]Numbers may not add to total due to missing responses.

[b]Asked only of past 30-day e-cigarette users (N=192; numbers may not add up to total due to missing responses).

TABLE 2.

Reasons for e-cigarette use and percentage for each reason endorsed among ever e-cigarette users (N=614).

	Reasons for E-cigarette use	Yes (%)[a]
1.	They come in flavors I like	282 (56.6)
2.	They taste better	247 (51.0)
3.	They might be less harmful to me than cigarettes	220 (46.7)
4.	They might be less harmful to people around me than cigarettes	205 (43.7)
5.	They don't smell	201 (41.6)
6.	I like the smell	201 (41.3)
7.	They are more acceptable to non-tobacco users	163 (34.8)
8.	I can use them in places where smoking cigarettes isn't allowed	127 (27.6)
9.	They are affordable	77 (17.9)
10.	They are more affordable than other tobacco products	65 (15.3)
11.	People who are important to me use them	64 (13.8)
12.	Using them helps me quit smoking cigarettes	58 (12.8)
13.	Using them feels like smoking regular cigarettes	57 (12.6)
14.	People in the media or other public figures use them	50 (11.1)
15.	The advertising appeals to me	31 (6.6)

[a]Missing responses were excluded. (Range of Ns= 426–498)

TABLE 3.

Reasons for e-cigarette use by percentage endorsed by 2014 American Lung Association (ALA) local jurisdiction grade in reduced tobacco sales (A vs. D/F; N=614).

	Reasons for E-cigarette Use	ALA Local Jurisdiction Grade[a]		
		A (N=156) N (%)	D & F (N=458) N (%)	p-Value*
1.	They come in flavors I like	61 (49.6)	221 (58.9)	0.05*
2.	They taste better	54 (44.2)	194 (53.3)	0.11
3.	They might be less harmful to me than cigarettes	43 (36.2)	178 (50.1)	0.04*
4.	They might be less harmful to people around me than cigarettes	40 (34.5)	165 (46.7)	0.08
5.	They don't smell	39 (32.5)	162 (44.6)	0.02*
6.	I like the smell	43 (34.7)	158 (43.5)	0.14
7.	They are more acceptable to non-tobacco users	29 (25.0)	134 (38.0)	0.04*
8.	I can use them in places where smoking cigarettes isn't allowed	21 (18.3)	106 (30.7)	0.02*
9.	They are affordable	14 (13.0)	63 (19.5)	0.33
10.	They are more affordable than other tobacco products	12 (11.1)	53 (16.7)	0.26
11.	People who are important to me use them	15 (13.0)	49 (14.1)	0.89
12.	Using them helps me quit smoking cigarettes	11 (9.9)	47 (13.8)	0.20
13.	Using them feels like smoking regular cigarettes	14 (12.1)	43 (12.7)	0.75
14.	People in the media or other public figures use them	11 (9.6)	39 (11.5)	0.44
15.	The advertising appeals to me	7 (5.8)	24 (6.8)	0.56

*P-value for multivariate logistic regression model adjusted for gender, ethnicity, highest parental education, random effect for jurisdiction, and past cigarette history

[a]Missing values were excluded. Range of Ns=426–498.