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Expectancies for and Use of E-Cigarettes and Hookah among Young Adult Non-Daily Smokers

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Abstract

Introduction—Understanding predictors of e-cigarette and hookah use among young adults is important in light of their increasing prevalence, particularly in younger populations. The purpose of this study was to test the hypothesis that young adult non-daily cigarette smokers' use of e-cigarettes and hookah would be positively associated with their expectancies about these products.

Methods—Young adults (n = 377, 58.0% male) aged 18–24 years (M = 20.5, SD = 1.8) who had been non-daily smokers for at least six months but had never been daily smokers completed a baseline assessment online or via mobile phone as part of a larger, longitudinal study.

Results—Approximately one in three participants reported any e-cigarette (34.0%) and/or hookah (33.4%) use in the past 14 days; 37% of those who used either product reported using both. More positive e-cigarette expectancies were associated with higher odds of any e-cigarette use and with heavier use in the past two weeks. Similarly, more positive expectancies for hookah use predicted greater odds of any use as well as more frequent use of hookah (all *p*s < .001). Cigarette expectancies were correlated with ANTP expectancies, but did not account for the latter's association with ANTP use.

Conclusions—Findings suggest that expectancies play a role in determining whether young adult cigarette smokers also use these nicotine products. These data also suggest use of e-cigarettes and/or hookah may be as common as not among young adult nondaily smokers.

Keywords

tobacco; e-cigarettes; hookah; expectancies; young adult

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Contributors

Neal Doran designed the study, conducted statistical analyses, and led the preparation of the manuscript. Kristin Brikmanis conducted literature review and assisted with statistical analysis and manuscript preparation.

Conflicts of interest

The authors have no conflicts of interest to report.

Young adult polytobacco use is a growing public health concern. Polytobacco use is the concurrent use of cigarettes and at least one alternative nicotine and tobacco product (ANTP). ANTPs include cigars and smokeless tobacco as well as newer products like electronic nicotine delivery systems (ENDS or "e-cigarettes") and hookah. ANTP use has doubled over the past 15 years, yet these products remain largely unregulated (Centers for Disease Control and Prevention, 2012), and for some (i.e., e-cigarettes and hookah) relatively little is known about short- or long-term consequences of use. ANTPs are marketed to young adults through advertisements and appealing flavor options (Alpert, Koh, & Connolly, 2008; Martinasek, McDermott, & Martini, 2011). Unsurprisingly, polytobacco use is most common among those aged 24 and under (Renaud, Nonemaker, Kim, & Busey, 2010). Nearly half of cigarette smokers in this age group also use ANTPs (Nasim, Blank, Cobb, & Eissenberg, 2012).

The increased prevalence of polytobacco use among young adults is troubling for several reasons. First, polytobacco use may heighten tobacco-associated health risks via increased exposure to carcinogens and other harmful constituents (Centers for Disease Control and Prevention, 2010; Chao et al., 2002; Ferrence & Stephens, 2000). Another concern is that greater nicotine exposure through polytobacco use will increase nicotine dependence and subsequently cigarette consumption. We recently reported that young adult cigarette smokers who had used hookah in the past month reported increased cigarette consumption six months later, whereas non-users of hookah reported no change (Doran, Godfrey, & Myers, 2015). Polytobacco use has also been associated with higher nicotine dependence, even among nondaily smokers (Timberlake, 2005, 2009), and greater difficulty quitting cigarettes (Thomas et al., 2015; Wetter et al., 2002). Overall, polytobacco use may increase nicotine intake, accelerating progression toward dependence and chronic, daily tobacco use. The effect of polytobacco use on cigarette progression may be particularly damaging to this age group given that young adulthood is a formative period for development of habits that impact long-term health (Chassin, Presson, Rose, & Sherman, 1996; Nelson Laska, Pasch, Lust, Story, & Ehlinger, 2009). These potential consequences highlight the need for improved understanding of polytobacco use among young adults.

The present study focused on predictors of use of the two ANTPs that are most prevalent among young adults: e-cigarettes and hookah. A few previous studies have examined e-cigarette and hookah use among young smokers. Use of these products has been associated with male sex, younger age, Caucasian ethnicity, and college enrollment (Doran & Trim, 2015; Lee, Bahreinifar, & Ling, 2014; Ramo, Young-Wolff, & Prochaska, 2015). Additionally, e-cigarette and hookah use have been associated with behavioral and temperamental factors including alcohol and drug consumption, cigarette frequency, and impulsivity (Doran, et al., 2015; Doran & Trim, 2015; Sterling & Mermelstein, 2011).

To date there has been little research on cognitive factors that may predict ANTP use. Cognitive processes such as outcome expectancies have been consistently associated with use of multiple substances, including tobacco (Doran et al., 2013; Heinz, de Wit, Lilje, & Kassel, 2013). Expectancies are beliefs about the consequences of substance use that reflect experience with and observation about the consequences of specific behaviors (Bolles, 1972; Tolman, 1932). Given their recent increase in popularity, there is little research on ANTP

expectancies. The lone study on the topic to our knowledge found an association between e-cigarette expectancies and use, such that positive expectancies predicted greater likelihood of past 30 day use(Pokhrel, Little, Fagan, Muranaka, & Herzog, 2014).

