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Electronic cigarette use outcome expectancies among college students

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Abstract

Background—E-cigarette use outcome expectancies and their relationships with demographic and e-cigarette use variables are not well understood. Based on past cigarette as well as e-cigarette use research, we generated self-report items to assess e-cigarette outcome expectancies among college students. The objective was to determine different dimensions of e-cigarette use expectancies and their associations with e-cigarette use and use susceptibility.

Methods—Self-report data were collected from 307 multiethnic 4- and 2-year college students [M age=23.5 (SD = 5.5); 65% Female; 35% current cigarette smokers] in Hawaii. Data analyses were conducted by using factor and regression analyses.

Results—Exploratory factor analysis among e-cigarette ever-users indicated 7 factors: 3 positive expectancy factors (social enhancement, affect regulation, positive sensory experience) and 4 negative expectancy factors (negative health consequences, addiction concern, negative appearance, negative sensory experience). Confirmatory factor analysis among e-cigarette never-users indicated that the 7-factor model fitted reasonably well to the data. Being a current cigarette smoker was positively associated with positive expectancies and inversely with negative expectancies. Higher positive expectancies were significantly associated with greater likelihood of past-30-day e-cigarette use. Except addiction concern, higher negative expectancies were significantly associated with lower likelihood of past-30-day e-cigarette use. Among e-cigarette never-users, positive expectancy variables were significantly associated with higher intentions to use e-cigarettes in the future, adjusting for current smoker status and demographic variables.

Conclusions—E-cigarette use expectancies determined in this study appear to predict e-cigarette use and use susceptibility among young adults and thus have important implications for future research.

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Contributors

Pallav Pokhrel designed the study, conducted the statistical analyses, and led the preparation of the manuscript. Melissa Little conducted literature review and assisted with statistical analyses. Pebbles Fagan and Thaddeus Herzog helped with data interpretation and provided inputs at various stages of the manuscript preparation. Nicholas Muranaka assisted with data collection and literature review.

Conflict of interest

The authors have no conflicts of interest to report.

Keywords

Electronic cigarettes; Outcome expectancies; Young adults

1. Introduction

Electronic- or e-cigarette use is becoming increasingly popular in the U.S., especially among young adults, even though e-cigarettes are not currently regulated by the U.S. Food and Drug Administration (FDA). Approximately 8.1% of the U.S. adults are likely to have tried e-cigarettes and 1.4% are likely to be current users (Zhu et al., 2013). E-cigarette use prevalence is especially higher among adult cigarette smokers: 32% report having tried e-cigarettes and 6% report being current e-cigarette users. At present, little is known about the motivational factors related to e-cigarette use and e-cigarette use susceptibility among young adults.

Outcome expectancies concerning a behavior refer to the outcomes that are expected from engaging in the behavior. Outcome expectancies are central to the cognitive models explaining substance use behavior and are important in understanding the motivational antecedents of substance use (Abrams & Niaura, 1987; Brandon, Juliano, & Copeland, 1999). Positive or favorable outcomes associated with a behavior motivate individuals from engaging in the behavior whereas negative or unfavorable outcomes deter individuals from engaging in the behavior (Fishbein & Ajzen, 1975). Outcome expectancies have been widely studied in the context of cigarette smoking. For example, Brandon and Baker (1991) validated four types of smoking expectancy constructs: negative consequences (e.g., smoking results in heart disease and lung cancer), positive reinforcement/sensory satisfaction (e.g., smoking helps relax), negative reinforcement/negative affect reduction (e.g., cigarettes help deal with anger), and appetite/weight control (e.g., smoking helps control weight).

Cigarette smoking expectancies have been found to predict not only dependence and cessation among adult smokers (Kristjansson, Pergadia, Agrawal, et al., 2011; Wetter, Smith, Kenford, et al., 1994) but also initiation and escalation among adolescents and young adults (Heinz, Kassel, Berbaum, & Mermelstein, 2010; Wetter, Kenford, Welsch, et al., 2004). Thus far there has been no systematic research on e-cigarette use outcome expectancies. Hence, this study aimed to determine the dimensions of e-cigarette use outcome expectancies among young adult (18–40 year olds) college students and to initiate the development of a valid measurement instrument that would adequately assess such expectancies.

