Published in final edited form as:

Am J Addict. 2017 June ; 26(4): 343–348. doi:10.1111/ajad.12530.

E-cigarette Use of Young Adults: Motivations and Associations with Combustible Cigarette, Alcohol, Marijuana, and Other Illicit Drugs

Jeff R. Temple, PhD¹, Ryan C. Shorey, PhD², Yu Lu, PhD¹, Elizabeth Torres, MPH¹, Gregory L. Stuart, PhD³, and Vi D. Le, MPH¹

¹Department of Ob/Gyn, University of Texas Medical Branch, Galveston, TX

²Department of Psychology, Ohio University, Athens, OH

³Department of Psychology, University of Tennessee, Knoxville, TN

Abstract

Background and Objectives—Although the prevalence of e-cigarette use among adolescents and young adults has caught up to or eclipsed that of combustible cigarette use, there is relatively little known about (a) the link between e-cigarettes and other substances and (b) the reasons underlying this increase in e-cigarette use. To address this gap in knowledge, the current study examined associations between e-cigarette use and other substances and identified motives for e-cigarette use among young adults.

Methods—Participants included an ethnically diverse sample of African American, White, and Hispanic young adults (N=662; 61% female) who were participating in an ongoing survey-based longitudinal study of health and risky behaviors.

Results—Hispanic, White, and male young adults reported significantly greater past year e-cigarette use compared to their African American and female counterparts. Bivariate correlations showed that use of e-cigarettes was positively associated with use of combustible cigarettes, alcohol, marijuana, cocaine, amphetamines, inhalants, hallucinogens, ecstasy, and misuse of over-the-counter and prescription medications. Furthermore, e-cigarette users reported a higher prevalence of substance use relative to those who did not use e-cigarettes. The taste of e-cigarettes was identified as an important motive for use.

Conclusions and Significance—Although the potential harm associated with e-cigarettes remains largely unknown, e-cigarettes appear to be a risk marker for the use of substances that are known to pose substantial health problems. Health care providers should screen for e-cigarette use, and youth substance use prevention programs should target the reduction of e-cigarette use with particular attention to addressing their taste appeal.

Address correspondence to Jeff Temple, 301 University Blvd, 3.110D John Sealy Annex, Galveston, TX 77555. Tel: 309-747-8560
Fax: 409-747-5129, jtemple@utmb.edu.

Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

Background and Objectives

Electronic nicotine delivery system, commonly known as vaping or e-cigarettes, is quickly gaining popularity in the U.S. With the common belief that e-cigarettes are less harmful than combustible cigarettes,¹ e-cigarettes are often promoted as a safer alternative.² This notion of reduced harm, coupled with aggressive marketing to younger consumers,³ likely contributed to the tripling of e-cigarette use among youth in just one year.⁴ Indeed, recent estimates suggest that over 2 million U.S. adolescents currently use e-cigarettes⁵ and more than 20% of U.S. young adults have used them in the past.⁶

Although the nature and degree of harm associated with e-cigarette use is not fully known, emerging evidence suggests potential acute⁷ and chronic⁸ effects. One significant concern is the potential for e-cigarettes to serve as a precursor to combustible cigarette use,^{9–10} which is an enormous public health burden. Schneider and Diehl¹¹ proposed a catalyst model to describe this “gateway effect” in which they suggested that the low perceived health risks and characteristics of e-cigarettes (e.g., taste, price, and inconspicuous use), and a higher level of acceptance among peers, makes e-cigarettes initially more attractive to youth than combustible cigarettes. Over time, however, the increased tolerance to the relatively low levels of nicotine in e-cigarettes may lead to a transition to the use of combustible cigarettes. Indeed, U.S. adolescents and young adults appear to progress from e-cigarettes to combustible cigarette use.¹² Moreover, lifetime use of e-cigarettes is positively related to the use of a number of other tobacco products, such as hookah and snus.^{4,13–14} Based on a review of existing research, Kritjansson and Sigfusdottir¹⁵ concluded that the presence of e-cigarettes increases the overall rate of youth engagement in tobacco use of any kind. Leventhall and colleagues¹⁰ conducted a compelling longitudinal study demonstrating that baseline e-cigarette use among youth predicted subsequent initiation of combustible cigarette, cigar, and hookah use at both six-month and 12-month follow ups.