In contrast, there is an extensive literature on the role of cigarette expectancies in youth smoking. Cigarette expectancies are important predictors of use (Hine, Honan, Marks, & Brettschneider, 2007), as well as of dependence, initiation and progression (Doran, et al., 2013; Myers, McCarthy, MacPherson, & Brown, 2003; Wetter et al., 2004). The two expectancy domains that have consistently predicted cigarette consumption are social facilitation (Myers, et al., 2003; Schweizer, Doran, & Myers, 2014) and affect regulation (i.e., positive and negative reinforcement) (Brandon & Baker, 1991; Doran, et al., 2013; Guller, Zapolski, & Smith, 2015). Because cigarettes and ANTPs each deliver nicotine, one might expect that the link between expectancies and use would be similar across products. However, expectancies are thought to develop based on observation in addition to direct experiences, and there are strong indications that observations about ANTPs differ from observations about cigarettes. In particular, youth and young adults perceive e-cigarettes and hookah as conferring less risk of health consequences, addiction, and social disapproval relative to cigarettes (Berg et al., 2015; Pepper & Brewer, 2014). Additionally, these groups are extensively exposed to pro-ANTP messages in social and other media (Hua, Yip, & Talbot, 2013; Pepper & Brewer, 2014). Previous studies have shown that pro-drug message exposure increases use via increased positive expectancies (Dal Cin et al., 2009; Willis, Sargent, Stoolmiller, Gibbons, & Gerrard, 2008). In other words, it is possible that ANTP and cigarette expectancies differ, and have differential relationships with ANTP and cigarette use, as a result of differential exposure to positive messages.

The current investigation sought to address the lack of knowledge about ANTP expectancies by examining relationships between e-cigarette and hookah expectancies and use over two weeks. We hypothesized that more positive ANTP expectancies would predict greater probability and frequency of ANTP use. We also examined whether these associations varied by expectancy type (i.e., health consequences, affect regulation, relief of cigarette craving, social facilitation). Because e-cigarette marketing and media often focus on use where cigarettes are prohibited (Kim et al., 2015), we hypothesized that expectancies related to ameliorating cigarette craving would be the strongest predictor of e-cigarette use. In contrast, because hookah is most often used in social settings (Kassem et al., 2015), we expected that social facilitation expectancies would best predict hookah use. Finally, we examined whether associations between ANTP use and expectancies were independent of cigarette expectancies. We anticipated that ANTP and cigarette expectancies would be correlated, but because of differences in product perceptions we hypothesized that ANTP expectancies' association with ANTP use would be independent of cigarette expectancies.

Materials and Methods

Participants

Participants (n=377, 58.0% male) were young adults (M=20.5, SD=1.8) recruited as part of a longitudinal study of nondaily cigarette smoking. In terms of race/ethnicity, 37.9% identified as Caucasian, 23.9% as Asian American, 19.6% as Hispanic or Latino, and 13.0%

as multi-racial. Eligibility criteria included being 18–24 years old, having smoked monthly for the previous six months, never having smoked daily for one month and being a California resident. Because assessments were completed online or via mobile phone app (Opinionmeter International, San Leandro, CA), participants were required to either own a smartphone or have regular internet access.

Procedure

Participants were recruited primarily via online advertisements. Interested individuals (n=4735) completed a brief screening. Research staff e-mailed individualized links to those who were eligible (n=727). Interested and eligible participants (n=377) provided informed consent and completed the baseline assessment, for which they received a $25 gift card. Procedures were approved by the University of California, San Diego Institutional Review Board. Data were collected between March and October, 2015.

Measures

Demographic and tobacco-related characteristics—Demographic variables included age, sex, race/ethnicity, student status, and education. Tobacco-related characteristics included intent to quit cigarettes in the next month and the next year, assessed on 5-point scales, with higher scores representing stronger intent. Due to small cell sizes, race was categorized as Caucasian (n=155), Asian American (n=90), Hispanic or Latino (n=96), or other (n=36).

Cigarette and ANTP use—ANTP and cigarette use for the past 14 days were assessed via Timeline Followback (Sobell & Sobell, 1992, 1996). For each product, days on which use occurred were indicated. The TLFB has strong validity and reliability with nondaily smokers (Harris et al., 2009) and has been validated for online use (Pedersen, Grow, Duncan, Neighbors, & Larimer, 2012; Ramo, Hall, & Prochaska, 2011).

