



HHS Public Access

Author manuscript

Addict Behav. Author manuscript; available in PMC 2018 December 01.

Published in final edited form as:

Addict Behav. 2017 December ; 75: 79–84. doi:10.1016/j.addbeh.2017.07.008.

Do personality traits related to affect regulation predict other tobacco product use among young adult non-daily smokers?

Kristin Brikmanis¹, Angela Petersen^{1,2}, and Neal Doran^{1,2}

¹Department of Psychiatry, University of California, San Diego

²VA San Diego Healthcare System

Abstract

Introduction—Understanding factors that influence non-cigarette tobacco use is important given these products' prevalence and health risks. The goal of this study was to test the hypothesis that personality traits related to affect regulation would be associated with greater frequency of other tobacco product (OTP) use in a sample of young adult non-daily smokers.

Methods—Participants (n=518, 51% male) aged 18–24 were non-daily cigarette smokers recruited from the community for a longitudinal study of tobacco use. Personality characteristics (impulsivity, anhedonia, and negative affectivity) were measured at baseline, and participants reported recent tobacco use at baseline and 3, 6, and 9 months later. Assessments were conducted online or via mobile phone.

Results—Across the 4 assessments, 33–52% of participants reported recent OTP use, with frequency of use decreasing over time. Longitudinal negative binomial regression models indicated that greater sensation seeking and lack of premeditation were associated with more frequent OTP use ($p < .05$). These effects were consistent over time.

Conclusions—Findings suggest that young adult non-daily cigarette smokers with greater propensity for immediately rewarding behaviors may use OTPs more frequently. Young, non-daily cigarette smokers with high levels of sensation seeking and/or lack of premeditation may be at increased risk for harms related to OTP use and may benefit from prevention and cessation strategies that specifically address affect.

Keywords

tobacco; young adult; personality; affect regulation

CORRESPONDING AUTHOR: Kristin Brikmanis, Suite B109, 8950 Villa La Jolla Drive, San Diego, CA 92037, Tel: 858-822-1519, kbrikmanis@ucsd.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Contributors: Neal Doran designed the study and assisted with statistical analysis and manuscript preparation. Kristin Brikmanis conducted statistical analyses and led the preparation of the manuscript. Angela Petersen assisted with manuscript preparation.

Conflict of Interest: The authors have no conflicts of interest to report.

Non-cigarette tobacco or nicotine product (other tobacco products; OTPs) use is increasing and is most pervasive among younger cigarette smokers (Y. Lee et al., 2014, 2015). In 2012, 70% of youth and 62% of young adult cigarette smokers reported using OTPs in addition to cigarettes, compared with 6% and 10% of non-smoking youth and adults, respectively (Y. Lee et al., 2014, 2015). OTPs most commonly include but are not limited to e-cigarettes, hookah, cigars, and smokeless tobacco. These products each have associated health risks, including cancer, cardiovascular diseases, and respiratory issues (Baker et al., 2000; Critchley & Unal, 2003; Ferrence & Stephens, 2000; Maziak, 2013; Vardavas et al., 2012). Among cigarette smokers, another concern is that OTPs may exacerbate cigarette-related health risks (Centers for Disease Control and Prevention, 2010) by promoting cigarette progression (Doran et al., 2017; Doran et al., 2015) and nicotine dependence (Timberlake, 2005, 2009). While younger cigarette smokers may be vulnerable to OTP use and its effects, little is known about the characteristics of multiple tobacco product users.

One possible motive for OTP use is affect regulation (Doran & Brikmanis, 2016; H.-Y. Lee et al., 2017; Pokhrel et al., 2014; Wong et al., 2016). Affect regulation refers to the process by which people attempt to alter their emotional states (Larsen & Prizmic, 2004). Affect regulation expectancies and motives have been associated with specific OTPs (Doran & Brikmanis, 2016; Pokhrel et al., 2014; Wong et al., 2016). These studies suggest young adults use OTPs at least partly for affect modulation. Thus, they may be at an increased risk for progressive tobacco use as cigarette-specific studies have found that affect regulation beliefs contribute to progressive consumption (Kassel et al., 2007; Weinstein & Mermelstein, 2013; Wetter et al., 2004). Given this, it may be beneficial to examine associations between OTP use and traits related to affect regulation.

Impulsivity, anhedonia, and negative affectivity are affect regulation-related traits that have been positively associated with cigarette behaviors and expectancies (Bloom et al., 2014; Johnson et al., 2008; Kassel et al., 2003; Leventhal & Zvolensky, 2015). Individuals with these characteristics may expect that nicotine increases positive affect and reduces negative affect, making them more prone to using cigarettes. There is evidence that individuals with these traits find nicotine disproportionately reinforcing (Cook et al., 2007; Doran et al., 2006). Because of these expectancies, individuals with high levels of personality traits related to affect regulation may be similarly vulnerable to using nicotine from any source including OTPs.