The catalyst model effect of e-cigarette use may extend beyond tobacco products to include an increased risk of misusing other substances. As seen with the strong association between combustible cigarettes and alcohol/drug use,^{16–17} e-cigarette use may also be comorbid with alcohol use¹⁸ and a range of other substances. For example, one study demonstrated that the prevalence of e-cigarette use among adults seeking substance use treatment was higher than that in the U.S. general population of smokers.¹⁹ A study of adolescents found that e-cigarette users were more likely than nonusers to have used alcohol (including heavy drinking), oral tobacco, sleeping pills or tranquilizers, sniffed glue, marijuana, and amphetamines.²⁰ The present study extended this literature by investigating the association between e-cigarettes and other substances (i.e., cigarettes, alcohol, marijuana, cocaine, amphetamines, inhalants, hallucinogens, ecstasy, and misuse of over-the-counter and prescription medications) among young adults.

In addition to investigating the association between e-cigarette use and other substances, we also examined potential motives for young adult use of e-cigarettes. Although two commonly reported reasons for e-cigarette use among adults are to quit smoking and to reduce the harm of combustible cigarette use,^{21–23} motivations for use of e-cigarettes in younger populations do not appear to be associated with a desire to quit²⁴ or health

concerns.²⁵ Thus, we explored reasons underlying the use of e-cigarettes, including taste and cost, in a diverse population of young adults.

Race/Ethnicity

Although the literature consistently shows that males are generally more likely to use e-cigarettes than females,^{13–14,26} there is less agreement with respect to race/ethnicity. A recent study of Texas youth found that e-cigarette users were more likely to be White than African American or Hispanic,¹⁴ while another study of young adults found no differences by race/ethnicity.²⁶ A third study demonstrated that e-cigarettes were more commonly used by Hispanic and White adolescents, relative to African American and other youth.⁴ Using a large ethnically diverse sample of young adults, we extended this literature by investigating current e-cigarette use patterns with a particular focus on examining differences by race/ethnicity.

Methods

Participants and Procedure

We used data from our ongoing, longitudinal study of adolescent health. The original sample (Wave 1: Spring 2010) included 1042 participants (female: 56%) who were recruited from mandated classes in seven public high schools in southeast Texas (response rate: 62%) and followed annually thereafter.²⁷ The present study included only participants who completed Wave 6 in the spring 2015 ($n=758$; retention rate from baseline: 73%), which is the first Wave in which e-cigarette items were included. Analyses were then conducted on the 662 participants (61% female) who self-identified as Hispanic (37%), White (33%), or African American (30%), as remaining racial/ethnic groups (e.g., Asian) were too small for meaningful analyses. Most participants were either in college (65%) or working (28%) with a mean age of 20.03 years (range: 18–23 years, $SD = .79$). Participants received a \$30 gift card for completing the 45-minute survey. Active parental consent and child assent were obtained at Wave 1. Participants were re-consented upon reaching the age of 18. The Institutional Review Board of the first author approved the study.

Measures

Participants were asked (yes/no) about past year use of e-cigarettes, cigarettes (“more than just a puff”), alcohol (“more than just a few sips”), marijuana, cocaine, amphetamines, inhalants, hallucinogens, ecstasy, “over-the-counter cold or cough medication with the intent to get high,” and “prescription medications that weren’t prescribed by a health professional.” Due to relatively low rates of past-year use of cocaine, amphetamines, inhalants, hallucinogens, ecstasy, over the counter medication, and prescription medications, these substances were combined to form an additional variable of past year “hard drug use” (i.e., participants were categorized as past-year hard drug users if they endorsed one or more of these substances).

Motivations for using e-cigarettes were measured with the question, “what reasons motivated you to use e-cigarettes?” Culled from the literature, we provided participants with the following list of possible reasons for e-cigarette use and asked them to check all that

applied to their situation: 1) substitute for smoking in places where smoking is prohibited; 2) to avoid exposing others to second-hand smoke; 3) to avoid smelling like tobacco smoke; 4) to help cut down the number of cigarettes smoked; 5) to help quit smoking entirely; 6) to save money; and 7) the taste is better than regular cigarettes.

Data Analytic Strategy

All analyses were conducted in SPSS version 21 to examine the prevalence of e-cigarette use and its association with the use of other substances. Chi-square analyses were utilized to determine whether past year prevalence of e-cigarette use varied by gender and race/ethnicity. Bivariate correlations examined the association between past year prevalence of e-cigarette use and past year use of other substances. Chi-square analyses examined whether e-cigarette users were more likely to use other substances relative to participants who did not use e-cigarettes. Finally, we examined reasons for e-cigarette use.

