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Dual Users of E-Cigarettes and Cigarettes Have Greater Positive Smoking Expectancies than Regular Smokers: A Study of Smoking Expectancies among College Students

MacKenzie R. Peltier, PhD[1], **Aaron F. Waters, MA**[2], **Melanie R. Roys, MS**[2], **Shelby A. Stewart, BS**[2], **Krystal M. Waldo, PhD**[2], **Amy L. Copeland, PhD, MP**[*,2]

[1]Department of Psychiatry, Yale School of Medicine, New Haven, CT 06519

[2]Department of Psychology, Louisiana State University, Baton Rouge, LA 70802

Abstract

Objective: In the present study, we sought to determine the differences among college students using e-cigarettes, cigarettes, or both products (dual users) on smoking outcome expectancies and the role of smoking expectancies and e-cigarette use in cessation attempts.

Participants: We surveyed 1,370 undergraduate college students from November 2014 - November 2016.

Methods: Participants completed questionnaires regarding demographics, smoking status/history and expectancies.

Results: Dual users reported significantly longer smoking histories and more past quit attempts than other smoking groups. Those reporting dual use reported higher expectancies on positive/negative reinforcement and appetite/weight control subscales of the SCQ. E-cigarette use was a negative predictor of cessation attempts.

Conclusions: College students appear to be less motivated to use e-cigarettes for cessation and dual users endorsed higher levels of smoking expectancies previously shown to negatively impact treatment outcomes. Students, especially dual users, need targeted interventions to address the dangers of using tobacco products.

Keywords

e-cigarettes; college students; dual users; smoking expectancies

INTRODUCTION

Cigarette smoking is the most preventable cause of morbidity and mortality and more than 480,000 people die annually from smoking-related illness.[1,2] Given the high rates of smoking-related deaths, electronic cigarettes (e-cigarettes) have been promoted as an aid

[*]Correspondence to: Amy L. Copeland, PhD, 236 Audubon Hall, Department of Psychology, Louisiana State University; Fax: 225.578.4125; copelan@lsu.edu.

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to smoking cessation, and research demonstrates that many adults who endorse e-cigarette use are utilizing the devices to quit smoking.[3] Approximately 70% of smokers want to quit using tobacco products, and e-cigarette use has become a popular approach to smoking cessation. Cessation methods are certainly needed for smokers, with recent epidemiological data demonstrating an increase in prevalence of traditional tobacco product use, especially among young adults.[4,5]

Although e-cigarettes have been shown to reduce craving and nicotine withdrawal symptoms, the efficacy, safety, and long-term health consequences have not been established, and their utility as a long-term aid to smoking cessation has yet to be determined.[6] There is currently mixed evidence (see[7,8]) that e-cigarettes may be an effective cessation tool for short-term abstinence; however, recent longitudinal evidence suggests that e-cigarette use by smokers was not associated with reduction or cessation rates in regular smoking one year later.[9] This is disappointing given that 85% of adult e-cigarette users report explicitly using e-cigarettes to quit smoking.[10]

These patterns of e-cigarette use are especially problematic as young adults, including college students, are more likely to report e-cigarette use than other age groups.[5,11] Recent research indicates that 45% of undergraduate students (ages 18–25) endorsed using an e-cigarette at least once within their lifetime, and 12% of these students reported use within the past month.[12] Similarly, the 2013–2014 National Adult Tobacco Survey, a large national study of tobacco prevalence, stated that 35.8% of young adults (18–24 years old) reported ever use of e-cigarettes, and 13.6% of these individuals endorsed current e-cigarette use; with similar prevalence reported among those young adults with some college education.[11]