Tobacco expectancies—ANTP expectancies were measured with eight items per product that were identical aside from the product name. Items were selected based on cigarette research (Hine, et al., 2007; Myers, et al., 2003) and included one question addressing health (to what extent do you believe the product is harmful to your health?), four addressing affect regulation (e.g., e-cigarettes relieve stress; e-cigarettes give me a buzz), two about social facilitation (hookah helps me to look cool; hookah helps me to socialize with others), and one about substitution for cigarettes (e-cigarettes help reduce my cigarette cravings). Items were rated on a 4-point scale and coded so that higher values reflected more positive expectancies. Total scores reflected the average of the eight items. Internal consistency was acceptable for both the e-cigarette (α= 0.78) and hookah (α = 0.83) scales. We calculated subscale scores for affect regulation (α=.84–.86) and social facilitation (α=. 68–.71) for both products. Cigarette expectancies were assessed using a short form of the Smoking Consequences Questionnaire (S-SCQ), which has good reliability and validity for young adults (Myers, et al., 2003). We calculated the mean for each subscale (negative consequences, weight concern, and positive and negative reinforcement) and coded each such that higher scores reflected more positive expectancies.

Analytic plan

Preliminary bivariate tests were used to assess relationships between demographic and clinical characteristics and predictor and outcome variables. Separate analyses were used to test associations between product-specific expectancies and product use for e-cigarettes and hookah. For each product, logistic regression was used to assess whether more positive overall expectancies were associated with greater odds of use in the past 14 days. Additionally, because the modal value of both e-cigarette and hookah use days was 0, negative binomial regression (Atkins, Baldwin, Zheng, Gallop, & Neighbors, 2013) was used to assess whether greater overall expectancies predicted more days of use. We then conducted similar analyses after separating expectancies by type (i.e., health consequences, affect regulation, cigarette craving relief, and social facilitation). Demographic variables that were associated with predictor and outcome variables were included as covariates. Number of cigarette days in the past 14 was also accounted for in all hypothesis tests. Analyses were conducted using Stata IC 13 (StataCorp LP, College Station, TX), with α=.05.

Results

Preliminary Analyses

Demographic and clinical characteristics are shown in Table 1. ANTP use in the previous 14 days was common, with 126 participants (33.4%) reporting hookah use and 128 (34.0%) e-cigarette use. Among e-cigarette users, the average number of use days was 5.1 (SD=4.6). Hookah users averaged 3.2 (3.4) days of use. Sixty-eight (18.0%) participants reported using both ANTPs. In comparison, 356 (94.4%) reported smoking cigarettes, with an average of 5.7 (4.0) cigarette days.

E-cigarette use was more frequent among younger and male participants (*p*s<.05). Expectancies for both ANTPs were lower among Caucasian and Hispanic/Latino participants compared with other groups (*p*s<.05). Hookah use was associated with student status [$\chi^2(1)=7.28$, $p=.007$], and hookah days with cigarette days ($r=0.17$, $p<.001$). Intent to quit cigarettes was not significantly associated with ANTP expectancies or use. Consequently, age, sex, race/ethnicity, student status and cigarette days were included as covariates in subsequent analyses.

E-cigarette expectancies and use

Logistic models (Table 2) indicated that odds of any e-cigarette use were not associated with sex, age, race/ethnicity, student status, or cigarette days. However, e-cigarette expectancies predicted any e-cigarette use [Odds Ratio=3.31 (95% confidence interval 2.20, 4.99), $p<.001$], such that a one-point increase in the expectancy mean was associated with a 231% increase in the odds of use. In the negative binomial model (Table 3), age, race/ethnicity, and cigarette days were not significant predictors of e-cigarette days, but men reported more e-cigarette days ($b=-0.52$, $z=-2.32$, $p=.020$). Similar to the logistic model, more positive e-cigarette expectancies predicted greater e-cigarette frequency ($b=1.38$, $z=6.04$, $p<.001$).

We then re-fit both models with e-cigarette expectancies entered separately by type. In the logistic model, odds of use were associated with affect regulation [OR=1.12 (1.02, 1.22), *p*=.

013] and social facilitation [OR=1.22 (1.05, 1.43), p=.010] expectancies. In other words, participants with greater expectations that e-cigarettes would improve affect or aid socialization were more likely to have used them in the past two weeks. Expectancies for health consequences and relieving cigarette cravings were not related to e-cigarette use. In the negative binomial model, more frequent e-cigarette use was associated with greater expectations for affect regulation (z=3.33, p=.001) and relief of cigarette craving (z=2.96, p=.003). E-cigarette frequency was not associated with expectancies for health consequences or social facilitation.

Hookah expectancies and use

The odds of hookah use were not associated with sex, age, race/ethnicity, or number of cigarette days. Full-time students were 79% more likely to have used hookah compared with other participants [OR=1.79 (1.07, 2.99), p=.026]. Additionally, the odds of hookah use were associated with hookah expectancies, [OR=2.39 (1.68, 3.40), p<.001], with each one-point increase in mean expectancy predicting a 139% increase in the odds of any hookah use. In the negative binomial model, age, sex, race/ethnicity, and student status were not significant predictors. However, there was a positive association between cigarette days and hookah days (b=0.11, z=3.94, p<.001). As hypothesized, more positive hookah expectancies were associated with more frequent hookah use (b=0.78, z=4.66, p<.001).

We then re-fit both models with the hookah expectancy domains entered separately. The logistic model indicated that stronger expectancies for affect regulation [OR=1.17 (1.06, 1.29), p=.001] and cigarette craving relief [OR=1.37 (1.02, 1.86), p=.039] were associated with hookah use. The negative binomial model indicated that hookah use was more frequent among those with higher affect regulation expectancies (z=2.20, p=.028), but was unrelated to the other hookah expectancy domains.