Results

Past year prevalence of e-cigarette use across the entire sample was 28.3%. Chi-square analyses demonstrated that past year prevalence of e-cigarette use was higher for males (36.1%) than for females (23.2%), $\chi^2(1) = 12.88, p < .001$. Significant differences between the three ethnic/racial groups in the prevalence of past year e-cigarette use also emerged, $\chi^2(2) = 38.83, p < .001$. Specifically, Hispanic (31.6%) and White (38.9%) emerging adults reported a higher past year prevalence of e-cigarette use than their African American counterparts (11.9%). Whites and Hispanics did not significantly differ from each other.

Bivariate correlations between use of e-cigarettes and use of other substances are presented in Table 1, along with prevalence data for all substances. E-cigarette use was positively and significantly associated with every type of substance use. The strongest correlation was between e-cigarettes and combustible cigarettes ($r = .51$). Fisher r-to-z transformation, which tests whether the strength of two separate correlations are statistically different, demonstrated that the correlation between past year e-cigarette use and cigarette use was statistically stronger than the correlations between e-cigarette use and all other types of substances.

As shown in Table 2, young adults who used e-cigarettes in the past year reported a higher prevalence of every type of substance examined, relative to those who did not use e-cigarettes. With the exception of inhalant use, all differences remained significant after applying a Bonferroni correction, which adjusted for the number of analyses conducted.

Among young adults who reported past year e-cigarette use, reasons for use included: the taste is better than regular cigarettes (55.7%), using as a substitute for smoking in places where smoking is prohibited (36.2%), to avoid smelling like tobacco smoke (31.9%), to help cut down on the number of cigarettes smoked (23.8%), to help quit smoking entirely (23.8%), to save money (18.9%), and to avoid exposing others to second-hand smoke (17.3%).

Discussion

Overall, 28.3% of this ethnically diverse sample of young adults reported e-cigarette use, which was similar to their reported use of combustible cigarettes (27.6%). This finding provides further evidence that e-cigarettes have become a popular substance among young adults.²⁸ Consistent with previous research,¹³ past year e-cigarette use was higher in males. Similar to the 2014 Youth Tobacco Survey,⁴ a significantly higher proportion of Hispanics (32%) and Whites (39%) reported e-cigarette use compared to their African American counterparts (12%). These race/ethnicity differences may have implications for prevention resources available to schools and communities. Specifically, prevention and intervention programs targeting White and Hispanic students may benefit from including information on e-cigarettes, while programs targeting African American youth may be better served by focusing on other substances.

As expected, past year e-cigarette use was strongly related to combustible cigarette use. This link, coupled with the knowledge that e-cigarette use may progress to combustible cigarette use,¹⁰ indicates that e-cigarettes may not be a safe alternative for young adults. That is, even if the long-term evidence demonstrates that e-cigarettes themselves are harmless, their strong relationship to a substance that causes known harms warrants concern.

The present study adds to the literature by demonstrating that e-cigarette use among young adults was associated with a variety of other substances including alcohol, marijuana, cocaine, amphetamines, inhalants, hallucinogens, ecstasy, and misuse of over-the-counter and prescription medications. Moreover, the prevalence of past year use of all types of substances was higher among e-cigarette users compared to non-users. Thus, in addition to confirming the comorbidity between e-cigarettes, cigarettes, and alcohol,^{18,29–30} the present study identified a link between e-cigarettes and a range of “hard” drugs. It is possible that young adults use e-cigarettes as a “safe” method of experimentation, with the potential that this progresses to the misuse of cigarettes and other harmful substances. Another plausible explanation is that risky behaviors (e.g., substance use) cluster together and that a third variable underlies their collective use (e.g., impulsivity, poor mental health). Regardless of the reasons underlying the association between e-cigarettes and a range of licit and illicit substances, current findings suggest that the use of e-cigarettes is a risk marker for other substances with known harmful effects. Thus, young adult-focused health care providers should routinely query patients about their e-cigarette use. Moreover, health prevention programs should address the rapidly growing use of e-cigarettes among young adults to prevent the undermining of ongoing substance prevention efforts.