Impulsivity is conceptualized as a multidimensional construct consisting of five factors: lack of premeditation, lack of perseverance, sensation seeking, and positive and negative urgency, or the tendency to act impulsively during positive and negative affective states (Cyders et al., 2007; Whiteside & Lynam, 2001). Impulsive individuals are prone to engaging in immediately rewarding behaviors (e.g., nicotine intake) regardless of potential long-term consequences (Bloom et al., 2014) and appear to smoke cigarettes for positive and negative reinforcement (Doran et al., 2007). Impulsivity has been linked to e-cigarette, hookah, and cigar use (Doran & Trim, 2015; Enofe et al., 2014; Fielder et al., 2012; Leventhal et al., 2016; Sterling et al., 2013). Specifically, sensation seeking and positive urgency were associated with the likelihood of recent OTP use (Doran & Trim, 2015). Another study found that positive and negative urgency were highest among dual cigarette and e-cigarette

users, followed by e-cigarette only users, and then non-users (Leventhal et al., 2016). Therefore, individuals high in sensation seeking and urgency may be particularly prone to OTP use. Most previous studies have either focused on one component of impulsivity or used composite impulsivity scores. Because the components of impulsivity are related but distinct constructs with different underlying causes that interact to influence behavior (Lejuez et al., 2005), the present study sought to evaluate the prospective relations between the five factors and OTP use.

Another possible OTP risk factor is anhedonia, or reduced capacity to feel pleasure in response to rewards (Gard et al., 2006). Those with high levels of anhedonia may be more likely to engage in behaviors, like cigarette use, to compensate for deficiencies in positive affect (Leventhal & Zvolensky, 2015). Anhedonia has been associated with cigarette initiation and progression and nicotine dependence (Leventhal & Zvolensky, 2015). Little research has examined the relationship between anhedonia and OTP use. In one study, anhedonia was highest among dual cigarette and e-cigarette users, moderate among single-product users, and lowest among non-users (Leventhal et al., 2016). While few OTP studies have focused on anhedonia alone, hookah and cigar use has been associated with scores on a two item measure assessing frequency of depressed mood and anhedonia (Berg et al., 2011; Sterling et al., 2013). These initial studies suggest that those high in anhedonia may be vulnerable to OTP use.

A third trait that may impact OTP use is negative affectivity, the tendency to experience negative affective states. Rather than using substances to increase positive affect, such individuals may use to ameliorate negative affect (Myers et al., 2003). To our knowledge, no previous studies have examined the association between negative affectivity and OTP use. Literature has linked negative affectivity and neuroticism, a related construct, to cigarette use (Kassel et al., 2003; Malouff et al., 2006; Munafo et al., 2007). Those high in negative affectivity may also be disproportionately prone to OTP use to alleviate negative moods.

The purpose of the present secondary analysis was to examine personality traits related to affect regulation as prospective predictors of OTP use in a sample of young adult non-daily cigarette smokers. To the extent that individuals with affect regulation-related traits use nicotine to manage affect, they are likely at greater risk for OTP use. We hypothesized that higher levels of the sensation seeking and positive and negative urgency facets of impulsivity; anhedonia; and negative affectivity would be associated with greater OTP frequency. We also predicted that OTP frequency would escalate more quickly over time among individuals higher in these traits. Finally, we explored whether the effects of impulsivity, anhedonia, and negative affectivity differed among the most common individual OTPs (i.e. e-cigarettes, hookah, and cigars).

Materials and Methods

Participants

Participants ($n= 518$; 51% male) were young adults (18–24 years old; $M=20.5$, $SD=1.8$) in a longitudinal study of tobacco. The sample was 48.8% non-Hispanic White, 15.8% Asian American, 26% Hispanic/Latino, and 9.3% from other or multiple racial/ethnic

backgrounds. Eligibility criteria included smoking cigarettes monthly or more for at least the past six months, never smoking cigarettes daily for one month or more, and California residency. Because all assessments were completed online, consistent internet access was required.

Procedure

Participants were recruited primarily via online advertisements. After online eligibility screening, interested candidates provided informed consent and completed the baseline assessment. At the 3, 6 and 9 month follow-ups, participants completed brief daily assessments for 9 consecutive days. Incentives included a \$25 gift card for completion of baseline assessment and up to \$40 for each of the three quarterly assessments. All procedures were approved by the University of California, San Diego Institutional Review Board. Data were collected March 2015-December 2016.

Measures

Demographic characteristics—Demographic characteristics assessed included age, sex, race/ethnicity and current student status. Race was collapsed into four categories: non-Hispanic White (n=253), Asian American (n=82), Hispanic or Latino (n=135), and other or multiple backgrounds (n=48). Student status was collapsed into full time students (60%) versus others (40%).