2. Methods

2.1. Recruitment, participants, and data collection

Participants were recruited at a 4-year college/university and two community or 2-year colleges in Oahu, Hawaii, using on-campus advertisements. Interested students were screened based on age (18–40 years) and smoking status: we intended to recruit almost

equal proportions of current cigarette smokers, never smokers, and former smokers/experimenters. Data were collected online in September–October, 2013. Of the 326 eligible students who were invited via e-mail to participate in the main study survey, 307 (94%) completed the survey. Each participant who completed the survey was e-mailed a \$15 Starbucks e-gift-card.

The mean age of the participants was 23.5 (SD=5.5) and the participants represented 65% women, 64% 4-year college students, 36% 2-year college students, 25% Asian-Americans (e.g., Japanese, Chinese, Korean), 30% Filipino, 28% White, and 17% other ethnicities. Forty-three percent of the participants reported household income of less than \$30,000/year. Thirty-five percent of the participants represented current cigarette smokers, 37% never-smokers, and 28% former smokers. Forty-three percent of the participants reported ever-using e-cigarettes and 28% had used e-cigarettes at least once in the past 30 days. E-cigarette ever-use was highest among current cigarette smokers (68.2%) than among former smokers/experimenters (47.7%) and never-smokers (18.4%).

2.2. Measures

2.2.1. Demographics—Data were collected on participants' age, gender, income, and ethnicity. To assess ethnicity, participants were asked two questions, each followed by a list of ethnic/racial categories common in the U.S. and in Hawaii (Kolonel et al., 2000): 1) “What is your ethnic/racial background? (Select all that apply)” and 2) “If you selected more than one ethnic/racial category above, select one that defines you most.” Certain racial/ethnic categories were combined to result in four broader categories: White, Asian-American (56% Japanese, 16% Chinese, 20% Korean, 8% other Asians), Filipino, and Other (75% Native Hawaiian/Pacific Islander).

2.2.2. Outcome expectancies—Participants rated 40 expectancy items on a 10-point scale. Twenty-eight of the 40 items were adapted from Hine, Honan, Marks, and Brettschneider (2007); the remaining 12 items were created based on past e-cigarette research (e.g., Etter, 2010; Etter & Bullen, 2011).

2.2.3. Cigarette smoking and e-cigarette use—Cigarette smoking was assessed in terms of self-reported lifetime cigarette use (0, <100, 100 cigarettes), past 30-day cigarette use frequency (0 days, ..., all 30 days), and current smoking status (“I don't smoke,” “I smoke sometimes,” “I smoke daily”). E-cigarette use was assessed in terms of self-reported lifetime e-cigarette use (Yes/No) and past 30-day e-cigarette use (“How many times have you used e-cigarettes in the past 30 days?” assessed on a 12-point scale).

2.2.4. E-cigarette use susceptibility—E-cigarette use susceptibility was assessed by using two measures: intentions and willingness. Intentions were measured by using a version of a widely used 4-item measure of smoking susceptibility (Pierce, Choi, Gilpin, Farkas, & Merritt, 1996) adapted for e-cigarettes. Willingness is a less direct measure of susceptibility. A measure of willingness was adapted for e-cigarettes based on previous research (Gibbons, Gerrard, Blanton, & Russell, 1998; Gibbons et al., 2004).