The primary motivation for e-cigarette use among our ethnically diverse sample was that they “taste better” than combustible cigarettes. This is an important finding given that e-cigarettes are often marketed toward younger consumers with enticing flavors like fruit (e.g., pineapple) and dessert/candy (e.g., Skittles).³¹ Although the 2009 Family Smoking Prevention and Tobacco Control Act bans cigarette companies from characterizing specific flavors that are attractive to youth,³² the regulation does not apply to e-cigarettes. It is estimated that 82% of 12–17 year olds and 88% of 18–21 year olds have seen e-cigarette advertising,³ and youth and young adults exposed to e-cigarette advertisements, particularly

flavored e-cigarette advertisements, tend to rate e-cigarettes as more appealing and have greater interests in buying and trying them.^{33–34} This reality makes the association between e-cigarettes and other substances much more alarming. Despite the restricted e-cigarette access with the newly announced FDA rule that requires photo identification at purchase and bans sales to adolescents, this restriction only applies to anyone under age 18.³⁵ The taste appeal of e-cigarettes will likely continue to motivate use among young adults. Policy makers should consider restricting the availability of e-cigarette flavors or regulating current marketing messages that focus on flavors and taste.

Limitations

Findings should be interpreted in light of several limitations. First, participants self-reported past year substance use. Second, the data were cross-sectional, which prohibits making causal inferences or understanding temporality of relationships. Longitudinal data could help to determine if and how the relationship between the use of e-cigarettes and other substances change over time. Third, participants were asked to choose their motivations to use e-cigarettes from a list of pre-specified items. Although this list was fairly comprehensive, the reasons were not exhaustive and nuances may have been lost in this process, whereby more complicated reasons were not captured by a close-ended survey. Qualitative research may be necessary to grasp a full picture of the motivation underlying the decisions to initiate and continue use of e-cigarettes.

Conclusions and Significance

The present study is among the first to identify the association between e-cigarette use and a range of other substances in a large, ethnically diverse sample of young adults. In addition to the expected link between e-cigarettes and combustible cigarettes, we found an association between e-cigarettes and alcohol, marijuana, cocaine, amphetamines, inhalants, hallucinogens, ecstasy, and the misuse of over-the-counter and prescription medications. Given that e-cigarette use appears to be a risk marker for known harmful substances, public health professionals and policy makers should address e-cigarette use in prevention programs. We also found that taste is a highly motivating factor for young adults to use e-cigarettes and identified a list of other motivations. Regulations on e-cigarettes and their marketing messages are necessary for substance use prevention for youth. A new FDA rule that bans e-cigarette sales to anyone under age 18 took effect in August 2016. The high prevalence of e-cigarette use among young adults, as well the association between e-cigarettes and a range of other substances, support the need for the recent federal regulations and further indicate the need to continue surveillance and implement new regulations on marketing messages for e-cigarettes, particularly those focusing on flavors and taste.

Acknowledgments

Funding: This research was supported by Award Number K23HD059916 (PI: Temple) from the Eunice Kennedy Shriver National Institute of Child Health & Human Development (NICHD), Bethesda, MD, and 2012- WG-BX-0005 (PI: Temple) from the National Institute of Justice (NIJ), Washington, D.C. The content is solely the responsibility of the authors and does not necessarily represent the official views of NICHD or NIJ.