Cigarette and OTP use—Cigarette and OTP use were measured at baseline, and 3, 6, and 9 months later. OTPs included e-cigarettes, hookah, cigars, smokeless tobacco (SLT), and snus. At baseline, participants reported whether they used cigarettes and OTPs on each of the past 14 days using the Timeline Followback (Sobell & Sobell, 1992, 1996), which has strong validity and reliability with nondaily smokers (Harris et al., 2009). At 3, 6, and 9 months, participants completed daily assessments and reported whether they had used OTPs and cigarettes during the previous day. Assessments were completed on 9 consecutive days, always starting on a Saturday. Overall, participants completed 84.9% of assessments. The majority (51–55%) of participants completed all 9 days across timepoints. Studies have shown that self-reported smoking frequency is significantly correlated with tobacco biomarkers such as cotinine (Gass et al., 2016; Shiffman et al., 1994).

Raw data were collapsed to create variables reflecting frequency of cigarette (*cigarette days*), e-cigarette (*e-cigarette days*), hookah (*hookah days*), cigar (*cigar days*), SLT (*SLT days*), and snus use (*snus days*) at each timepoint: baseline, 3 months, 6 months, and 9 months. Overall OTP use (*OTP days*) was calculated by totaling the days on which any OTP was used at each timepoint. Using 2 products on the same day counted as one *OTP day*. To account for differences in frequency related to number of assessment days, we created a time-varying variable (*assessment days*) measuring the number of days on which use was assessed at each timepoint.

Impulsivity—Impulsivity was assessed with the short form of the UPPS-P Impulsive Behavior Scale (SUPPS-P), a 20-item scale measuring impulsivity across multiple dimensions (Cyders et al., 2014). The SUPPS-P demonstrates good reliability and validity in

subscales measuring sensation seeking, lack of premeditation and perseverance, and positive and negative urgency (Cyders et al., 2014).

Anhedonia—Anhedonia was measured with the 14-item Snaith-Hamilton Pleasure Scale (SHAPS; Snaith et al., 1995) (Snaith et al., 1995) (Snaith et al., 1995) (Snaith et al., 1995). The SHAPS has strong internal consistency and validity with young adults, measuring decreased responsiveness to positive events (Leventhal et al., 2006).

Negative affectivity—Negative affectivity was measured using the 30-item Negative Emotionality scale (NEM-30; Waller et al., 1996) (Waller et al., 1996) (Waller et al., 1996) (Waller, Tellegen, McDonald, & Lykken, 1996). The NEM-30 has demonstrated acceptable internal consistency and construct validity with young adults (Lilienfeld & Hess, 2001).

Analytic plan

Preliminary bivariate tests were used to assess relations between demographic, predictor, and outcome variables. Variables associated with the personality predictors and OTP outcomes were included as covariates. The number of days completed at each timepoint was also included as a covariate in all analyses because the number of OTP use days was expected to vary as a function of the number of days assessed. Hypothesis tests were performed by fitting longitudinal models of the associations of personality predictors with each time-varying outcome (overall OTP, e-cigarette, hookah and cigar days). All predictors (lack of perseverance, lack of premeditation, sensation seeking negative urgency, positive urgency, anhedonia, and negative affectivity) were entered in each model. Comparisons to alternative choices (e.g., multi-level or Poisson models) indicated the negative binomial distribution fit better because the outcome variables were over-dispersed. Models initially included terms for each time \times personality predictor (e.g., time \times anhedonia). Interaction terms were removed when not significant. Missing data were not imputed. Analyses were conducted using the *xtnbreg* module in Stata 14.0 (StataCorp LP, College Station, TX), with $\alpha=.05$.

Results

Missing data

Seventy-one (12%) participants dropped out after the baseline assessment and were excluded from further analyses. Those who dropped out did not differ in age, race/ethnicity, sex, student status, or frequency of cigarette use from rest of the sample. Because those who dropped out used OTPs more frequently at baseline ($t=2.10$, $p=0.04$), we ran separate negative binomial models for each personality predictor to test the associations of enrollment status and personality on OTP frequency at baseline. None of the enrollment \times personality interactions were significant, suggesting that dropout was not related to these traits. Among the 518 participants included in subsequent analyses, the proportions of missing tobacco use data at baseline, 3 months, 6 months, and 9 months were 0%, 2%, 12%, and 16%.

Preliminary analyses

Demographic and clinical characteristics are shown in Table 1. OTP use declined over time, from 52% of participants reporting recent use at baseline to 33% at 9 months. Bivariate analyses indicated that OTP use was more frequent among men and more frequent cigarette users ($p < .05$). Full-time students used smokeless tobacco more frequently, while those who were not used e-cigarettes more frequently ($p < .05$). Women reported greater negative affectivity, negative urgency, and lack of premeditation, and lower sensation seeking ($p < .05$). White participants reported greater lack of premeditation compared to Hispanic or Latino participants and greater lack of perseverance compared to participants from other and multi-racial backgrounds ($p < .05$). Consequently, sex, race/ethnicity, student status, and cigarette days were included as covariates in subsequent hypothesis tests.

