Published in final edited form as:

Addict Behav. 2018 March ; 78: 67–73. doi:10.1016/j.addbeh.2017.11.008.

Development and Initial Testing of the Brief Adolescent Smoking Curiosity Scale (ASCOS)

Georges E Khalil^{a,*}, Karen S Calabro^a, and Alexander V Prokhorov^a

^aThe University of Texas MD Anderson Cancer Center Department of Behavioral Science 1155 Pressler, Unit 1330, Houston, Texas 77030

Abstract

Background—Although the reasons behind tobacco smoking at young age are complex, research has identified curiosity as a potent driver of smoking among adolescents.

Objective—The objective of the current study is to develop and provide initial evidence of reliability and validity of a short scale assessing smoking curiosity among adolescents (first measure of its kind). In particular, we developed and tested the adolescent smoking curiosity scale (ASCOS).

Methods—After scale development, 101 adolescents completed a survey on smoking-related measures, including ASCOS (June to August, 2014). We conducted exploratory factor analysis and Cronbach's alpha calculation to inspect factor-structure and reliability. We conducted multiple linear regression models to examine the scale's capacity to predict antecedents of smoking initiation.

Results—Factor analysis supported a single-factor structure of smoking curiosity. ASCOS was internally reliable (Cronbach's alpha = 0.83). Controlling for demographics, the measure correlated significantly with temptation to try smoking ($\beta=0.41$, $p<0.01$), number of friends who smoke ($\beta=0.27$, $p<0.01$), agreeing with the pros of smoking ($\beta=0.41$, $p<0.001$), sensation seeking ($\beta=0.21$, $p<0.05$), and depression ($\beta=0.23$, $p<0.01$). When controlling for a single-item measure for smoking curiosity, ASCOS significantly predicted susceptibility to smoke cigarettes (OR=3.40, $p<0.05$) and cigars (OR=6.66, $p<0.01$).

*Corresponding Author: Georges E Khalil, The University of Texas MD Anderson Cancer Center Department of Behavioral Science 1155 Pressler, Unit 1330, Houston, Texas 77030, gekhalil@mdanderson.org.

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

Georges E Khalil is responsible for the design of the study; Alexander V Prokhorov provided guidance on the design of the study; Georges E Khalil was responsible for the data collection, acquisition, and analysis; Karen S Calabro participated in the data collection and implementation of the study procedure at research sites; Georges E Khalil, Alexander V Prokhorov, and Karen S Calabro contributed to the conceptualization and design of the paper; Georges E Khalil drafted the paper; Alexander V Prokhorov, and Karen S Calabro critically revised the paper. All authors read and approved the final version. Georges E Khalil had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Conflict of Interest

All authors declare that they have no conflicts of interest.

Conclusions—ASCOS presented good psychometric properties and passed initial validity-testing through associations with antecedents of smoking. ASCOS was a better predictor of susceptibility to smoke than did a traditional single-item measure used by previous research. As an implication, ASCOS can be crucial to the development of tailored interventions for smoking prevention that can reduce smoking curiosity.

Keywords

psychometrics; adolescents; smoking; nicotine/tobacco; curiosity; scale

1. Introduction

1.1. Background

Adolescents' cognitive development is at a stage of increased need for exploration of novel practices, including tobacco smoking (Dahl, 2004). While overall rates of cigarette smoking in the United States have decreased during the past 20 years, adolescents increased their use of a variety of tobacco products, including hookah (i.e., water pipes) and cigars (Miech, Johnston, O'Malley, Bachman, & Schulenberg, 2015, 2012). Although the reasons behind adolescent smoking initiation (i.e., starting to smoke on regular basis) are complex, research has identified curiosity as a common psychological phenomenon.