Cross-Product Expectancy Comparisons

First, we examined correlations among measures. Total expectancies for e-cigarettes and hookah were strongly associated with each other (r=.46, p<.001), and modestly associated with cigarette expectancies (rs .19–.20, ps<.001). Next, we tested whether the associations between ANTP expectancies and use remained significant if cigarette expectancies were accounted for. For e-cigarettes, neither S-SCQ total nor subscale scores were related to likelihood or frequency of use. Including S-SCQ scores in the models did not alter the associations between e-cigarette expectancies and use. Similarly, associations between hookah expectancies and use remained significant when either S-SCQ total or subscale scores were included. While total S-SCQ score was unrelated to hookah use, the odds of hookah use were lower for participants with stronger expectancies for positive [OR=0.96 (0.93, 1.00), p=.025] and negative [OR=0.97 (0.94, 0.99), p=.016] reinforcement from cigarettes. Similarly, those with stronger negative reinforcement expectancies for cigarettes reported fewer hookah days (z=−3.05, p=.002). In light of the strong correlation between e-cigarette and hookah expectancies, we also conducted post-hoc analyses to explore the overlap between the two in terms of predicting ANTP use. We found that e-cigarette expectancies were not associated with hookah use, and hookah expectancies were not associated with e-cigarette use. The association between e-cigarette expectancies and use did

not change meaningfully when hookah expectancies were included in the model, and vice versa.

Discussion

The goal of this study was to test the hypothesis that young adult nondaily cigarette smokers' ANTP use would be associated with ANTP expectancies. Secondary hypotheses were that expectancies related to relief from cigarette cravings and social facilitation would be most strongly related to e-cigarette and hookah use, respectively, and that ANTP expectancies would be related to cigarette expectancies but would independently predict ANTP use. Consistent with predictions, participants who endorsed stronger overall positive expectancies also reported greater odds of any use as well as more frequent use of both ANTPs. When individual domains were evaluated, higher affect regulation expectancies were consistently associated with likelihood and frequency of ANTP use. Expectancies for cigarette craving relief predicted frequency of e-cigarette use and likelihood of hookah use, and social facilitation expectancies predicted likelihood of e-cigarette use. While both e-cigarette and hookah expectancies were associated with cigarette expectancies, their respective relationships with e-cigarette and hookah use were independent of cigarette expectancies and of each other.

To our knowledge, the present study is one of the first to examine links between ANTP expectancies and use. Findings are consistent with the few earlier studies of young adults (Pokhrel, et al., 2014), and comparable to considerable research on cigarette expectancies and consumption. More positive cigarette expectancies have been associated with greater nicotine dependence and likelihood of initiation and progression, lower motivation to quit, and less cessation success (Brandon & Baker, 1991; Doran, et al., 2013; Heinz, Kassel, Berbaum, & Mermelstein, 2010; Kristjansson et al., 2011). This suggests individuals with more positive ANTP expectancies may be more vulnerable to dependence resulting from ANTP use and have greater difficulty quitting.

One novel aspect of the study is assessment of expectancies and use of both products. Of those who had used either ANTP in the past two weeks (49%), more had used both (18%) than had used only e-cigarettes (16%) or hookah (15%). Thus, it is perhaps unsurprising that there was a strong correlation between e-cigarette and hookah expectancies. *Post-hoc* analyses indicated this association was similar for those who had used hookah, regardless of e-cigarette use, and those who had used only cigarettes (rs 0.46–0.51, ps<.001), but weaker among e-cigarette only users (r=0.24, p=.066). This difference may be a function of student status and consequent exposure; as noted, full-time students made up 70% of hookah users versus 54% of the remainder of the sample. This is consistent with previous studies suggesting that heightened hookah use among college students may be a function of the college environment (Lee, et al., 2014). Overall, findings suggest that young adult smokers' use of specific ANTPs may be a function of exposure and availability, rather than preference for a specific product.

Another novel element of the study is the comparison between ANTP and cigarette expectancies. The fact that ANTP expectancies' impact on ANTP use was independent of

cigarette expectancies is interesting given the products deliver the same psychoactive drug. One potential explanation is the existence of a “non-cigarette expectancies” construct reflecting perception of ANTPs as safer and more socially acceptable than cigarettes, which may result from greater exposure to positive messages (Blake et al., 2015; Coleman et al., 2016). This is consistent with the correlation between e-cigarette and hookah expectancies, but not with the finding that expectancies for one ANTP were not associated with use of the other. Another possibility is that the distinction between ANTP and cigarette expectancies is related to greater ANTP use in social situations; however, social facilitation expectancies did not consistently predict ANTP use in this sample.

The fact that affect regulation expectancies consistently predicted ANTP use is potentially important. Because increased ANTP use has occurred recently, there is not yet sufficient research to determine long-term impacts on tobacco use and addiction. However, evidence from youth and young adult cigarette smokers suggests that affect regulation expectancies are an important pathway to dependence (Baker, Brandon, & Chassin, 2004; Kassel et al., 2007; Weinstein & Mermelstein, 2013). Thus, findings suggest young adults who use ANTPs may be doing so to modulate affect, and therefore are at risk for progressive use and/or initial or heavier cigarette smoking. Additional research is needed to better understand these risks.