References

1. King BA, Alam S, Promoff G, Arrazola R, Dube SR. Awareness and ever-use of electronic cigarettes among US adults, 2010–2011. *Nicotine Tob Res.* 2013; 15(9):1623–1627. <http://dx.doi.org/10.1093/ntr/ntt013>. [PubMed: 23449421]
2. Nutt DJ, Phillips LD, Balfour D, et al. Estimating the harms of nicotine-containing products using the MCDA approach. *Eur Addic Res.* 2014; 20(5):218–225. <http://dx.doi.org/10.1159/000360220>.
3. Truth Initiative Vaporized: Youth and young adult exposure to e-cigarette marketing. Washington, DC: Truth Initiative; http://truthinitiative.org/sites/default/files/Vaporized-Youth_and_young_adult_exposure_to_e-cigarette_marketing.pdf Published 2015. Accessed July 14, 2016
4. Arrazola RA, Singh T, Corey CG, et al. Tobacco use among middle and high school students–United States, 2011–2014. *MMWR Morb Mortal Wkly Rep.* 2015; 64(14):381–385. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6414a3.htm>. Accessed July 14, 2016. [PubMed: 25879896]
5. Singh T, Arrazola RA, Corey CG, et al. Tobacco use among middle and high school students – United States, 2011–2015. *MMWR Morb Mortal Wkly Rep.* 2016; 65:361–367. <http://dx.doi.org/10.15585/mmwr.mm6514a1>. [PubMed: 27077789]
6. Schoenborn, CA., Gindi, RM. NCHS data brief, no. 217. Hyattsville, MD: National Center for Health Statistics; Electronic cigarette use among adults: United States, 2014. <http://www.cdc.gov/nchs/data/databriefs/db217.pdf>. Published 2015. Accessed July 14, 2016.
7. Diepinigaitis PV, Chang AL, Diepinigaitis AJ, Negassa A. Effect of electronic cigarette use on the urge-to-cough sensation. *Nicotine Tob Res.* 2016; 18(8):1763–1765. <http://dx.doi.org/10.1093/ntr/ntw021>. [PubMed: 26803150]
8. Park SJ, Walser TC, Perdomo C, et al. Abstract B16: The effect of e-cigarette exposure on airway epithelial cell gene expression and transformation. *Clin Cancer Res.* 2014; 20(suppl 2):B16. <http://dx.doi.org/10.1158/1078-0432.14aacriasc-b16>.
9. Kmietowicz Z. E-cigarettes are “gateway devices” for smoking among young people, say researchers. *BMJ.* 2014; 348:g2034. <http://dx.doi.org/10.1136/bmj.g2034>. [PubMed: 24615253]
10. Leventhal AM, Strong DR, Kirkpatrick MG, et al. Association of electronic cigarette use with initiation of combustible tobacco product smoking in early adolescence. *Jama.* 2015; 314(7):700–707. <http://dx.doi.org/10.1001/jama.2015.8950>. [PubMed: 26284721]
11. Schneider S, Diehl K. Vaping as a catalyst for smoking? An initial model on the initiation of electronic cigarette use and the transition to tobacco smoking among adolescents. *Nicotine Tob Res.* 2016; 18(5):647–653. <http://dx.doi.org/10.1093/ntr/ntv193>. [PubMed: 26386472]
12. Primack BA, Soneji S, Stoolmiller M, Fine MJ, Sargent JD. Progression to traditional cigarette smoking after electronic cigarette use among US adolescents and young adults. *JAMA Pediatr.* 2015; 169(11):1018–1023. <http://dx.doi.org/10.1001/jamapediatrics.2015.1742>. [PubMed: 26348249]
13. Barnett TE, Soule EK, Forrest JR, Porter L, Tomar SL. Adolescent electronic cigarette use: associations with conventional cigarette and hookah smoking. *Am J Prev Med.* 2015; 49(2):199–206. DOI: 10.1016/j.amepre.2015.02.013 [PubMed: 25840880]
14. Cooper M, Case KR, Loukas A. E-cigarette use among Texas youth: Results from the 2014 Texas Youth Tobacco Survey. *Addic Behav.* 2015; 50:173–177. <http://dx.doi.org/10.1016/j.addbeh.2015.06.034>.
15. Kristjansson AL, Sigfusdottir ID. E-cigarette use and relations to tobacco and alcohol use among adolescents. *BMC Med.* 2015; 13(1):1. <http://dx.doi.org/10.1186/s12916-015-0339-y>. [PubMed: 25563062]
16. Nichter M, Nichter M, Carkoglu A, Lloyd-Richardson E. Tobacco Etiology Research Network. Smoking and drinking among college students: “It’s a package deal”. *Drug Alcohol Depend.* 2010; 106(1):16–20. <http://dx.doi.org/10.1016/j.drugalcdep.2009.07.025>. [PubMed: 19758771]
17. Ramo DE, Liu H, Prochaska JJ. Tobacco and marijuana use among adolescents and young adults: a systematic review of their co-use. *Clin Psychol Rev.* 2012; 32(2):105–121. <http://dx.doi.org/10.1016/j.cpr.2011.12.002>. [PubMed: 22245559]