2.3. Data analysis

Data were analyzed by using SAS and Mplus software. Exploratory Factor Analysis (EFA) on the 40e-cigarette outcome expectancy items was conducted among e-cigarette ever-users only, using an oblique rotation method (promax). The Kaiser–Guttman rule which recommends retention of factors with eigenvalues >1 was used to extract factors. Items that showed high loadings on more than one factor (i.e., cross-loadings) and items with small loadings on all factors (i.e., low communalities) were eliminated from further analyses (Brown, 2006). Given the relatively small sample size, a standardized factor loading of 0.35 or greater was considered salient. The items retained from the EFA were tested for construct validity among e-cigarette never-users by using Confirmatory Factor Analysis (CFA). A standardized factor loading of 0.50 or greater was considered meaningful in CFA. Provided the items that loaded on the same factor were adequately internally consistent (i.e., $\alpha > 0.70$), the items were summed to create an expectancy index. Next, a series of multiple logistic and linear regression models were run to determine the associations among demographic variables, expectancies and e-cigarette use and use susceptibility. In models testing the associations of demographic variables with e-cigarette use or expectancies, all demographic variables were included simultaneously in the model. Models testing the associations of expectancies with e-cigarette use or susceptibility included demographic variables as covariates.

3. Results

3.1. Characteristics of lifetime e-cigarette users

Lifetime e-cigarette users tended to be significantly younger than non-users, $t = -2.02$, $df = 305$, $p = 0.04$. Further, e-cigarette users and non-users tended to differ significantly in ethnic composition and cigarette smoking status. Lifetime e-cigarette users represented 20% Asian, 37% Filipino, 24% White, and 19% Other; non-users represented 29% Asian, 24% Filipino, 31% White, and 16% Other. Lifetime e-cigarette users represented 16% cigarette never smokers, 30% former smokers/experimenters, and 54% current smokers; non-users represented 54% never smokers, 26% former smokers/experimenters, and 20% current smokers. No significant differences were detected between lifetime e-cigarette users and non-users in terms of gender, annual household income, and 4- vs. 2-year college status.

3.2. Exploratory factor analysis among e-cigarette ever-users

Total 8 factors were extracted. However, the 8th factor was eliminated because all items that loaded highly on the 8th factor cross-loaded on other factors. In addition, of the 40 items, 8 items were selected for elimination because they loaded highly on more than one factor. The remaining 32 items were found to represent 7 factors, which were labeled as follows: social enhancement [10 items; eigenvalue (λ) = 4.5], affect regulation (7 items; $\lambda = 3.8$), negative health consequences (4 items; $\lambda = 3.0$), addiction concern (3 items; $\lambda = 2.1$), positive sensory experience (3 items; $\lambda = 2.0$), negative appearance (2 items, $\lambda = 1.8$), and negative sensory experience (3 items; $\lambda = 1.8$).

3.3. Confirmatory factor analysis among e-cigarette never-users

Table 1 shows the results of the CFA. Based on the EFA results, 32 items were selected to be included in the CFA. All items loaded strongly on the factors they were hypothesized to indicate. Based on the following indices, the fit of the model to the data was concluded to be reasonably good (Kline, 2011): $\chi^2 = 877$, $df = 434$, RMSEA = 0.077 (90% CI = 0.070, 0.085), CFI = 0.92, and SRMR = 0.06.

3.4. Regression analyses

3.4.1. Participant characteristics as concurrent predictors of e-cigarette use and outcome expectancies

Age was inversely associated with lifetime [Odds ratio (OR) = 0.91; 95% CI = 0.86–0.96; $p < 0.001$] and recent e-cigarette use (OR = 0.88; 95% CI = 0.83–0.94; $p < 0.001$). Relative to Whites, Filipinos were significantly more likely to report lifetime (OR = 2.70, 95% CI = 1.30–5.62; $p < 0.01$) and past 30-day e-cigarette use (2.23, 95% CI = 1.03–4.82, $p < 0.01$). Relative to those who had never smoked cigarettes, current cigarette smokers were more likely to report lifetime (OR = 14.2, 95% CI = 6.98–28.7; $p < 0.001$) and past-30-day e-cigarette use (10.41, 95% CI = 4.98–21.7; $p < 0.001$). Former cigarette smokers were significantly more likely to report lifetime e-cigarette use (OR = 8.04, 95% CI = 3.85–16.8; $p < 0.001$) but not past-30-day e-cigarette use (OR = 2.23, 95% CI = 0.97–5.09; $p = 0.06$).