Among college students endorsing traditional cigarette use, past research has identified a role for smoking outcome expectancies and cigarette use patterns. Outcome expectancies are a construct defined as the anticipated rewarding and punishing consequences of smoking a cigarette. Past research has found strong associations between cigarette use and positive/negative reinforcement outcome expectancies as well as an inverse relationship between cigarette use and negative consequence expectancies.[13] Similar trends regarding e-cigarette usage and positive, as well as negative, expectancies have also begun to be identified among college students.[14] Reasons for such expectancies may be attributable to the recent increase in the positive social acceptability of e-cigarettes, the perceived advantages and consequences of use, or the ability to experience diverse positive sensory experiences from a variety of e-liquids.[14–16] There is evidence that college students perceive e-cigarettes to be less harmful and overall helpful in aiding in cessation attempts, despite not using them to stop smoking.[17,18]

Overall, youths and college students tended to view e-cigarette use as less harmful and less addictive than traditional cigarettes.[17] In fact, one study reported that nearly 45% of young adults who ever used an e-cigarette viewed they were less harmful than traditional cigarettes.[18] While many young adults may believe e-cigarettes are less harmful, a surprisingly small percentage can actually name the different ingredients within e-liquids or the constituents that make up different flavorants.[19] However, when separating young adults based upon experience with e-cigarettes [e.g., dual users (e-cigarettes and cigarettes), e-

cigarettes only, cigarettes only], no significant differences in perceived risk of e-cigarette use among these groups is observed, or they report being unsure of the harm of e-cigarettes.[19,20] The lack of understanding of the negative health consequences is concerning given that e-cigarettes pose similar risks as regular cigarettes for nicotine addiction and long term harm to respiratory health and brain development.[21] Indeed, there is evidence showing that the additives in e-cigarettes themselves have harmful effects. These additives include benzene, diacetyl, and metals such as nickel, tin, and lead. In addition, the smoker and others close by are exposed to the aerosol they inhale from e-cigarettes which can contain harmful chemicals.[21]

College students use e-cigarettes at a disproportionately higher rate compared to other age groups and may subsequently suffer the worst potential long-term health consequences as a result. Recent research has supported the potential for overlap in outcome expectancies between e-cigarettes and cigarettes. However, more research is needed to further understand differences in expectancies between college student e-cigarette, cigarette, and dual users in order to develop tailored interventions to reduce usage among this population. The goals of the current study were to determine how college student e-cigarette users compared with cigarette smokers on smoking outcome expectancies and to identify the role smoking expectancies and e-cigarette use play in smoking cessation attempts in college student smokers.

METHODS

Participants

Undergraduate students at a large southern university (N = 1,370) were recruited through the Department of Psychology undergraduate research participant pool and received extra credit in their courses for participation in the study. Inclusion criteria were being at least 18 years of age and a current undergraduate student enrolled at the university for the semester. We included both smokers and nonsmokers in the study. All participants who initiated the online survey proceeded to consent to the study and proceed with responding to the questions

Procedures

The current study was approved by the university's Institutional Review Board (IRB) prior to data collection. Participants were recruited from the Department of Psychology's research participant pool and granted course credit for participation. Participants who met inclusion criteria provided informed consent online, as approved by the university's IRB and completed a series of measures via a secure online survey engine. The measures included a demographic questionnaire, a smoking status and history questionnaire, and the Smoking Consequences Questionnaire (SCQ; Brandon & Baker, 1991) to assess smoking outcome expectancies.

Measures

Demographic questionnaire.—This questionnaire includes questions regarding participant demographics, age, gender, ethnicity, education and marital status.

Smoking Status Questionnaire (SSQ).—This form includes questions assessing smoking-related variables, such as current and past smoking patterns, previous smoking cessation attempts, and concerns about post-cessation related weight gain. It included the Fagerström Test for Nicotine Dependence (FTND) to assess nicotine dependence level.[22] The SSQ also inquired about whether participants were currently attempting to quit smoking (yes/no), whether they had made previous serious attempts (at least 24 hours) in the past (yes/no), number of previous cessation attempts, and types of cessation methods tried (e.g., nicotine replacement therapies, social support). This form also included the following question to be answered with a scale from 1 (being the lowest) to 10 (being the highest): "*How much do you want to quit smoking*?" Questions regarding e-cigarette use were included as well [i.e., "*Do you currently use e-cigarettes*?" (yes/no) and "*Do you currently use e-cigarettes daily*?" (yes/no)].