18. Hershberger AR, Karyadi KA, VanderVeen JD, Cyders MA. Combined expectancies of alcohol and e-cigarette use relate to higher alcohol use. *Addict Behav.* 2016; 52:13–21. <http://dx.doi.org/10.1016/j.addbeh.2015.08.005>. [PubMed: 26334561]
19. Peters EN, Harrell PT, Hendricks PS, et al. Electronic cigarettes in adults in outpatient substance use treatment: Awareness, perceptions, use, and reasons for use. *Am J Addic.* 2015; 24(3):233–239. <http://dx.doi.org/10.1111/ajad.12206>.
20. Kristjansson AL, Mann MJ, Sigfusdottir ID. Licit and illicit substance use by adolescent e-cigarette users compared with conventional cigarette smokers, dual users, and nonusers. *J Adolesc Health.* 2015; 57(5):562–564. <http://dx.doi.org/10.1016/j.jadohealth.2015.07.014>. [PubMed: 26372367]
21. Amato MS, Boyle RG, Levy D. How to define e-cigarette prevalence? Finding clues in the use frequency distribution. *Tob Control.* 2016; 25:e24–e29. <http://dx.doi.org/10.1136/tobaccocontrol-2015-052236>. [PubMed: 26085124]
22. Etter JF. Electronic cigarettes: a survey of users. *BMC Public Health.* 2010; 10:231–237. <http://dx.doi.org/10.1186/1471-2458-10-231>. [PubMed: 20441579]
23. Nonnemaker J, Kim AE, Lee YO, et al. Quantifying how smokers value attributes of electronic cigarettes. *Tob Control.* 2016; 25:e37–e43. <http://dx.doi.org/10.1136/tobaccocontrol-2015-052511>. [PubMed: 26546152]
24. Lippert AM. Do adolescent smokers use e-cigarettes to help them quit? The sociodemographic correlates and cessation motivations of US adolescent e-cigarette use. *Am J Health Promot.* 2015; 29(6):374–379. <http://dx.doi.org/10.4278/ajhp.131120-quan-595>. [PubMed: 24968185]
25. Kong G, Morean ME, Cavallo DA, Camenga DR, Krishnan-Sarin S. Reasons for electronic cigarette experimentation and discontinuation among adolescents and young adults. *Nicotine Tob Res.* 2015; 17(7):847–854. <http://dx.doi.org/10.1093/ntr/ntu257>. [PubMed: 25481917]
26. Littlefield AK, Gottlieb JC, Cohen LM, Trotter DR. Electronic cigarette use among college students: Links to gender, race/ethnicity, smoking, and heavy drinking. *J Am Coll Health.* 2015; 63(8):523–529. <http://dx.doi.org/10.1080/07448481.2015.1043130>. [PubMed: 26057365]
27. Temple JR, Shorey RC, Fite P, et al. Substance use as a longitudinal predictor of the perpetration of teen dating violence. *J Youth Adolescence.* 2013; 42(4):596–606. <http://dx.doi.org/10.1007/s10964-012-9877-1>.
28. Center for Disease Control and Prevention. Youth and Tobacco Use. Center for Disease Control and Prevention website. http://www.cdc.gov/tobacco/data_statistics/fact_sheets/youth_data/tobacco_use/. Updated April 14, 2016. Accessed July 14, 2016
29. Anand V, McGinty KL, O'Brien K, et al. E-cigarette use and beliefs among urban public high school students in North Carolina. *J Adolesc Health.* 2015; 57(1):46–51. <http://dx.doi.org/10.1016/j.jadohealth.2015.03.018>. [PubMed: 26095408]
30. Barrington-Trimis JL, Berhane K, Unger JB, et al. Psychosocial factors associated with adolescent electronic cigarette and cigarette use. *Pediatrics.* 2015; 136(2):308–317. <http://dx.doi.org/10.1542/peds.2015-0639>. [PubMed: 26216326]
31. Zhu SH, Sun JY, Bonnevie E, et al. Four hundred and sixty brands of e-cigarettes and counting: implications for product regulation. *Tob Control.* 2014; 23(suppl 3):iii3–9. <http://dx.doi.org/10.1136/tobaccocontrol-2014-051670>. [PubMed: 24935895]
32. U.S. Food and Drug Administration. Tobacco Control Act. U.S. Food and Drug Administration website. <http://www.fda.gov/TobaccoProducts/GuidanceComplianceRegulatoryInformation/ucm246129.htm>. Updated June 30, 2016. Accessed July 14, 2016.
33. Singh T, Agaku IT, Arrazola RA, et al. Exposure to advertisements and electronic cigarette use among US middle and high school students. *Pediatrics.* 2016; 137(5):e20154155. <http://dx.doi.org/10.1542/peds.2015-4155>. [PubMed: 27244815]
34. Vasiljevic, M., Petrescu, DC., Marteau, TM. Impact of advertisements promoting candy-like flavoured e-cigarettes on appeal of tobacco smoking among children: an experimental study [published online January 17 2016]. *Tob Control.* 2016. <http://dx.doi.org/10.1136/tobaccocontrol-2015-052593>
35. U.S. Food and Drug Administration. FDA takes significant steps to protect Americans from dangers of tobacco through new regulation. U.S. Food and Drug Administration website. <http://www.fda.gov/oc/2016/01/14/fda-takes-significant-steps-to-protect-americans-from-dangers-of-tobacco-through-new-regulation>