Also worthy of note is the level of ANTP use in the sample. The prevalence of two-week hookah (33%) and e-cigarette (34%) use were comparable to past month rates based on data collected in 2008–12 (Doran, et al., 2015), and to rates of polytobacco use from a national adult sample (Schauer, Malarcher, & Berg, 2014). This suggests that prevalence of ANTP use among non-daily young adult cigarette smokers substantially exceeds prevalence among non-smoking young adults (Grinberg et al., 2015; Linde et al., 2015; Little et al., 2015), which likely increases overall nicotine exposure, potentially accelerating risk for chronic cigarette smoking.

There are limitations to the study. Expectancy measures were brief and adapted from previous research, rather than developed via a systematic process. Most ANTP expectancy domains included 1–2 items, and may not reflect the full scope of these constructs. Only recent ANTP use was assessed; given the instability of tobacco use in young adults (Schweizer, Roesch, Khoddam, Doran, & Myers, 2014), the stability of the relationships between expectancies and use are unknown. The study was cross-sectional, precluding examination of the impact of expectancies on ANTP initiation or progression, or the temporal relationship between ANTP and cigarette use. It is possible the sample was unrepresentative of young adult non-daily smokers due to the recruitment approach, although it was comparable to recent studies in terms of cigarette consumption (Berg, 2014; Schauer, et al., 2014). Finally, because it was not assessed, the extent to which participants used ANTPs labeled as low- or non-nicotine is unknown.

Conclusions

Findings from the present study suggest that ANTP expectancies influence whether young adult cigarette smokers also use these products; moreover, ANTP expectancies appear

distinct from cigarette expectancies. Of the expectancy domains assessed, affect regulation was the most consistent predictor of ANTP use. These data also suggest that, among young adult nondaily smokers, use of e-cigarettes and/or hookah may be as common as not. Findings suggest a need for ANTP-specific prevention and intervention programs, and indicate that such programs should include affect regulation components in addition to psychoeducation about ANTP risks. Additional longitudinal research is needed to better understand the impact of e-cigarettes and hookah use on long-term tobacco use and related risks.

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References

Alpert H, Koh H, Connolly G. After the master settlement agreement: Targeting and exposure of youth to magazine tobacco advertising. Health Affairs. 2008; 27:503–512. DOI: 10.1377/hlthaff.27.6.w503

Atkins DC, Baldwin SA, Zheng C, Gallop RJ, Neighbors C. A tutorial on count regression and zero-altered count models for longitudinal substance use data. Psychology of Addictive Behaviors. 2013; 27:166–177. DOI: 10.1037/a0033147 [PubMed: 22905895]

Baker TB, Brandon TH, Chassin L. Motivational influences on cigarette smoking. Annual Review of Psychology. 2004; 55:463–491.

Berg C. Reasons for nondaily smoking among young adults: Scale development and validation. Journal of Smoking Cessation. 2014; 9:17–25. [PubMed: 25258646]

Berg C, Stratton E, Schauer G, Lewis M, Wang Y, Windle M, Kegler M. Perceived harm, addictiveness, and social acceptability of tobacco products and marijuana among young adults: Marijuana, hookah, and electronic cigarettes win. Substance Use and Misuse. 2015; 50:79–89. [PubMed: 25268294]

Blake K, Rutten L, Grana R, Kaufman A, Agunwamba A, Wilson P, … Leischow S. Information exposure about e-cigarettes predicts reduced harm perceptions and e-cigarette use among adult smokers in the US. Tobacco Regulatory Science. 2015; 3:265–275.

Bolles R. Reinforcement, expectancy, and learning. Psychological Review. 1972; 79:394.

Brandon TH, Baker TB. The Smoking Consequences Questionnaire: The subjective expected utility of smoking in college students. Psychological Assessment. 1991; 3:481–491. DOI: 10.1037/1040-3590.3.3.484

Centers for Disease Control and Prevention. Any tobacco use in 13 States---behavioral risk factor surveillance system, 2008. MMWR. Morbidity and mortality weekly report. 2010; 59(30):946. [PubMed: 20689499]

Centers for Disease Control and Prevention. Consumption of cigarettes and combustible tobacco--United States, 2000–2011. MMWR. Morbidity and mortality weekly report. 2012; 61(30):565. [PubMed: 22854624]

Chao A, Thun M, Henley S, Jacobs E, McCullough M, Calle E. Cigarette smoking, the use of other tobacco products and stomach cancer mortality in US adults: The Cancer Prevention Study II. International Journal of Cancer. 2002; 101:380–389. DOI: 10.1002/ijc.10614 [PubMed: 12209964]

Chassin L, Presson CC, Rose JS, Sherman SJ. The natural history of cigarette smoking from adolescence to adulthood: Demographic predictors of continuity and change. Health Psychology. 1996; 15:478–484. [PubMed: 8973929]