Smoking status group was determined via information collected in the SSQ, such that e-cigarette users were defined as currently using e-cigarettes on a daily or nondaily basis but no current use of traditional cigarettes, and cigarette smokers were defined as individuals who reported current use of traditional cigarettes on a daily, weekly, monthly, or yearly basis, but no use of e-cigarettes. Dual users were defined as individuals who endorsed both current use of e-cigarettes and use of traditional cigarettes.

Smoking Consequences Questionnaire (SCQ).[13]—The SCQ has 51 items that assess tobacco outcome expectancies. It was developed by Brandon and Baker (1991) using college student nonsmokers, triers, ex-smokers, occasional, and daily smokers. Principal components analysis yielded 4 factors: Negative Consequences, Positive Reinforcement-Sensory Satisfaction, Negative Reinforcement-Negative Affect Reduction, and Appetite-Weight Control. Coefficient alpha reliabilities averaged .94. In previous studies, the SCQ scales have been related to smoking status (nonsmoking, ex-smoking, occasional smoking, and daily smoking) and nicotine dependence,[13,23] providing evidence of construct validity. They have predicted smoking cessation treatment outcome in various tests of validity.[24,25] Scale scores are obtained by calculating the mean response to the items on each respective scale.

Data Analysis

In order to determine whether smoking status groups differed in demographics and smoking-related variables, one-way analyses of variance (ANOVAs) with the four smoking status groups as factors were conducted with the continuous demographic variables as dependent variables, and chi-square analyses were conducted with categorical and dichotomous variables. Additionally, ANOVAs were conducted with smoking status group as the factor and the four SCQ scales as dependent variables.

Hierarchical logistic regression analyses were conducted to examine whether e-cigarette use, and smoking expectancies predicted past or current smoking quit attempts. Past or current quit attempt (yes/no) was the dependent variable in respective analyses and e-cigarette use and the SCQ scales were predictors. The demographic variables on which the groups

differed (gender and race) were entered on the first step, e-cigarette use was entered on the second step, and the four SCQ scales were entered on the third step.

RESULTS

Participants were divided into smoking status groups depending on their cigarette smoking and e-cig use patterns: nonsmokers (n=816), e-cigarette users (n=319), cigarette smokers (n=48), and dual users (cigarette/e-cigarette users; n=187).

Participant Characteristics by Smoking Status Group

Participants were primarily Caucasian (78.8%) and female (77.8%). There were significant differences across groups on race, $X^2(6) = 28.18$, $p < 0.001$, and gender, $X^2(3) = 51.54$, $p < 0.001$. There were no differences across groups in age, $F(3, 1368) = 2.28$, $p = .078$. Among those participants who endorsed current use of e-cigarettes (n=506), the large majority (86.4%) endorsed using e-cigarettes on a nondaily basis. Among those who endorsed smoking traditional cigarettes (n = 235), 102 reported smoking daily, smoking approximately 6.47 (SD =5.0) cigarettes per day. The daily smokers endorsed low levels of nicotine dependence (FTND score, M=1.98, SD=2.19) and they smoked for an average of 3.15 (SD=3.04) years. Daily smokers in the dual user group did not differ significantly from daily smokers in the regular smoker group on FTND score, $F(1, 101) = .03$, $p = .864$. Smokers in the dual user group had been smoking significantly longer [$F(1, 234) = 5.47$, $p = 0.02$] and reported smoking a greater number of cigarettes per week as compared to regular smokers [$F(1, 234) = 4.83$, $p = 0.03$]. Smokers in the dual user group were significantly more likely to have made a past quit attempt [$X^2(1) = 7.86$, $p = 0.01$] and had made a greater number of quit attempts as compared to regular smokers, $F(2, 552) = 4.57$, $p = 0.01$]. Dual users and smokers did not differ significantly on whether they were making a current attempt to quit smoking, $X^2(1) = 2.59$, $p = .075$. There was no difference across the smoking groups on desire to quit smoking, $F(2, 553) = 2.16$, $p = .117$. See Table 1 for means and standard deviations for each smoking status group and for between group differences.