Significant concurrent predictors of social enhancement expectancies included female gender ($\beta = -0.22$, $p < 0.001$) and current cigarette smoker status ($\beta = 0.14$, $p < 0.05$). Significant concurrent predictors of affect regulation expectancies included age ($\beta = -0.16$, $p < 0.01$), female gender ($\beta = -0.15$, $p < 0.05$), and current ($\beta = 0.36$, $p < 0.001$) and former cigarette smoker status ($\beta = 0.15$, $p < 0.05$). Positive sensory experience expectancies were associated with age ($\beta = -0.13$, $p < 0.05$), 2-year college status ($\beta = 0.13$, $p < 0.05$), and current cigarette smoker status ($\beta = 0.39$, $p < 0.001$). Negative health outcome expectancies were associated with 2-year college status ($\beta = -0.16$, $p < 0.01$) and current cigarette smoker status ($\beta = -0.21$, $p < 0.001$). Only current cigarette smoker status was associated with addiction concern ($\beta = -0.13$, $p < 0.05$) and negative sensory experience ($\beta = -0.32$, $p < 0.001$) expectancies. Negative appearance expectancies were associated with 2-year college status ($\beta = -0.14$, $p < 0.05$) and current cigarette smoker status ($\beta = -0.22$, $p < 0.001$).

3.4.2. Outcome expectancies as concurrent predictors of e-cigarette use and e-cigarette use susceptibility

Table 2 shows the relationships between outcome expectancies and e-cigarette use and use susceptibility, after adjusting for demographic and cigarette use characteristics.

4. Discussion

The present study is one of the first studies to examine e-cigarette use outcome expectancies. We demonstrated the presence of multiple dimensions of e-cigarette outcome expectancies, both positive and negative, among young adult college students who represented cigarette current smokers, former smokers, and never-smokers. The expectancy factors extracted showed good construct validity. The factor structure elicited through EFA among lifetime e-

cigarette users fitted the data reasonably well among non-users when tested by using CFA. In addition, all expectancy factors except “addiction concern” were significantly associated with lifetime and/or recent e-cigarette use and e-cigarette use intentions and/or willingness in expected directions, adjusting for demographic variables and cigarette smoking status.

The expectancy items tested in the present study were largely adapted from the tobacco literature and some of the expectancy factors that we found paralleled the smoking expectancies reported in past smoking research, suggesting that for young adults, some of the expectancies motivating or deterring use overlap between cigarettes and e-cigarettes. Notably, four cigarette smoking expectancy factors found by Hine et al. (2007) were replicated in the current sample in regard to e-cigarettes: social enhancements, affect regulation, negative health consequences, and addiction concern. The social expectancies of e-cigarette use among youth and young adults have not been adequately studied and deserve further research.

Being a current cigarette smoker was consistently associated with higher positive expectancies and lower negative expectancies in the current sample, suggesting that young adult cigarette smokers may be more likely to view e-cigarette use as a more appropriate “smoking” option because of the possibly increasing positive social norms regarding e-cigarettes among young adults (Trumbo & Harper, 2013). Further, higher scores reported by cigarette smokers on positive sensory experience suggest that the possibility of being able to enjoy various flavors without having to deal with the smell of tobacco smoke makes e-cigarettes attractive to cigarette smokers. Future studies are needed to determine the stability of e-cigarette expectancies among cigarette smokers over time and how each type of expectancies affects the transition of a cigarette user to an e-cigarette user or affects the pattern of e-cigarette and cigarette dual use.

There are some limitations to the present study. First, the expectancy items studied in the present study were adapted from tobacco literature or created ad hoc by the authors based on previous e-cigarette research. A more systematic approach to item development would have been desirable. Second, the sample employed in this study was a convenience sample. Third, owing to the preliminary nature of this study the size of the current sample was relatively small. Because of the small sample size, we may have failed to detect potentially significant small-size effects. However, despite the limitations, this study is significant for determining and validating constructs of e-cigarette use outcome expectancies among young adults. The expectancy constructs developed herein may be used in future social-cognitive research concerning e-cigarette use.