Coleman B, Johnson S, Tessman G, Tworek C, Alexander J, Dickinson D, … Green K. It's not smoke. It's not tar. It's not 4000 chemicals. Case closed": Exploring attitudes, beliefs, and perceived social nroms of e-cigarette use among adult users. Drug Alcohol Depend. 2016; 159:80–85. [PubMed: 26708706]

Dal Cin S, Worth K, Gerrard M, Gibbons F, Stoolmiller M, Willis T, Sargent J. Watching and drinking: Expectancies, prototypes, and peer affiliations mediate the effect of exposure to alcohol use in movies on adolescent drinking. Health Psychology. 2009; 28:473–483. [PubMed: 19594272]

Doran N, Godfrey KM, Myers MG. Hookah use predicts cigarette smoking progression among college smokers. Nicotine and Tobacco Research. 2015; 17(11):1347–1353. DOI: 10.1093/ntr/ntu343 [PubMed: 25586774]

Doran N, Khoddam R, Sanders PE, Schweizer CA, Trim RS, Myers MG. A prospective study of the Acquired Preparedness Model: The effects of impulsivity and expectancies on smoking initiation in college students. Psychology of Addictive Behaviors. 2013; 27:714–722. DOI: 10.1037/a0028988 [PubMed: 22686965]

Doran N, Trim RS. Correlates of other tobacco use in a community sample of young adults. Addict Behav. 2015; 51:131–135. DOI: 10.1016/j.addbeh.2015.07.023 [PubMed: 26255638]

Ferrence R, Stephens T. Monitoring tobacco use in Canada: The need for a surveillance strategy. Chronic Diseases in Canada. 2000; 21:50–53. [PubMed: 11007654]

Grinberg A, Hart CL, Shapiro J, Keith D, Taha F, McNeil MP, Goodwin R. Hookah use among college students: Prevalence, mental health and drug use. Drug and alcohol dependence. 2015; 146:e131.doi: 10.1016/j.drugalcdep.2014.09.274

Guller L, Zapolski T, Smith G. Longitudinal test of a reciprocal model of smoking expectancies and smoking experience in youth. Psychology of Addictive Behaviors. 2015; 29:201–210. [PubMed: 25180556]

Heinz AJ, de Wit H, Lilje TC, Kassel JD. The combined effects of alcohol, caffeine and expectancies on subjective experience, impulsivity and risk-taking. Experimental and Clinical Psychopharmacology. 2013; 21:222–234. [PubMed: 23750693]

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(1):128–135. DOI: 10.1016/j.drugalcdep.2010.04.001 [PubMed: 20547013]

Hine D, Honan C, Marks A, Brettschneider K. Development and validation of the Smoking Expectancy Scale for Adolescents. Psychological Assessment. 2007; 19:347–355. DOI: 10.1016/j.drugalcdep.2010.04.001 [PubMed: 17845126]

Hua M, Yip H, Talbot P. Mining data on usage of electronic nicotine delivery systems (ENDS) from YouTube videos. Tobacco Control. 2013; 22:103–106. [PubMed: 22116832]

Kassel JD, Evatt D, Greenstein J, Wardle M, Yates M, Veilleux J. The acute effects of nicotine on positive and negative affect in adolescent smokers. Journal of Abnormal Psychology. 2007; 116:543–553. [PubMed: 17696710]

Kassem N, Jackson S, Boman-Davis M, Kassem N, Liles S, Daffa R, … Hovell M. Hookah smoking and facilitators/barriers to lounge use among students at a US university. American Journal of Health Behavior. 2015; 39:832–848. [PubMed: 26450551]

Kim A, Hopper T, Simpson S, Nonnemaker J, Lieberman A, Hansen H, … Porter L. Using Twitter data to gain insights into e-cigarette marketing and locations of use: An infoveillance study. Journal of Medical Internet Research. 2015; 17:e251. [PubMed: 26545927]

Kristjansson SD, Pergadia ML, Agrawal A, Lessov-Schlaggar CN, McCarthy DM, Piasecki TM, Heath AC. 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. DOI: 10.1016/j.drugalcdep.2010.11.017 [PubMed: 21194853]

Lee YO, Bahreinifar S, Ling PM. Understanding tobacco-related attitudes among college and noncollege young adult hookah and cigarette users. Journal of American College Health. 2014; 62:10–18. DOI: 10.1080/07448481.2013.842171 [PubMed: 24313692]

Linde BD, Ebbert JO, Pasker CK, Talcott GW, Schroeder DR, Hanson AC, Klesges RC. Prevalence and predictors of hookah use in US Air Force military recruits. Addictive Behaviors. 2015; 47:5–10. DOI: 10.1016/j.addbeh.2015.03.012 [PubMed: 25841088]

Little MA, Derefinko KJ, Colvin L, Ebbert JO, Bursac Z, Talcott GW, … Klesges RC. The prevalence of e-cigarette use in a sample of US Air Force recruits. American Journal of Preventive Medicine. 2015; 49:402–408. DOI: 10.1016/j.amepre.2015.02.019 [PubMed: 25896193]