SCQ Scale Scores by Smoking Status Group

There was a significant main effect for the Positive Reinforcement SCQ scale [$F(3, 1370) = 111.26$), $p < .001$], the Negative Reinforcement SCQ scale [$F(3,1368) = 70.01$, $p < .001$], and the Appetite/Weight Control SCQ scale [$F(3, 1368) = 20.71$, $p < .001$], such that dual users consistently reported the highest scores, followed by regular smokers, followed by e-cigarette users, followed by nonsmokers. The main effect for Negative Consequences approached significance [$F(3, 1368) = 2.24$, $p = .08$], with dual users reporting the highest scores. See Table 1 for complete results.

E-Cigarette Use and Smoking Expectancies Predict Cessation Attempts

Regarding e-cigarette use predicting a past cessation attempt, the overall model was significant, $X^2(8) = 32.88$, $p < .001$. Step 1 was not significant, $X^2(3) = 2.18$, ns. Step 2 was significant, $X^2(1) = 5.68$, $p = .017$, with e-cigarette use as a significant negative predictor of a quit attempt, $\beta = -1.09$, $p = .024$. Step 3 was also significant, $X^2(4) = 25.03$, $p < .001$, with Negative Reinforcement expectancies as a significant predictor, $\beta = .24$, $p =$

.043, and Negative Consequences expectancies approaching significance as a predictor, β = .23, p = .084. See Table 2 for specific coefficients and significance level for each predictor variable.

Regarding smoking expectancies predicting a current quit attempt, the overall model approached significance, $X^2(8) = 14.09$, $p = .08$. Step 1 was not significant [$X^2(3) = .79$, *ns*], nor was Step 2, $X^2(1) = 1.91$, *ns*. Step 3 was significant, $X^2(4) = 11.40$, $p = .022$, with Negative Consequences expectancies as a significant predictor of a current quit attempt, β = .39, p = .016. See Table 3 for specific coefficients and significance level for each predictor variable.

COMMENT

In the present study, we sought to explore how college students using e-cigarettes compared to those smoking traditional cigarettes on measures of smoking outcome expectancies and to identify the role of smoking expectances and e-cigarette use in quit attempts in this population. Overall, dual users, who had significantly longer smoking histories (e.g., cigarettes/week; years smoked), were more likely to have made a past quit attempt and more likely to have made more quit attempts than those using only traditional cigarettes or e-cigarettes alone. Dual users also endorsed higher scores on smoking expectancies related to positive/negative reinforcement, and appetite and weight control when compared to other smoking groups. Examples of positive reinforcement expectancies included social facilitation and taste, and specific negative reinforcement expectancies included those related to mood management, such as anxiety and boredom reduction. These results provide valuable insight onto the e-cigarettes use patterns of college students and the potential dangers of those students using both traditional and e-cigarettes.

Despite previous literature showing that e-cigarette use is associated with planning to quit among current adolescent smokers,[26] the present results demonstrated that college students were not using e-cigarettes to quit smoking, as e-cigarette use was a negative predictor of past quit attempts. Given the alarming rates of e-cigarette use among this population, the potential recreational use of these devices is problematic. Preliminary research demonstrates that e-cigarette use is associated with an increased likelihood of cigarette smoking, as a recent meta-analysis found greater risk of both smoking initiation and past 30-day smoking among young adults and adolescents using e-cigarettes.[27] However, evidence regarding the potential dangers of subsequent traditional cigarette use among young adults using e-cigarette use is mixed as clinical research continues.[28] There is also emerging evidence that use of e-cigarettes among young adult smokers was associated with a reduction in cigarettes smoked and increased cessation, despite low levels of motivation to quit.[26,29] Thus, additional research is needed to clarify and elucidate the utility of e-cigarettes in cessation for this population.