OTP frequency

The negative binomial model is shown in Table 2. OTP use was more frequent among men [$p < .001$, Incidence Rate Ratio (IRR)=1.95 (95% confidence interval 1.54, 2.45)] and more frequent cigarette smokers [$p < .001$, IRR=1.05 (1.03, 1.08)]. OTP frequency decreased over time [$p < .001$, IRR=0.84 (0.78, 0.91)].

Anhedonia, negative affectivity, perseverance, and negative and positive urgency were non-significant in the model. Sensation seeking [$p = .037$, IRR=1.04 (1.00, 1.08)] and lack of premeditation [$p = .018$, IRR=1.07 (1.01, 1.13)] were positively associated with OTP frequency, indicating that participants high in these traits tended to use OTPs more often. For each one standard deviation increase in sensation seeking and lack of premeditation, the number of OTP use days increased 12% and 20%, respectively. None of the predictor \times time interactions were significant, indicating that the strength of the effects of impulsivity and anhedonia did not change over time.

E-cigarette frequency

The models of individual products are summarized in Table 3. Because the models were identical in terms of the covariates and predictors that were included and these variables had similar effects across products, the table only includes significant personality effects. E-cigarette use was more frequent among men [$p = .001$, IRR=1.65 (1.21, 2.25)] and more frequent cigarette smokers [$p = .001$, IRR=1.05 (1.02, 1.08)]. Lack of premeditation [$p = .024$, IRR=1.09 (1.01, 1.17)] was the only trait that significantly predicted e-cigarette frequency. Each one standard deviation increase in lack of premeditation predicted a 26% increase in the number of e-cigarette days. None of the predictor \times time interactions were significant.

Hookah frequency

Men [$p < .001$, IRR=1.55 (1.15, 2.09)] and more frequent cigarette smokers [$p < .001$, IRR=1.08 (1.05, 1.12)] used hookah more frequently. Frequency of hookah use decreased over time [$p < .001$, IRR=0.77 (0.69, 0.87)]. Perseverance, sensation seeking, and negative and positive urgency were not significant predictors of hookah frequency. Lack of premeditation [$p = .001$, IRR=1.12 (1.05, 1.21)] and anhedonia [$p < .001$, IRR=1.04 (1.02, 1.06)] predicted hookah frequency. For each one standard deviation increase in lack of premeditation and anhedonia, the number of hookah days increased 15% and 29%,

respectively. Negative affectivity was negatively associated with hookah use [$p=.003$, $IRR=0.96$ (0.94, 0.99)]. A one standard deviation increase in negative affectivity predicted a 24% decrease in the number of hookah days. The predictor \times time interactions were nonsignificant.

Cigar frequency

Men [$p<.001$, $IRR=3.32$ (2.14, 5.13)] and those who smoked cigarettes more frequently [$p=.002$, $IRR=1.09$ (1.03, 1.15)] used cigars more frequently. Cigar use frequency significantly decreased over time [$p=.005$, $IRR=0.76$ (0.63, 0.92)]. Positive urgency [$p=.045$, $IRR=1.09$ (1.00, 1.04)] was the only trait that significantly predicted cigar frequency. Each one standard deviation increase in positive urgency predicted a 25% increase in the number of cigar days. None of the predictor \times time interactions were significant.

Discussion

The present study tested the hypothesis that personality characteristics associated with affect regulation would predict greater frequency of total OTP use in a sample of young adult non-daily cigarette smokers. As expected, those who reported greater sensation seeking reported more frequent OTP use. Lack of premeditation was a significant predictor of OTP frequency, while positive and negative urgency, anhedonia and negative affectivity were not. We also explored whether these traits differed in their associations with individual OTPs. As with OTP frequency, lack of premeditation was a significant predictor of e-cigarette and hookah frequency. However, sensation seeking was not associated with e-cigarette, hookah, or cigar use. Furthermore, anhedonia and negative affectivity predicted hookah. Those with greater anhedonia used hookah more frequently, while those with greater negative affectivity used hookah less frequently. Finally, cigar frequency was positively associated with positive urgency. Effects were consistent over 9 months.

These findings suggest that individuals with certain characteristics that increase propensity for immediately rewarding behaviors may use OTPs more frequently. The positive association between OTP frequency and lack of premeditation is consistent with studies examining cigarette frequency (Miller et al., 2003). Individuals who lack premeditation tend to be enticed by immediate rewards and act without considering consequences. They may use OTPs more frequently because they are attracted to the immediate positive effects of nicotine and are less sensitive to consequences. Prevention and cessation strategies highlighting health risks, including product warning labels, mass-media campaigns, and health care providers' advice, could be less effective for this group.