Curiosity has been conceptualized as one's intrinsic motivational system that is activated by a specific stimulus or activity with inherent uncertainty and novelty, and a motivation for exploratory behavior (Grossnickle, 2016; Kashdan, Rose, & Fincham, 2004). To adolescents, tobacco smoking can be a novel stimulus or activity that is open for exploration (Laucht, El-Faddagh, Hohm, & Schmidt, 2005). As a result, *smoking curiosity* involves the motivation to gain knowledge about smoking behavior as an experience, and the desire to explore the effects of smoking on one's senses (e.g., touch, smell, and mental consequences) (Litman, Collins, & Spielberger, 2005). Researchers have consistently supported such a definition of curiosity (Grossnickle, 2016). Early qualitative research has unveiled adolescents' curiosity to smoking. When asked about smoking behavior, adolescents have consistently reported feeling "curious" or "intrigued", how they "wondered" about smoking, and how they wanted to discover "what all the fuss was about" (DeLorme, Kreshel, & Reid, 2003; Kim, Kim, Kang, & Kim, 2010; Kingston, Rose, Cohen-Serrins, & Knight, 2017; Subramaniam et al., 2015). In addition, quantitative research has shown that smoking curiosity can predict adolescents' experimentation with different tobacco products, including cigarettes, cigars, and hookah (Labib et al., 2007; Nodora et al., 2014; Pierce, Distefan, Kaplan, & Gilpin, 2005; Stone, Audrain-McGovern, & Leventhal, 2017), and it is the most commonly reported reason for smoking initiation (Jawaid et al., 2008; Kim et al., 2010; Subramaniam et al., 2015).

Currently, there is no established measure for smoking curiosity. Studies examining curiosity have measured the concept with a single item such as: "Have you ever been curious about smoking a cigarette?" (Pierce et al., 2005). The item presents some benefits as it explicitly asks about smoking curiosity and simplifies measurement during repeated observations over time. However, the single item presents limitations, as it does not consider the complexity of

curiosity based on its definition. First, by being broad, the item does not consider the core descriptors of smoking curiosity, including motivation to gain knowledge and exploration of smoking sensations. Second, it only considers combustible cigarettes, despite adolescents' tendency to explore a variety of tobacco products (Miech et al., 2015, 2012). Given these limitations, it is essential to develop and test the validity and reliability of a measure for smoking curiosity among adolescents.

For validity-testing, it is important to consider how certain known predictors of smoking initiation correlate with a smoking curiosity scale. Some predictors identified by the literature include adolescents' susceptibility to smoke, decisional balance, temptation to try smoking, tendency for sensation seeking, and depression (Table 1) (Brick, Redding, Paiva, & Velicer, 2017; Case et al., 2017; Fluharty, Taylor, Grabski, & Munafò, 2016; Plummer et al., 2001).

First, susceptibility to smoke (i.e., intention to smoke and social influence to smoke) has been found to be the most potent predictor of adolescents' smoking initiation (Choi, Gilpin, Farkas, & Pierce, 2001; Nodora et al., 2014; Pierce, Choi, Gilpin, Farkas, & Merritt, 1996; Stone et al., 2017). In addition to cross-sectional associations between the two concepts, longitudinal research has shown that adolescents who exhibit curiosity to smoke are more likely to become susceptible to smoke (Pierce et al., 2005; Strong et al., 2014). Second, research has indicated that adolescents who agree with the pros of smoking are more likely to become smokers than adolescents who agree with the cons of smoking (Khazaei-Pool, Pashaei, Koen, Jafari, & Alizadeh, 2017; Plummer et al., 2001; Prochaska et al., 1994). Third, adolescents who are tempted to smoke at different situations have been found to be more likely to progress through the stages of smoking acquisition (Brick et al., 2017; Pallonen, Prochaska, Velicer, Prokhorov, & Smith, 1998; Plummer et al., 2001). Such a relationship can be supported by adolescents' curiosity, and one continuously reported tempting situation is when adolescents are curious about smoking (Pallonen et al., 1998; Plummer et al., 2001). In addition, adolescents who are predisposed to seek sensations are more likely to exhibit curiosity traits (Camp, Rodrigue, & Olson, 1984; Case et al., 2017), and ultimately engage in addictive behaviors (e.g., alcohol and tobacco use) (Case et al., 2017; Comeau, Stewart, & Loba, 2001). Finally, previous research has shown an association between *depression* and smoking initiation (Fluharty et al., 2016). With higher depressive symptoms, adolescents can become curious about depressive-reducing behaviors such as smoking (Kaczmarek, B. czkowski, Enko, Baran, & Theuns, 2014). The testing of such relationships may allow researchers to confirm the validity of a smoking curiosity scale (Table 1).