www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm499234.htm. Updated May 10, 2016. Accessed July 16, 2016.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1

Correlation and Prevalence of Substance Use Variables

Variables	N	%	1	2	3	4	5	6	7	8	9	10	11	12
1. E-cig	653	28.3	1.00											
2. Cigarettes	655	27.6	.51**	1.00										
3. Alcohol	655	80.8	.27**	.25**	1.00									
4. Marijuana	655	42.7	.32**	.32**	.29**	1.00								
5. Cocaine	655	7.9	.33**	.13**	.36**	.31**	1.00							
6. Amphetamines	654	2.3	.18**	.08	.16**	.14**	.41**	1.00						
7. Inhalants	655	1.8	.09*	.07	.12**	.09*	.21**	.28**	1.00					
8. Hallucinogens	655	7.2	.26**	.14**	.29**	.27**	.49**	.43**	.32**	1.00				
9. Ecstasy	655	9.0	.26**	.13**	.31**	.32**	.52**	.38**	.20**	.53**	1.00			
10. Over the counter	655	6.4	.15**	.10*	.22**	.27**	.41**	.29**	.15**	.41**	.42**	1.00		
11. Prescription	655	14.8	.26**	.18**	.29**	.39**	.42**	.22**	.17**	.38**	.37**	.45**	1.00	
12. All hard drugs ^a	654	15.3	.37**	.19**	.40**	.41**	.69**	.36**	.32**	.66**	.41**	.74**	.47**	1.00

** Correlation is significant at the .01 level (2-tailed)

* Correlation is significant at the .05 level (2-tailed)

^a All hard drugs is "yes" to one or more of the cocaine, amphetamines, inhalants, hallucinogens, over the counter, ecstasy, and prescription drug items.

Table 2

Comparison of Race, Gender, and Substance Use by E-cigarette Use Status

Variables	E-Cigarette User			Nonuser			p
	N	%		N	%		
Race							
	Hispanic	77	31.7 %	166	68.3 %		
	White	85	39.0 %	133	61.0 %		<.001
	African American	23	12.0 %	169	88.0 %		
Gender							
	Female	92	23.2 %	304	76.8 %		<.001
	Male	93	36.2 %	164	63.8 %		
Cigarettes							
	Yes	118	65.6 %	62	34.4 %		<.001
	No	67	14.2 %	406	85.8 %		
Alcohol							
	Yes	181	34.3 %	347	65.7 %		<.001
	No	4	3.2 %	121	96.8 %		
Marijuana							
	Yes	126	45.2 %	153	54.8 %		<.001
	No	59	15.8 %	315	84.2 %		
Cocaine							
	Yes	41	78.8 %	11	21.2 %		<.001
	No	144	24.0 %	457	76.0 %		
Amphetamines							
	Yes	12	80.0 %	3	20.0 %		<.001
	No	173	27.2 %	464	72.8 %		
Inhalants							
	Yes	7	58.3 %	5	41.7 %		.02
	No	178	27.8 %	463	72.2 %		
Hallucinogens							
	Yes	33	70.2 %	14	29.8 %		<.001

Variables	E-Cigarette User		Nonuser		<i>p</i>
	N	%	N	%	
Ecstasy	No	152	25.1 %	454	74.9 %
	Yes	39	66.1 %	20	33.9 %
	No	146	24.6 %	448	75.4 %
Over-the-counter	Yes	23	54.8 %	19	45.2 %
	No	162	26.5 %	449	73.5 %
Prescription medications	Yes	55	56.7 %	42	43.3 %
	No	130	23.4 %	426	76.6 %