Individuals high in sensation seeking are drawn to novel reinforcers and willing to take risks to obtain rewards (Wagner, 2001; Zuckerman, 2005). Previous research has found an association between sensation seeking and OTP use (Doran & Trim, 2015; Enofe et al., 2014). Interestingly, sensation seeking predicted overall OTP frequency but was not related to frequency of any individual OTP. This indicates that those with higher levels of sensation seeking used OTPs more often but were not more likely to use a particular OTP. One possibility is that the risk of sensation seeking on OTP use is nonspecific. Another potential explanation is that individuals high in sensation seeking are more likely to use multiple

OTPs. This finding demonstrates the value of examining OTPs collectively. Evidence suggests that mass media campaigns targeting sensation seeking with messages designed to elicit greater affective and arousal responses are effective in reaching future smokers and reducing smoking (Palmgreen & Donohew, 2010; Sargent et al., 2010). Therefore, these types of campaigns would likely be effective in reducing general nicotine and tobacco use among this high-risk group as well.

Many of the personality characteristics were not significant predictors of OTP frequency. The lack of association between OTP frequency and negative urgency suggest that users may not be drawn to using OTPs when experiencing negative affective states. Perseverance also did not impact OTP use. While anhedonia, negative affectivity, and positive urgency were not associated with overall OTP frequency, they did predict frequency of individual product use. This suggests that the effects of these personality characteristics may be specific to each product. Future studies should explore whether these effects are a function of factors (e.g., perceptions and expectancies) associated with the individual products.

Findings indicate that impulsivity, anhedonia, and negative affectivity were differentially related to e-cigarette, hookah, and cigar use. As with overall OTP frequency, lack of premeditation was a significant predictor of e-cigarette and hookah use frequency. It may be that the accessibility of e-cigarettes allows them to be used as frequently as desired without requiring planning. For hookah, one possibility is that social acceptance and influence may encourage participation in this immediately rewarding behavior without considering consequences. Two personality predictors were specific to hookah frequency: anhedonia and negative affectivity. Those with high levels of anhedonia may seek rewards in order to offset deficits in their ability to experience positive affect. Therefore, they may be drawn to hookah more frequently than either e-cigarettes or cigars because hookah use tends to be more social and possibly more rewarding for some individuals. Contrary to expectation, negative affectivity was negatively associated with hookah frequency. While most studies have found positive associations between negative affectivity and substance use, at least one other study has reported the inverse (Gunnarsson et al., 2008). Because hookah use typically occurs in a group setting (Braun et al., 2012; Heinz et al., 2013), one possibility is that this effect may be more specific to context than product; the socializing that often accompanies hookah use could deter high negative affectivity individuals as negative affectivity is strongly correlated with social anxiety (Myers et al., 2003). Finally, positive urgency was positively associated with cigar frequency, suggesting that those high in positive urgency use cigars to enhance already positive states. Additional research is needed to better understand these product-specific relations.

Limitations of this study should be considered when interpreting the results. The sample consisted of young adult non-daily cigarette smokers who reside in California; thus, findings may not be generalizable to all OTP users, including those who differ in age group, cigarette smoking status, and location. Additionally, those who dropped out of the study reported more frequent OTP use at baseline, potentially altering the impact of the personality characteristics on OTP frequency. Nicotine dependence and nicotine content of OTPs used were not assessed. Finally, 95% of participants reported lifetime OTP use prior to study enrollment, and the personality predictors were only measured at baseline. While our

interpretation was that individuals with greater impulsivity are prone to frequent OTP use, it may be that more frequent OTP use leads to increased impulsivity or that the relationship is bi-directional.

Findings suggest that young adult non-daily cigarette smokers with personality traits that increase propensity for immediately rewarding behaviors are prone to more frequent OTP use. Lack of premeditation and sensation seeking prospectively predicted frequency of OTP use over 9 months. Individuals with these traits may benefit from prevention and cessation strategies that specifically address affect. Data also indicate that affect regulation-related traits may differ in their associations with e-cigarette, hookah, and cigar use. Findings suggest value in examining use of OTPs both collectively and individually.

Acknowledgments

This research was funded by the National Institutes of Health grant R01 DA037217 (Doran).

Role of Funding Sources: Funding for this study was provided by a National Institute on Drug Abuse grant to Neal Doran (R01 DA037217).