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References

- Abrams, DB.; Niaura, RS. Social learning theory. In: Blane, HT.; Leonard, KE., editors. Psychological theories of drinking and alcoholism. New York: Guilford Press; 1987. p. 181-226.
- Brandon TH, Baker TB. The Smoking Consequences Questionnaire: The subjective expected utility of smoking in college students. *Psychological Assessment*. 1991; 3:484–491.
- Brandon, T.; Juliano, L.; Copeland, A. Expectancies for tobacco smoking. In: Kirsh, I., editor. How expectancies shape experience. Washington, DC: American Psychological Association; 1999. p. 263-299.
- Brown, TA. Confirmatory factor analysis for applied research. New York, NY: The Guildford Press; 2006.
- Etter J-F. Electronic cigarettes: A survey of users. *BMC Public Health*. 2010; 10:231. Retrieved from <http://www.biomedcentral.com/1471-2458/10/231>. [PubMed: 20441579]
- Etter J-F, Bullen C. Electronic cigarette: Users profile, utilization, satisfaction and perceived efficacy. *Addiction*. 2011; 106:2017–2028. [PubMed: 21592253]
- Fishbein, M.; Ajzen, I. Belief, attitude, intention, and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley; 1975.
- Gibbons FX, Gerrard M, Blanton H, Russell DW. Reasoned action and social reaction: Willingness and intention as independent predictors of health risk. *Journal of Personality and Social Psychology*. 1998; 74:1164–1180. [PubMed: 9599437]
- Gibbons FX, Gerrard M, Lune LSV, Wills TA, Brody G, Conger RD. Context and cognitions: Environmental risk, social influence, and adolescent substance use. *Personality and Social Psychology Bulletin*. 2004; 30:1048–1061. [PubMed: 15257788]
- Heinz AJ, Kassel JD, Berbaum M, Mermelstein R. Adolescents' expectancies for smoking to regulate affect predict smoking behavior and nicotine dependence over time. *Drug and Alcohol Dependence*. 2010; 111:128–135. [PubMed: 20547013]
- Hine DW, Honan CA, Marks ADG, Brettschneider K. Development and validation of the smoking expectancy scale for adolescents. *Psychological Assessment*. 2007; 19:347–355. [PubMed: 17845126]
- Kline, R. Principles and practice of structural equation modeling. New York, NY: Guilford Press; 2011.
- Kolonel LN, Henderson BE, Hankin JH, Nomura AMY, Wilkens LR, Pike MC, et al. A multiethnic cohort in Hawaii and Los Angeles: Baseline characteristics. *American Journal of Epidemiology*. 2000; 151:346–357. [PubMed: 10695593]
- Kristjansson SD, Pergadia ML, Agrawal A, Lessov-Schlaggar CN, McCarthy DM, Piasecki TM, et al. Smoking outcome expectancies in young adult female smokers: Individual differences and associations with nicotine dependence in a genetically informative sample. *Drug and Alcohol Dependence*. 2011; 116:37–44. [PubMed: 21194853]
- Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Merritt RK. Validation of susceptibility as a predictor of which adolescents take up smoking in the U.S. *Health Psychology*. 1996; 15:355–361. [PubMed: 8891714]
- Trumbo CW, Harper R. Use and perception of electronic cigarettes among college students. *Journal of American College Health*. 2013; 61:149–155. [PubMed: 25158012]
- Wetter DW, Kenford SL, Welsch SK, Smith SS, Fiore MC, Baker TB. Prevalence and predictors of transitions in smoking behavior among college students. *Health Psychology*. 2004; 23:168–177. [PubMed: 15008662]
- Wetter DW, Smith S, Kenford S, Jorenby DE, Fiore MC, Hurt RD, Offord KP. Smoking outcome expectancies: Factor structure, predictive validity, and discriminant validity. *Journal of Abnormal Psychology*. 1994; 103:801–811. [PubMed: 7822583]
- Zhu S-H, Gmst A, Lee M, Cummins S, Yin L, Zoref L. The use and perception of electronic cigarettes and snus among the U.S. population. *PLoS ONE*. 2013; 8:e79332. [PubMed: 24250756]

HIGHLIGHTS

- Little is known about e-cigarette use outcome expectancies.
- Multiple e-cigarette use expectancy dimensions were identified among young adults.
- Expectancies were associated with e-cigarette use and use susceptibility.

