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# Risky behaviors, e-cigarette use and susceptibility of use among college students

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ABSTRACT

*Background:* Since 2007, there has been a rise in the use of electronic cigarettes (e-cigarettes). The present study uses cross-sectional data (2013) to examine prevalence, correlates and susceptibility to e-cigarettes among young adults.
*Methods:* Data were collected using an Internet survey from a convenience sample of 1437, 18–23 year olds attending four colleges/universities in Upstate New York. Results were summarized using descriptive statistics; logistic regression models were analyzed to identify correlates of e-cigarette use and susceptibility to using e-cigarettes.
*Results:* Nearly all respondents (95.5%) reported awareness of e-cigarettes; 29.9% were ever users and 14.9% were current users. Younger students, males, non-Hispanic Whites, respondents reporting average/below average school ability, ever smokers and experimenters of tobacco cigarettes, and those with lower perceptions of harm regarding e-cigarettes demonstrated higher odds of ever use or current use. Risky behaviors (i.e., tobacco, marijuana or alcohol use) were associated with using e-cigarettes. Among never e-cigarette users, individuals involved in risky behaviors or, with lower harm perceptions for e-cigarettes, were more susceptible to future e-cigarette use.
*Conclusions:* More e-cigarette users report use of another nicotine product besides e-cigarettes as the first nicotine product used; this should be considered when examining whether e-cigarette use is related to cigarette susceptibility. Involvement in risky behaviors is related to e-cigarette use and susceptibility to e-cigarette use. Among college students, e-cigarette use is more likely to occur in those who have also used other tobacco products, marijuana, and/or alcohol.


## 1. Introduction

Since 2007, electronic cigarettes (e-cigarettes) have gained popularity in the U.S. In April 2014, the Food and Drug Administration (FDA) proposed regulations restricting e-cigarette sales to minors. One public health concern is that e-cigarettes may be a "gateway," leading e-cigarette users to begin smoking (Cobb and Abrams, 2011). E-cigarettes are often believed by users to be less harmful than cigarettes (Choi and Forster, 2013; Pearson et al., 2012). A recent review supports beliefs about reduced harmfulness, concluding "Health professionals may consider advising smokers unable or unwilling to quit through other routes to switch to e-cigarettes as a safer alternative to smoking and a possible pathway to complete cessation of nicotine use" (Hajek et al., 2014). Perceptions of e-cigarettes as less harmful than cigarettes may be associated with use of e-cigarettes. Perceived harmfulness of marijuana is strongly associated with marijuana use (Bachman et al., 1998; Bailey et al., 1992). Existing studies offer mixed results on associations between e-cigarette harm perceptions and use (Adkison et al., 2013; Choi and Forster, 2013; Sutfin et al., 2013).

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Prevalence of e-cigarette ever use is highest among young adults (Adkison et al., 2013; Pearson et al., 2012; Regan et al., 2013). Young adults are more aware and have higher rates of use than older groups (Choi and Forster, 2013; Pearson et al., 2012; Pepper et al., 2013; Sutfin et al., 2013; Trumbo and Harper, 2013). Trumbo et al. surveyed students at a Colorado university in 2011: 13.0% had ever used e-cigarettes (Trumbo and Harper, 2013). Sutfin et al. surveyed undergraduates in North Carolina colleges in 2009 (in early years of e-cigarette marketing), reporting prevalence of 4.9%; those who were smokers, male, Hispanic, "other race," or in Greek organizations (sorority/fraternity), or with lower harm perceptions of e-cigarettes were likelier to use e-cigarettes (Sutfin et al., 2013). Latimer et al. surveyed urban public universities in Texas during 2011 and reported 3.1% used e-cigarettes during the previous 30-days (Latimer et al., 2013). In 2014, e-cigarette prevalence rates among middle and high school students were 6.5% (ever use) and 2.0% (current use; Dutra and Glantz, 2014).

The present study measured prevalence and correlates of e-cigarette use among college students attending four colleges/universities in Upstate New York in 2013. Given concerns about e-cigarette use in never smokers of cigarettes, analyses explored correlates of e-cigarette use in never smokers. We examined factors that could lead young adults to try e-cigarettes. Among *never e-cigarette users*, we assessed correlates of "susceptibility" to future e-cigarette use adapting measures Pierce (Pierce et al., 1996, 2005, 1995) employed to examine 'susceptibility to cigarette smoking' which predicted never smokers who later become cigarette smokers (Pierce et al., 1996; Zhu et al., 2013).

## 2. Methods

### 2.1. Sample

Undergraduate students in selected classes (e.g., psychology/health behavior-related courses) at four colleges/universities in New York State (NYS; outside of New York City) participated in fall, 2013, providing informed consent for this IRB-approved research.

### 2.2. Survey instrument

Our 111-item, self-administered, web-based survey, used items from published studies on e-cigarettes, assessed awareness, ever and current use (i.e., within the past 30-days). Skip patterns determined items completed. We collected students' individual school identification number and school email address, to give credit for participation and to ensure surveys were completed only once. The survey assessed demographic characteristics and other health risk behaviors, such as, cigarette use, use of other nicotine and tobacco products, patterns of alcohol use, and marijuana use.