References

- Baker F, Ainsworth SR, Dye JT, Crammer C, Thun MJ, Hoffmann D, Pinney J. Health risks associated with cigar smoking. *Jama*. 2000; 284(6):735–740. [PubMed: 10927783]
- Berg CJ, Schauer GL, Asfour OA, Thomas AN, Ahluwalia JS. Psychosocial factors and health-risk behaviors associated with hookah use among college students. *Journal of addiction research & therapy*. 2011; doi: 10.4172/2155-6105.S2-001
- Bloom EL, Matsko SV, Cimino CR. The relationship between cigarette smoking and impulsivity: A review of personality, behavioral, and neurobiological assessment. *Addiction Research & Theory*. 2014; 22(5):386–397. DOI: 10.3109/16066359.2013.867432
- Braun RE, Glassman T, Wohlwend J, Whewell A, Reindl DM. Hookah use among college students from a Midwest University. *Journal of community health*. 2012; 37(2):294–298. [PubMed: 21805373]
- 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]
- Cook JW, Spring B, McChargue D. Influence of nicotine on positive affect in anhedonic smokers. *Psychopharmacology*. 2007; 192(1):87–95. DOI: 10.1007/s00213-006-0688-5 [PubMed: 17277935]
- Critchley JA, Unal B. Health effects associated with smokeless tobacco: a systematic review. *Thorax*. 2003; 58(5):435–443. [PubMed: 12728167]
- Cyders MA, Littlefield AK, Coffey S, Karyadi KA. Examination of a short English version of the UPPS-P Impulsive Behavior Scale. *Addictive behaviors*. 2014; 39(9):1372–1376. DOI: 10.1016/j.addbeh.2014.02.013 [PubMed: 24636739]
- Doran N, Brikmanis K. Expectancies for and use of e-cigarettes and hookah among young adult non-daily smokers. *Addictive behaviors*. 2016; 60:154–159. DOI: 10.1016/j.addbeh.2016.04.008 [PubMed: 27155241]
- Doran N, Brikmanis K, Petersen A, Delucchi K, Al-Delaimy WK, Luczak S, Strong D. Does e-cigarette use predict cigarette escalation? A longitudinal study of young adult non-daily smokers. *Preventive Medicine*. 2017; 100:279–284. [PubMed: 28583658]
- 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, McChargue D, Cohen L. Impulsivity and the reinforcing value of cigarette smoking. *Addictive behaviors*. 2007; 32(1):90–98. DOI: 10.1016/j.addbeh.2006.03.023 [PubMed: 16675149]
- Doran N, McChargue D, Spring B, VanderVeen J, Cook J, Richmond M. Effect of nicotine on negative affect among more impulsive smokers. *Experimental and Clinical Psychopharmacology*. 2006; 14(3):287. doi: 10.1037/1064-1297.14.3.287 [PubMed: 16893271]
- 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]
- Enofe N, Berg CJ, Nehl EJ. Alternative tobacco use among college students: who is at highest risk? *American journal of health behavior*. 2014; 38(2):180–189. [PubMed: 24629547]
- 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]
- Fielder RL, Carey KB, Carey MP. Predictors of initiation of hookah tobacco smoking: A one-year prospective study of first-year college women. *Psychology of Addictive Behaviors*. 2012; 26(4): 963. [PubMed: 22564201]
- Gard DE, Gard MG, Kring AM, John OP. Anticipatory and consummatory components of the experience of pleasure: a scale development study. *Journal of research in personality*. 2006; 40(6): 1086–1102.
- Gass JC, Germeroth LJ, Wray JM, Tiffany ST. The reliability and stability of puff topography variables in non-daily smokers assessed in the laboratory. *Nicotine & Tobacco Research*. 2016; 18(4):484–490. [PubMed: 25744955]
- Gunnarsson M, Gustavsson JP, Tengström A, Franck J, Fahlke C. Personality traits and their associations with substance use among adolescents. *Personality and individual differences*. 2008; 45(5):356–360.
- Harris KJ, Golbeck AL, Cronk NJ, Catley D, Conway K, Williams KB. Timeline follow-back versus global self-reports of tobacco smoking: a comparison of findings with nondaily smokers. *Psychology of Addictive Behaviors*. 2009; 23(2):368. [PubMed: 19586155]
- Heinz AJ, Giedgowd GE, Crane NA, Veilleux JC, Conrad M, Braun AR, Kassel JD. A comprehensive examination of hookah smoking in college students: use patterns and contexts, social norms and attitudes, harm perception, psychological correlates and co-occurring substance use. *Addictive behaviors*. 2013; 38(11):2751–2760. [PubMed: 23934006]
- Johnson KA, Zvolensky MJ, Marshall EC, Gonzalez A, Abrams K, Vujanovic AA. Linkages between cigarette smoking outcome expectancies and negative emotional vulnerability. *Addictive behaviors*. 2008; 33(11):1416–1424. [PubMed: 18550294]
- Kassel JD, Evatt DP, Greenstein JE, Wardle MC, Yates MC, Veilleux JC. The acute effects of nicotine on positive and negative affect in adolescent smokers. *Journal of abnormal psychology*. 2007; 116(3):543. [PubMed: 17696710]
- Kassel JD, Stroud LR, Paronis CA. Smoking, stress, and negative affect: correlation, causation, and context across stages of smoking. *Psychological bulletin*. 2003; 129(2):270. [PubMed: 12696841]
- Larsen RJ, Prizmic Z. *Affect regulation*. 2004
- Lee HY, Lin HC, Seo DC, Lohrmann DK. Determinants associated with E-cigarette adoption and use intention among college students. *Addictive behaviors*. 2017; 65:102–110. [PubMed: 27816034]
- Lee Y, Hebert CJ, Nonnemaker JM, Kim AE. Multiple tobacco product use among adults in the United States: cigarettes, cigars, electronic cigarettes, hookah, smokeless tobacco, and snus. *Preventive Medicine*. 2014; 62:14–19. [PubMed: 24440684]
- Lee Y, Hebert CJ, Nonnemaker JM, Kim AE. Youth tobacco product use in the United States. *Pediatrics*. 2015; 135(3):409–415. [PubMed: 25647680]
- Lejuez C, Aclin WM, Bornovalova MA, Moolchan ET. Differences in risk-taking propensity across inner-city adolescent ever-and never-smokers. *Nicotine & Tobacco Research*. 2005; 7(1):71–79. [PubMed: 15804679]
- Leventhal AM, Chasson GS, Tapia E, Miller EK, Pettit JW. Measuring hedonic capacity in depression: a psychometric analysis of three anhedonia scales. *Journal of clinical psychology*. 2006; 62(12): 1545–1558. [PubMed: 17019674]