Table 1

Results of confirmatory factor analysis (CFA) of expectancy items among lifetime e-cigarette non-users (n = 172).

Factors	Expectancy items	Standardized factor loadings	Cronbach's α
Social enhancement			0.94
	Gain respect of friends	0.69 ***	
	Increase chances of being liked by friends	0.75 ***	
	Increase chances of being liked by opposite sex	0.79 ***	
	Make life less dull	0.62 ***	
	Look sophisticated	0.79 ***	
	Become more popular	0.68 ***	
	Look more attractive	0.92 ***	
	Belong to an exclusive group	0.67 ***	
	Fit in better with friends	0.87 ***	
	Increase status	0.88 ***	
Affect regulation			0.94
	Feel calm	0.85 ***	
	Feel good	0.83 ***	
	Control or reduce anger	0.84 ***	
	Feel less weary	0.74 ***	
	Feel less stressed	0.88 ***	
	Feel less bored	0.75 ***	
	Feel relaxed	0.90 ***	
Positive sensory experience			0.91
	Smell good	0.89 ***	
	Feel good taste	0.87 ***	
	Have good breath	0.87 ***	
Negative health consequences			0.94
	Damage health	0.90 ***	
	Hurt lungs	0.92 ***	
	Die prematurely	0.88 ***	
	Get lung cancer	0.87 ***	
Negative appearance			0.77
	Look awkward	0.69 ***	
	Look unpleasant	0.84 ***	
Addiction concern			0.87

Factors	Expectancy items	Standardized factor loadings	Cronbach's α
	Feel controlled by e-cigarettes	0.78 ^{***}	
	Make it harder to quit e-cigarettes	0.82 ^{***}	
	Become addicted to e-cigarettes	0.88 ^{***}	
	Negative sensory experience		0.93
	Smell bad	0.88 ^{***}	
	Feel bad taste	0.90 ^{***}	
	Have bad breath	0.93 ^{***}	

Note.

* $p < 0.05$,

** $p < 0.01$;

*** $p < 0.001$.

Table 2

Expectancy variables as predictors of lifetime and past 30-day e-cigarette use ($N = 307$) and intentions and willingness to use e-cigarettes in the future ($N = 172$).

	Odds ratio (95% Confidence interval)		Standardized regression coefficients (β)	
	Lifetime e-cigarette use	Past 30-day cigarette use	Intentions to use e-cigarettes	Willingness to use e-cigarettes
Social enhancement	1.01 (0.99, 1.03)	1.02 (1.01–1.04) **	0.19 **	0.10
Affect regulation	1.02 (1.01, 1.05) **	1.05 (1.03, 1.07) ***	0.24 ***	0.18 *
Positive sensory experience	1.07 (1.03, 1.12) ***	1.09 (1.04, 1.13) ***	0.20 **	0.10
Negative health outcomes	0.97 (0.95, 0.99) *	0.96 (0.93, 0.99) **	–0.10	–0.20 **
Addiction concern	0.99 (0.96, 1.03)	0.99 (0.95, 1.03)	0.07	–0.10
Negative appearance	0.89 (0.85, 0.94) ***	0.92 (0.87, 0.97) **	–0.13 *	–0.19 **
Negative sensory experience	0.93 (0.90, 0.97) ***	0.95 (0.92, 0.99) **	–0.11	0.10

Note. $p < 0.10$;

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$.

Analyses involving intentions and willingness outcomes included only those individuals who had never used e-cigarettes ($n = 172$). All regression models included age, sex, income, college status (i.e., 4- or 2-year), ethnicity, and smoker and ex-smoker status as covariates.