### 2.3. Procedures

A Web-based survey was used. At one college/university ($n = 875$), the survey was available through a psychology research website that was only accessible to introductory psychology students (PSY 101). At the other colleges/universities, students ($n = 137$, $n = 81$, and $n = 333$, respectively; 11 students did not provide university attendance information) accessed the survey website as directed by instructors. At the discretion of the investigator(s) at each college/university, respondents were granted either some form of course credit/research credits or entered into a lottery for a $25 grocery store gift card. To accurately represent a college population and because the legal age to provide consent is age 18 years, students younger than 18 years old and older than 23 were excluded from analyses ($n = 111$). International students were excluded from analyses ($n = 100$) due to cultural values which are distinct from U.S. college students and the variable availability of e-cigarettes elsewhere.

### 2.4. Measures

*2.4.1. Demographic characteristics.* Age was recoded as 18, 19 and 20–23 years to keep distributions similar, yet illustrate multiple age groups.

*2.4.2. Gender.* Male or female.

*2.4.3. Race/ethnicity.* Created from two separate items (Race and Ethnicity: "Are you Spanish, Hispanic or Latino?"), a 3 category variable was constructed: Non-Hispanic White/Caucasian, Non-Hispanic non-whites (all races excluding white/Caucasian), and Hispanic (regardless of race).

*2.4.4. School ability.* Assessed by: "How well do you do in school? Would you say. . .," "Much better than average," "Better than average", "Average," "Below average" or, "Don't know." "Much better than average" and "better than average" were combined and then recoded into 2 categories: "Average/below average/don't know" and "better than average".

*2.4.5. Awareness of e-cigarettes.* One item asked about awareness of e-cigarettes: "Prior to today, have you ever heard about electronic cigarettes (e-cigarettes)?" Responses included: "No, I have never read anything about them and have never been told about them;" "Yes, I read a bit about them or someone told me about them;" "Yes, I am informed on the e-cig, but I have never used it;" "Yes, and I have already used an e-cigarette." A binary variable was created (yes/no); any "yes" response indicated awareness.

*2.4.6. E-cigarette ever use.* Assessed by: "Have you ever tried or experimented with an e-cigarette, even one or two puffs?" Those who responded "yes" were classified as ever users.

*2.4.7. E-cigarette use. Current use* included use on one or more days in the previous 30 days. Respondents who ever used e-cigarettes, but not in the previous 30 days, were classified as *discontinued e-cigarette users*.

*2.4.8. Tobacco cigarette smoking status.* Based on having ever tried or experimented with tobacco cigarettes, the number of days smoked in the past 30 days, and the number of cigarettes smoked in one's lifetime, a four category variable was created: *Never smokers* (never tried a tobacco cigarette), *former smokers* (smoked $\geq 100$ cigarettes in lifetime, and have smoked 0 out of the past 30 days), *experimenters* (have ever tried a cigarette, have smoked $< 100$ cigarettes in lifetime, and have smoked 0 of the past 30 days), and *current smokers* (have smoked at least 1 day out of the past 30). For the multivariable analyses, smoking status was collapsed into three categories (never smokers, experimenters and ever [current and former smokers]), due to few former smokers in our sample ($n = 17$).

*2.4.9. Other tobacco use.* Assessed by one item: "From the following list, please check any of the tobacco products, besides cigarettes, you have used in the last 30 days:" (responses included: cigars, pipes, chewing tobacco, snuff, snus, hookah, clove cigarettes, bidis, other, or I have not used any other tobacco products). A binary variable was created (any/none).

*2.4.10. First nicotine product used.* A two-category variable was created from: Which one of the following was the first nicotine product that you used? (same responses as above 2.4.9). A three category variable was created: never used a nicotine product, first used a form of nicotine besides e-cigarettes, and first used e-cigarettes.

*2.4.11. Alcohol use.* Two items, (1) "During the past 30 days, how many days did you have at least one drink of any alcoholic beverage?" Responses were scored as binary (any/none), "Considering all types of alcoholic beverages, how many times during the past 30 days did you have 5 (for males)/4 (for females) or more drinks on an occasion?" Responses were recoded (any/none).

*2.4.12. Marijuana use.* One item, "During the last 12 months, how often did you use marijuana (cannabis, weed, pot)?" was scored as a binary variable (any/none).

*2.4.13. Perceived harm of e-cigarettes.* Respondents chose from a 5-category Likert scale, ranging from strongly agree to strongly disagree: "E-cigarettes are less harmful than tobacco cigarettes." "Strongly agree" and "agree" were combined to form the "agree" group, and "strongly disagree" and "disagree" into "disagree;" a two-category variable was then created to distinguish those who think e-cigarette use is dangerous (disagreed that e-cigarettes were less harmful than tobacco cigarettes) from those who think it is not dangerous (agreed/neutral about the harm of e-cigarettes): *disagree* versus *agree/neutral*.

*2.4.14. Susceptibility to tobacco cigarette smoking.* This measure was adapted from Pierce's susceptibility measure and was assessed in never users of cigarettes (Pierce et al., 1996, 2005, 1995). The measure combined two questions: "Do you think that you will try cigarettes soon?" and "If one of your best friends were to offer you a cigarette, would you try it?" Responses included: definitely yes, probably yes, probably not, definitely not and don't know. A binary variable was created; any response other than "definitely not" qualified respondents as *susceptible* to cigarette smoking.

*2.4.15. Susceptibility to e-cigarette use.* This employed two items similar to cigarette susceptibility, except related to e-cigarettes. A binary variable was created (susceptible/not susceptible). This susceptibility measure is used to predict future e-cigarette use among those who have never tried e-cigarettes.