Martinasek M, McDermott R, Martini L. Waterpipe (hookah) tobacco smoking among youth. Current Problems in Pediatric and Adolescent Health care. 2011; 41:34–57. DOI: 10.1016/j.cppeds.2010.10.001 [PubMed: 21232693]

Myers MG, McCarthy DM, MacPherson L, Brown SA. Constructing a short form of the smoking consequences questionnaire with adolescents and young adults. Psychological Assessment. 2003; 15:163–172. DOI: 10.1037/1040-3590.15.2.163 [PubMed: 12847776]

Nasim A, Blank M, Cobb C, Eissenberg T. Patterns of alternative tobacco use among adolescent cigarette smokers. Drug and alcohol dependence. 2012; 124:26–33. DOI: 10.1016/j.drugalcdep.2011.1011.1022 [PubMed: 22209307]

Nelson Laska M, Pasch KE, Lust K, Story M, Ehlinger E. Latent class analysis of lifestyle characteristics and health risk behaviors among college youth. Prevention Science. 2009; 10:376–386. [PubMed: 19499339]

Pedersen ER, Grow J, Duncan S, Neighbors C, Larimer ME. Concurrent validity of an online version of the Timeline Followback assessment. Psychology of Addictive Behaviors. 2012; 26(3):672. [PubMed: 22486334]

Pepper J, Brewer N. Electronic nicotine delivery system (electronic cigarette) awareness, use, reactions and beliefs: A systematic review. Tobacco Control. 2014; 23:375–384. [PubMed: 24259045]

Pokhrel P, Little MA, Fagan P, Muranaka N, Herzog TA. Electronic cigarette use outcome expectancies among college students. Addict Behav. 2014; 39(6):1062–1065. DOI: 10.1016/j.addbeh.2014.02.014 [PubMed: 24630824]

Ramo DE, Hall S, Prochaska JJ. Reliability and validity of self-reported smoking in an anonymous online survey with young adults. Health Psychology. 2011; 30:693–701. [PubMed: 21574709]

Ramo DE, Young-Wolff KC, Prochaska JJ. Prevalence and correlates of electronic-cigarette use in young adults: findings from three studies over five years. Addict Behav. 2015; 41:142–147. DOI: 10.1016/j.addbeh.2014.10.019 [PubMed: 25452058]

Renaud, J.; Nonemaker, J.; Kim, A.; Busey, A. Polytobacco use among adults, young adults, and youth in Florida. Research Triangle Park, NC: Bureau of Tobacco Prevention Program, Florida Department of Health; 2010.

Schauer G, Malarcher A, Berg C. Differences in smoking and cessation characteristics among adult nondaily smokers in the United States: Findings from the 2009–2010 National Adult Tobacco Survey. Nicotine and Tobacco Research. 2014; 16:58–68. [PubMed: 23925825]

Schweizer CA, Doran N, Myers MG. Social facilitation expectancies for smoking: Psychometric properties of a new measure. Journal of American College Health. 2014; 62:136–144. [PubMed: 24456515]

Schweizer CA, Roesch SC, Khoddam R, Doran N, Myers MG. Examining the stability of young adult alcohol and tobacco co-use: A latent transition analysis. Addiction Research and Theory. 2014; 22:325–335. DOI: 10.3109/16066359.2013.856884

Sobell, LC.; Sobell, MB. Timeline follow-back: A technique for assessing self-reported alcohol consumption. In: Litten, RZ.; Allen, JP., editors. Measuring alcohol consumption: Psychosocial and biochemical methods. Totowa, NJ: Humana Press; 1992. p. 41-72.

Sobell, LC.; Sobell, MB. Timeline followback: A calendar method for assessing alcohol and drug use. Toronto: Addiction Research Foundation; 1996.

Sterling KL, Mermelstein R. Examining hookah smoking among a cohort of adolescent ever smokers. Nicotine Tob Res. 2011; 13(12):1202–1209. DOI: 10.1093/ntr/ntr146 [PubMed: 21896886]

Thomas JL, Bengtson JE, Wang Q, Luo X, Marigi E, Ghidei W, Ahluwalia JS. Abstinence rates among college cigarette smokers enrolled in a randomized clinical trial evaluating quit and win contests: The impact of concurrent hookah use. Preventive Medicine. 2015; 76:20–25. [PubMed: 25773472]

Timberlake D. A latent class analysis of nicotine-dependence criteria and use of alternative tobacco. Journal of Studies on Alcohol and Drugs. 2005; 69:709–717. DOI: 10.15288/jsad.2008.69.709 [PubMed: 18781246]

Timberlake D. Are smokers receptive to using smokeless tobacco as a substitute? Preventive Medicine. 2009; 49:229–232. DOI: 10.1016/j.ypmed.2009.07.012 [PubMed: 19631684]

Tolman, E. Purposive Behavior in Animals and Men. London: Century/Random House UK; 1932.