- Leventhal AM, Strong DR, Sussman S, Kirkpatrick MG, Unger JB, Barrington-Trimis JL, Audrain-McGovern J. Psychiatric comorbidity in adolescent electronic and conventional cigarette use. *J Psychiatr Res.* 2016; 73:71–78. DOI: 10.1016/j.jpsychires.2015.11.008 [PubMed: 26688438]
- Leventhal AM, Zvolensky MJ. Anxiety, depression, and cigarette smoking: a transdiagnostic vulnerability framework to understanding emotion-smoking comorbidity. *Psychol Bull.* 2015; 141(1):176–212. DOI: 10.1037/bul0000003 [PubMed: 25365764]
- Lilienfeld SO, Hess TH. Psychopathic personality traits and somatization: Sex differences and the mediating role of negative emotionality. *Journal of Psychopathology and Behavioral Assessment.* 2001; 23(1):11–24.
- Malouff JM, Thorsteinsson EB, Schutte NS. The five-factor model of personality and smoking: A meta-analysis. *Journal of Drug Education.* 2006; 36(1):47–58. [PubMed: 16981639]
- Maziak W. The waterpipe: an emerging global risk for cancer. *Cancer epidemiology.* 2013; 37(1):1–4. [PubMed: 23196170]
- Miller J, Flory K, Lynam D, Leukefeld C. A test of the four-factor model of impulsivity-related traits. *Personality and individual differences.* 2003; 34(8):1403–1418.
- Munafò MR, Zettler JI, Clark TG. Personality and smoking status: A meta-analysis. *Nicotine & Tobacco Research.* 2007; 9(3):405–413. [PubMed: 17365772]
- Myers MG, Aarons GA, Tomlinson K, Stein MB. Social anxiety, negative affectivity, and substance use among high school students. *Psychology of Addictive Behaviors.* 2003; 17(4):277. [PubMed: 14640823]
- Palmgreen P, Donohew L. Impact of SENTAR on prevention campaign policy and practice. *Health communication.* 2010; 25(6–7):609–610. [PubMed: 20845164]
- Pokhrel P, Little MA, Fagan P, Muranaka N, Herzog TA. Electronic cigarette use outcome expectancies among college students. *Addictive behaviors.* 2014; 39(6):1062–1065. [PubMed: 24630824]
- Sargent JD, Tanski S, Stoolmiller M, Hanewinkel R. Using sensation seeking to target adolescents for substance use interventions. *Addiction.* 2010; 105(3):506–514. [PubMed: 20402995]
- Shiffman S, Paty JA, Kassel JD, Gnys M, Zettler-Segal M. Smoking behavior and smoking history of tobacco chippers. *Experimental and Clinical Psychopharmacology.* 1994; 2(2):126.
- Snaith R, Hamilton M, Morley S, Humayan A, Hargreaves D, Trigwell P. A scale for the assessment of hedonic tone the Snaith-Hamilton Pleasure Scale. *The British Journal of Psychiatry.* 1995; 167(1): 99–103. [PubMed: 7551619]
- 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 K, Berg CJ, Thomas AN, Glantz SA, Ahluwalia JS. Factors associated with small cigar use among college students. *American journal of health behavior.* 2013; 37(3):325–333. [PubMed: 23985179]
- 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
- Timberlake D. Are smokers receptive to using smokeless tobacco as a substitute? *Preventive Medicine.* 2009; 49:229–232. DOI: 10.1016/j.yjmed.2009.07.012 [PubMed: 19631684]
- Vardavas CI, Anagnostopoulos N, Kougias M, Evangelopoulou V, Connolly GN, Behrakis PK. Short-term pulmonary effects of using an electronic cigarette: impact on respiratory flow resistance, impedance, and exhaled nitric oxide. *Chest Journal.* 2012; 141(6):1400–1406.
- Wagner MK. Behavioral characteristics related to substance abuse and risk-taking, sensation-seeking, anxiety sensitivity, and self reinforcement. *Addictive behaviors.* 2001; 26(1):115–120. [PubMed: 11196285]
- Waller NG, Tellegen A, McDonald RP, Lykken DT. Exploring nonlinear models in personality assessment: Development and preliminary validation of a negative emotionality scale. *Journal of Personality.* 1996; 64(3):545–576.