It should be noted that in the present study, endorsement of negative consequences (e.g., health risks) related to smoking were similar across smoking groups and predictive of the current smoking quit attempt. Thus, it appears that there is an association between the health risks of smoking and cessation among college students, and this association has been

previously been shown to predict motivation for cessation and cessation success.[24] However, given the reports of positive perceptions of e-cigarettes among college students and their association with reduced harm in comparison with traditional tobacco products, it is unclear how e-cigarette use may affect cessation attempts, especially since evidence suggests that e-cigarettes may be effective for short-term smoking abstinence, but not sustained cessation.[6,7] Future research, including longitudinal studies, are needed to determine how perceptions of e-cigarettes impact cessation among college students.

The present study also provides evidence that college students concurrently using both e-cigarettes and traditional cigarettes represent a group of student tobacco users that need to be targeted with public health interventions. Dual users in the present study endorsed more significant smoking histories and higher smoking expectancies related to positive/negative reinforcement and appetite/weight control than any other smoking group. Previous research has established that positive expectancies, as well as perceived negative affect reduction related to smoking are associated with increased withdrawal severity and relapse.[24,25] Given the connection between smoking expectancies and poor treatment outcomes, as well as the potential synergistic harm associated with dual use, it seems imperative to tailor interventions to educate this population concurrently using e-cigarettes and traditional cigarettes. Additionally, given that more students overall are endorsing e-cigarette use and perceiving such products to be less harmful and addictive, despite not knowing the potential harms of use, it appears that educational interventions are needed across young adult populations.[17–20] Patient education efforts should emphasize that use of both e-cigarettes and traditional cigarettes is potentially a worst case scenario for users because they are exposed to both sets of carcinogens, as well as any unknown synergistic effects. Such efforts should also advise students who want to quit smoking to focus on alternate available nicotine replacement therapies (e.g., gum, inhaler), pharmacological aids (e.g., Chantix), and behavior modification strategies.

Limitations

While the present study provides important information regarding the use of e-cigarettes among college students, several limitations warrant mention. First, the study included a college sample of convenience comprised of mostly white female students from the Southeastern U.S., who endorsed low levels of nicotine dependence. Thus, the present results may not be generalizable to other U.S. regions or student populations. Furthermore, this study utilized survey-based data, which has some potential for bias; no biological confirmation was collected to verify smoking status. In addition, some participant responses may reflect a social desirability bias, given the negative social stigma often association with tobacco use. Finally, information was not collected regarding the type of e-cigarette used or if students were modifying/manipulating the electronic devices. Future research should design studies to incorporate such variables and collect data to biological confirm smoking statuses to provide further information regarding how college students are using e-cigarettes and their potential role in quit attempts among this population.

Conclusions

College students underestimate the health-related consequences of tobacco problems, with dual users underestimating the harm associated with traditional cigarette use;[30] this may be compounded among college students who also perceive fewer health risks related to e-cigarette use than traditional cigarette use.[18–20,30,31] The present study identified that dual users endorsed significantly longer smoking histories and endorsed higher scores on smoking expectancies related to positive/negative reinforcement, and appetite and weight control when compared to other smoking groups. Overall, e-cigarette use was not predictive of cessation behavior among college students. This finding is problematic and provides further evidence that these young adults may be less likely to use these products to quit smoking and indicates that they do not recognize the harm of use of e-cigarettes. Thus, it is important to develop interventions to educate young adults on the potential dangers of e-cigarette use.

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Table 1.

Participant Characteristics by Smoking Status Group.