Weinstein S, Mermelstein R. Influences of mood variability, negative moods, and depression on adolescent cigarette smoking. Psychology of Addictive Behaviors. 2013; 27:1068–1078. [PubMed: 23438244]

Wetter DW, Kenford SL, Welsch SK, Smith SS, Fouladi RT, Fiore MC, Baker TB. Prevalence and predictors of transitions in smoking behavior among college students. Health Psychol. 2004; 23(2): 168–177. DOI: 10.1037/0278-6133.23.2.168 [PubMed: 15008662]

Wetter DW, McClure JB, de Moore C, Cofta-Gunn L, Cummings S, Cinciripini PM, Gritz ER. Concomitant use of cigarettes and smokeless tobacco: Prevalence, correlates, and predictors of tobacco cessation. Preventive Medicine. 2002; 34:638–648. [PubMed: 12052025]

Willis T, Sargent J, Stoolmiller M, Gibbons F, Gerrard M. Movie smoking exposure and smoking onset: A longitudinal study of mediation processes in a representative sample of US adolescents. Psychology of Addictive Behaviors. 2008; 22:269–277. [PubMed: 18540724]

Highlights

- About one in three young adults reported past 2 week e-cigarette and/or hookah use
- 37% of those who used either e-cigarettes or hookah reported using both
- Expectancies were associated with greater odds of use of e-cigarettes and hookah
- Expectancies were also associated with frequency of use of these products

Table 1

Demographic and clinical characteristics by past 14 day product use.

Variable	Cigarettes only	Cigarettes + e-cigarettes	Cigarettes + hookah	Cigarettes + both	Total
n	191	60	58	68	377
Age, M (SD)	20.6 (1.9)[a]	20.7 (2.0)[a]	20.1 (1.4)[a]	20.5 (1.6)[a]	20.5 (1.8)
Sex, % male	55.0% [a]	64.4% [a]	56.9% [a]	63.2% [a]	58.2%
Race/ethnicity, %	40.3% [a]	48.3% [a]	41.4% [a]	36.8% [a]	41.1%
Caucasian					
Student status, % full time student	57.1% [ab]	46.7% [b]	74.1%[c]	64.7%[ac]	59.4%
Cigarette smoking days in past 2 weeks, M (SD)	5.8 (4.1)[a]	5.3 (3.8)[a]	6.0 (3.9)[a]	6.3 (4.0)[a]	5.7 (4.0)
E-cigarette expectancies, M (SD)	1.9 (0.5)[a]	2.4 (0.5)[b]	2.0 (0.5)[a]	2.3 (0.6)[b]	2.1 (0.6)
Hookah expectancies, M (SD)	2.1 (0.6)[a]	2.2 (0.6)[ab]	2.4 (0.7)[bc]	2.6 (0.6)[c]	2.2 (0.7)

Note: different superscripts reflect significant differences between use groups ($p < .05$).

Table 2

Logistic models of the odds of using e-cigarettes and hookah in the previous 14 days.

Predictor	Coefficient	Standard Error	z-score	Odds Ratio (95% ci)	p-value
E-cigarettes: model χ^2 (6) = 39.20, $p < .001$					
Age	0.07	0.07	1.08	1.08 (0.94, 1.23)	.279
Sex	−0.25	0.23	−1.05	0.78 (0.49, 1.24)	.293
Race/ethnicity	0.00	0.11	0.00	1.00 (0.80, 1.25)	.998
Student status	−0.03	0.25	−0.11	0.97 (0.59, 1.60)	.911
Cigarette days	−0.01	0.03	−0.22	0.99 (0.94, 1.05)	.828
E-cigarette expectancies	1.20	0.21	5.70	3.31 (2.19, 5.00)	<.001
Hookah: model χ^2 (6) = 36.87, $p < .001$					
Age	−0.02	0.07	−0.24	0.98 (0.86, 1.13)	.812
Sex	−0.16	0.23	−0.71	0.85 (0.54, 1.34)	.479
Race/ethnicity	0.08	0.11	0.70	1.08 (0.87, 1.35)	.481
Student status	0.58	0.26	2.23	1.79 (1.07, 2.99)	.026
Cigarette days	0.05	0.03	1.75	1.05 (0.99, 1.11)	.080
Hookah expectancies	0.87	0.18	4.84	2.39 (1.68, 3.40)	<.001

Table 3

Negative binomial models predicting frequency of e-cigarette and hookah use.

Predictor	Coefficient	Standard Error	z-score	p-value
E-cigarettes: model χ^2 (6) = 46.73, p < .001				
Age	−0.02	0.08	−0.31	.758
Sex	−0.52	0.22	−2.32	.020
Race/ethnicity	0.04	0.12	0.35	.729
Student status	−0.14	0.27	−0.50	.615
Cigarette days	−0.01	0.03	−0.25	.800
E-cigarette expectancies	1.38	0.23	6.04	<.001
Hookah: model χ^2 (6) = 34.89, p < .001				
Age	−0.02	0.07	−0.24	.809
Sex	−0.32	0.24	−1.36	.175
Race/ethnicity	0.10	0.11	0.89	.375
Student status	0.24	0.25	0.96	.336
Cigarette days	0.11	0.03	3.94	<.001
Hookah expectancies	0.78	0.17	4.66	<.001