- Weinstein SM, Mermelstein RJ. Influences of mood variability, negative moods, and depression on adolescent cigarette smoking. *Psychology of Addictive Behaviors*. 2013; 27(4):1068. [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 psychology*. 2004; 23(2):168. [PubMed: 15008662]
- Wong EC, Haardörfer R, Windle M, Berg CJ. Distinct Motives for Use Among Polytabacco Versus Cigarette Only Users and Among Single Tobacco Product Users. *Nicotine & Tobacco Research*. 2016 ntw284.
- Zuckerman, M. *Neurobiology of exceptionalism*. Springer; 2005. The neurobiology of impulsive sensation seeking: genetics, brain physiology, biochemistry and neurology; p. 31-52.

Highlights

- Young adults with traits related to affect regulation may use OTPs more frequently
- Those who reported greater sensation seeking reported more frequent OTP use
- Greater lack of premeditation was associated with more frequent OTP use
- It may be useful to examine use of OTPs both collectively and individually.

Table 1

Demographic and clinical characteristics.

Variable	Proportion or Mean (SD)
N	518
Age	20.5 (1.8)
Sex, % male	50.6%
Race/ethnicity, % Caucasian	48.8%
Student status, % full time student	60.0%
Cigarette smoking days in past 2 weeks, baseline	5.5 (4.0)
OTP days in past 2 weeks, baseline	2.7 (4.2)
E-cigarette days in past 2 weeks, baseline	1.6 (3.4)
Hookah days in past 2 weeks, baseline	1.0 (2.4)
Cigar days in past 2 weeks, baseline	0.2 (0.9)
Lack of perseverance	8.0 (2.9)
Lack of premeditation	7.7 (2.9)
Sensation Seeking	11.4 (3.1)
Negative urgency	10.0 (2.9)
Positive urgency	8.7 (2.8)
Anhedonia	22.4 (7.2)
Negative affectivity	10.7 (6.0)

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 2

Sensation seeking and lack of premeditation predict frequency of OTP use over time.

Predictor	Coefficient	Standard Error	IRR (95% ci)
Sex	0.67	0.12	1.95 (1.54, 2.45)
Race	-0.05	0.05	0.95 (0.86, 1.05)
Student status	0.02	0.12	1.02 (0.81, 1.28)
Days completed	0.02	0.01	1.02 (0.99, 1.05)
Cigarette days	0.05	0.01	1.05 (1.03, 1.08)
Time	-0.17	0.04	0.84 (0.78, 0.91)
Lack of perseverance	-0.02	0.03	0.98 (0.93, 1.04)
Lack of premeditation	0.07	0.03	1.07 (1.01, 1.13)
Sensation Seeking	0.04	0.02	1.04 (1.00, 1.08)
Negative urgency	-0.03	0.02	0.98 (0.93, 1.02)
Positive urgency	0.03	0.02	1.03 (0.99, 1.08)
Anhedonia	0.01	0.01	1.01 (1.00, 1.03)
Negative affectivity	-0.01	0.01	0.99 (0.97, 1.01)

Table 3

Negative binomial model predicting individual product use over time.

Predictor	Coefficient	Standard Error	IRR (95% ci)
E-cigarettes			
Lack of premeditation	0.08	0.04	1.09 (1.01, 1.17)
Hookah			
Lack of premeditation	0.12	0.04	1.12 (1.05, 1.21)
Anhedonia	0.04	0.01	1.04 (1.02, 1.06)
Negative affectivity	-0.04	0.01	0.96 (0.94, 0.99)
Cigars			
Positive urgency	0.08	0.04	1.09 (1.00, 1.18)

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript