



Determinants associated with E-cigarette adoption and use intention among college students



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HIGHLIGHTS

- Many e-cigarette users are dual users of tobacco cigarettes and e-cigarettes.
- Flavors and USB rechargeability increase attractiveness of e-cigarettes.
- Positive sensory experiences are positively related to e-cigarette use.
- College students may care more about their appearance than their health.

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ABSTRACT

Objective: This study investigated characteristics of potential and current e-cigarette users based on four different levels of use acceptability along with the determinants that promote e-cigarette use acceptability among college students.

Methods: College students ($N = 1198$) aged 18–25 years at a Midwestern university were surveyed in September–October 2015. Participants were categorized into four groups based on e-cigarette use acceptability adapted from the Diffusion of Innovation Theory (i.e., laggards, late majority, early majority, and adopters). Multinomial logistic regressions and Heckman two-step selection procedures were performed to examine the determinants that promote e-cigarette use acceptability.

Results: Approximately 40% of the participants reported ever using e-cigarettes. E-cigarette adopters agreed that e-cigarettes are more socially acceptable than traditional tobacco cigarettes (relative risk ratio [RRR] = 1.43, $p < 0.01$). Unique features such as flavor appeared to encourage college students' experimentation with e-cigarettes ($ps < 0.05$). Participants mentioned positive sensory experiences as a reason for e-cigarette use ($ps < 0.01$) and reported caring about their appearance more than their health ($ps < 0.05$) when asked about possible outcomes of e-cigarette use.

Conclusions: Study findings indicate a possible explosive increase in e-cigarette experimentation or use among college students. Unique features of e-cigarettes such as flavor and USB rechargeability appear to be strong factors making e-cigarettes more acceptable and appealing to young adults regardless of their smoking status. Concerted efforts should be initiated to effectively counter or eliminate attractive features that lure young adults to experiment with e-cigarettes.

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1. Introduction

An electronic cigarette or e-cigarette is a device that mimics smoking by delivering nicotine without burning tobacco (Pepper & Brewer, 2014). Without appropriate governmental regulation, e-cigarettes have been heavily promoted in the United States, resulting in widespread public awareness (King, Patel, Nguyen, & Dube, 2015). >70% of U.S. adults were estimated to be aware of e-cigarettes as of 2012

(Adkison, O'Connor, Bansal-Travers, et al., 2013) and about 14% of U.S. adults reportedly used e-cigarettes between 2012 and 2013 (Agaku et al., 2014). Because e-cigarette experimentation and use are rapidly increasing (Park, Seo, & Lin, 2016), additional research aimed at better understanding of e-cigarette use determinants is warranted.

The majority of published e-cigarette studies have focused on individuals' awareness and ever-use of e-cigarettes. Demographic factors such as gender and smoking status have been confirmed as two of the most significant factors in predicting e-cigarette use (Choi & Forster, 2013; Coleman et al., 2014; Sutfin, McCoy, Morrell, Hoepfner, & Wolfson, 2013). Other demographics (e.g., race/ethnicity) and personal habits (e.g., substance use), however, were inconsistent predictors of e-

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cigarette use (Choi & Forster, 2013; Coleman et al., 2014; Sutfin et al., 2013). Furthermore, the influence of factors such as observable effect (e.g., negative health consequences) and exposure to e-cigarette advertisement is not clearly understood. Additionally, there is a paucity of data on the impact of unique features of e-cigarettes such as flavorings and USB rechargeability.

The e-cigarette is a relatively new innovative product in the marketplace that has been adopted by consumers over just a few years. Two major concepts of Diffusion of Innovations Theory (DOI) (Rogers, 2003) can possibly be used to explain this phenomenon. First, innovations are predictably adopted within social systems over time in successive waves by consumer groupings classified as innovators, early adopters, early majority, late majority and laggards. Second, new innovations possess several identifiable attributes: relative advantage, compatibility, complexity, triability, and observability (Rogers, 2003). Relative advantage refers to the extent to which a new innovation is better than an older product; compatibility relates to consumers values, past experiences and needs; complexity has to do with ease or difficulty of understanding and using an innovation; triability focuses on ability to experiment with an innovation on a limited basis; and observability is the extent to which an innovation is visible to others.

Nationally (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2014), the use prevalence of non-conventional tobacco products is increasing among college students. Results from previous studies also show that this age group has the highest rate of ever e-cigarette use, ranging from 13% to 25% (Baeza-Loya et al., 2014; Trumbo & Harper, 2013). These upward trends both indicate that more college students are at risk of nicotine addiction. The primary purpose of this study was to investigate the characteristics of potential and current e-cigarette users based on four phases of e-cigarette use adoption (i.e., laggards, late majority, early majority, and adopters) along with three determinants that promote e-cigarette use adoption among college students (i.e., relative advantage, compatibility and observability).

2. Methods

2.1. Conceptual framework

Given that e-cigarettes were relatively recently introduced as a product in the U.S. market, this study adapted the DOI to investigate factors influencing college students' e-cigarette use acceptability. Participants were categorized into four groups based on e-cigarette use acceptability: (1) laggards (Stage 1), (2) late majority (Stage 2), (3) early majority (Stage 3), and (4) adopters (Stage 4). At the initiation of this study > 10 years had elapsed since e-cigarettes entered the U.S. market, therefore, individuals in the original DOI innovator adoption stage could not be appropriately identified and were not included.

Three constructs of DOI, relative advantage, compatibility, and observable effect (Rogers, 2003), were examined regarding their influence on e-cigarette use acceptability. Relative advantages are features of e-cigarettes that are considered better than traditional cigarettes; compatibility is the degree to which e-cigarettes fit with college students; and observable effect refers to both positive and negative effects that

college students expect to gain from e-cigarette use. The remaining two DOI constructs were not assessed because the triability and complexity of e-cigarettes for college students were considered to be well established. The upward trends in college students e-cigarette use previously specified clearly substantiate that e-cigarettes have potential for college student experimentation (i.e., good triability) and, since method of use is similar to that of traditional tobacco cigarettes, e-cigarettes require little effort for college students to prepare, light and inhale (i.e., low complexity).

In addition to the three DOI constructs, other substance use and exposure to e-cigarette advertisement were added to the analysis. Previous studies have found a possible, but inconclusive, association between e-cigarette use and other substance use (Coleman et al., 2014; Sutfin et al., 2013). Thus, this possible relationship was examined in the present study. Additionally, given that tobacco companies have spent a substantial amount of money to advertise e-cigarettes (Kim, Arnold, & Makarenko, 2014) and that previous tobacco studies have demonstrated an increased intent to use tobacco products due to greater exposure to tobacco advertisements (Cai et al., 2015; DiFranza et al., 2006; Wakefield, Flay, Nichter, & Giovino, 2003; Wellman, Sugarman, DiFranza, & Winickoff, 2006), it was hypothesized that college students' level of exposure to e-cigarette advertisement would influence their e-cigarette use acceptability.

2.2. Data collection

Data were collected in September and October 2015 from undergraduate college students aged 18 to 25 years at a Midwestern university. Instructors of undergraduate-level general education courses were first contacted via email for permission to either administer paper-and-pencil surveys in class or provide a survey link to an online version of the questionnaire. The study was granted exemption from IRB review at the authors' institution. Study participants were informed of the study's purposes and assured that their participation was voluntary and anonymous. To increase response rates, raffle prizes were offered; participants with valid responses were eligible for entry to win prizes. A total of 1198 questionnaires were completed with an 88% response rate. After data cleaning, 1185 were retained for analysis.

2.3. Outcome variables and study groups

Three dependent variables were included in this study: (1) intention to use e-cigarettes within the next 12 months, (2) ever trying e-cigarettes, and (3) current e-cigarette use. Two questions were adapted from previous studies to measure the intention to use e-cigarettes: "Do you think you will use any e-cigarettes within the next 12 months?" and "If one of your best friends were to offer you an e-cigarette, would you use it?" (Bunnell et al., 2015; Choi, Gilpin, Farkas, & Pierce, 2001; Pierce, Choi, Gilpin, Farkas, & Merritt, 1996; Wakefield et al., 2009). The response options of the 5-point Likert scale for these two questions ranged from definitely yes to definitely not. Only participants who answered definitely not to the two questions were categorized as having no intention. Participants' experience of trying e-cigarettes was

Table 1
Analytical conceptualization of stage transition that used Heckman two-step selection procedures.

Stage	Definition	Transition	Heckman two-step selection procedure
1	Laggards Those who had never tried e-cigarettes and had no intention to try in the next 12 months.	Stage 1 to Stage 2: Model 2	Heckman two-step selection procedure #1: Model 2 and Model 3
2	Late Majority Those who had never tried e-cigarettes, but intended to try e-cigarettes in the next 12 months.	Stage 2 to Stage 3: Model 3	
3	Early Majority Those who had tried e-cigarettes, but did not use e-cigarettes in the past 30 days.	Stage 3 to Stage 4: Model 4	Heckman two-step selection procedure #2: Model 3 and Model 4
4	Adopters Those who used e-cigarettes at least one day in the past 30 days.		

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