	Overall (*N* = 1370)	Nonsmokers (*n* = 816)	E-cig users (*n* = 319)	Cigarette smokers (*n* = 48)	Dual users (*n* = 187)	P-value
Race, N (%)						
Caucasian	1079 (78.8%)	608 (74.5%)	265 (83.0%)	41 (85.4%)	165 (88.2%)	<0.001
African American	182 (13.3%)	138 (16.9%)$_{ab}$	31 (9.7%)$_{ac}$	4 (8.3%)	9 (4.8%)$_{bc}$	
Gender, N (% female)	1066 (78%)	684 (83.8%)$_{ab}$	226 (70.8%)$_{ac}$	39 (81.3%)$_{d}$	117 (62.6%)$_{bcd}$	<0.001
Age						
Mean (*SD*)	20.11 (*2.21*)	20.14 (*2.31*)	19.87 (*2.03*) $_{a}$	20.23 (*1.84*)	20.38 (*2.13*)$_{a}$	0.078
Cigarettes per week						
Mean (*SD*)	11.74 (*23.35*)	--	--	4.42 (*7.91*)$_{a}$	13.70 (*25.64*)$_{a}$	0.029
Years smoked						
Mean (*SD*)	0.97 (*1.99*)	--	--	0.37 (*1.04*)$_{a}$	1.13 (*2.15*)$_{a}$	0.02
FTND						
Mean (*SD*)	1.98 (*2.19*)	--	--	1.83 (*1.72*)	2.0 (*2.27*)	.864
Past Quit Attempt, N (%)						
Yes	628 (45.8%)	--	--	13 (27.7%)$_{a}$	95 (50.6%)$_{a}$	0.005
No						
Number of Quit Attempts						
Mean (*SD*)	1.65 (*5.90*)	--	0.89 (*2.52*)	0.51 (*1.10*)$_{b}$	2.64 (*8.25*)$_{ab}$	0.011
Desire to Quit						
Mean (*SD*)	5.79 (*3.35*)	--	6.10 (*3.90*)	4.91 (*2.96*)	5.77 (*2.92*)	.117
Current Quit Attempt, N (%)						
Yes	326 (23.8%)	--	--	7 (14.9%)$_{a}$	49 (26.1%)$_{a}$	.075
No						
SCQ, Mean (*SD*)						
Negative consequences	5.65 (*2.78*)	5.50 (*3.08*)$_{a}$	5.83 (*2.67*)	5.13 (*1.71*)	6.05 (*1.69*)$_{a}$	0.082
Positive reinforcement	2.06 (*2.29*)	1.37 (*1.98*)$_{abc}$	2.0 (*2.18*)$_{ade}$	3.69 (*1.50*)$_{bdf}$	4.42 (*1.95*)$_{cef}$	<.001
Negative reinforcement	2.46 (*2.73*)	1.80 (*2.46*)$_{abc}$	2.32 (*2.57*)$_{ade}$	4.10 (*2.39*)$_{bdf}$	4.74 (*2.64*)$_{cef}$	<.001
Weight control	2.19 (*2.45*)	1.80 (*2.42*)$_{abc}$	2.23 (*2.32*)$_{ade}$	3.14 (*2.01*)$_{bd}$	3.29 (*2.49*)$_{ce}$	<.001

Note. SD= standard deviation; FTND= Fagerström Test for Nicotine Dependence; SCQ= Smoking Consequences Questionnaire

Table 2.

E-Cigarette Use and Smoking Expectancies Predict Past Quit Attempt

	Step 1	Step 2	Step 3
Gender	.077	.236	−.063
Race	−.943	−.902	−.445
E-cigarette Use		−1.086 *	−.777
Negative Consequences			.233
Positive Reinforcement			.006
Negative Reinforcement			.242 *
Weight Control			.038

Note.

* $p < .05$

$N = 235$.

Table 3.

E-Cigarette Use and Smoking Expectancies Predict Current Quit Attempt

	Step 1	Step 2	Step 3
Gender	−.172	−.081	−.418
Race	.671	.689	.914
E-cigarette Use		−.756	−.296
Negative Consequences			.388 *
Positive Reinforcement			.017
Negative Reinforcement			−.076
Weight Control			.159

Note.

* $p < .05$

$N = 235$.