1.2. Objective

The objective of this study is to develop and provide initial evidence of reliability and validity of a short scale assessing smoking curiosity among adolescents: the adolescent smoking curiosity scale (ASCOS). We hypothesized that (1) ASCOS is an internally reliable single-factor scale, (2) ASCOS is associated with antecedents of smoking behavior, and (3) ASCOS has a stronger relationship with smoking susceptibility than the traditional single-item curiosity measure. Initial evidence of validity-testing is determined through

associations between ASCOS and antecedents of smoking initiation, and internal reliability is determined based on how strong the items agree to measure smoking curiosity.

2. Material and Methods

2.1. Participants and Procedure

Completion and testing of ASCOS was conducted through the baseline assessment for the ASPIRE Reactions randomized controlled trial (Khalil et al., 2017). The institutional review boards for human-subjects research at the MD Anderson Cancer Center and the University at Buffalo approved this study. Four after-school programs in Houston, Texas were randomly selected for recruitment. An announcement reached 509 adolescents, of whom 110 participated in the study. Eligibility criteria included being: 12 through 18 years old, students in middle school or high school, and nonsmokers (i.e., have not smoked in the past year, not even one cigarette, cigar, or hookah session).

A total of 101 adolescents were eligible (an acceptable sample size based on a subject-to-item ratio of 10-to1 (Costello & Osborne, 2005)). Participants signed consent forms and obtained parental permission. Participants completed a 20-minute survey on computers, in classrooms, with supervision from research assistants (June to August, 2014). They were offered a US \$15 gift card for participation.

2.2. Measures

The survey instrument was initially constructed by the research team, and administered to 10 adolescents for pilot-testing through one-on-one interviews. It was subsequently modified based on pilot-testing. The revised form was implemented in the current study. All survey measures were adapted from previous tobacco research. Items were 5-point Likert-type, and higher scores indicated greater endorsement of the statement, unless noted otherwise. The following measures were included in the survey.

2.2.1. The Adolescent Smoking Curiosity Scale—Following the conceptualization of smoking curiosity by previous research (DeLorme et al., 2003; Grossnickle, 2016; Kashdan et al., 2004; Nodora et al., 2014), we wrote 7 items covering the main characteristics of smoking curiosity (Table 2). We accounted for the complexity of smoking curiosity by explicitly designing items that tap on the intrinsic motivation to gain knowledge and the exploration of smoking senses. Considering the role of social influence on adolescent smoking, 2 items covered curiosity based on influence (items 6 and 7). We also designed the items to measure adolescents' curiosity to smoke three combustible tobacco products: cigarettes, cigars, and hookah. Items were worded to offer a relatively high average score on the Flesch reading ease (above 50.0) and relatively low average grade level on the Flesch–Kincaid readability grade level (sixth grade or lower). ASCOS items had the answer choices: *not at all*, *a little bit*, *somewhat*, *a lot*, and *very much*. The final score was computed as a mean score of all 7 items.

2.2.2. Susceptibility to Smoke—We assessed susceptibility to smoke using 2 items (Bogdanovica, McNeill, & Britton, 2017; Pierce et al., 1996): “Do you think that in the

future you might try smoking?” and “If one of your best friends were to offer you a cigarette, would you try it?” The 2 items were asked separately for cigarettes, cigars, and hookah, leading to a measure for each product. Answer choices were: *definitely not*, *probably not*, *maybe*, *probably yes*, and *definitely yes*. The 2 items significantly correlated for susceptibility to smoke cigarettes ($r = 0.76$, $p < 0.001$), cigars ($r = 0.66$, $p < 0.001$), and hookah ($r = 0.89$, $p < 0.001$). The final variable was dichotomous. For each product, an adolescent was considered susceptible to smoke when failing to answer *definitely not* to both items (Bogdanovica et al., 2017; Pierce et al., 1996). Otherwise, the adolescent was considered not susceptible.

2.2.3. Traditional curiosity measure—We included the single-item traditional measure of curiosity for each tobacco product: “Are you curious about smoking a cigarette?”, “Are you curious about smoking a cigar?”, and “Are you curious about smoking hookah?” (Leventhal et al., 2015; Pierce et al., 2005). Answer choices ranged from *definitely yes* to *definitely not*.

2.2.4. Other Antecedents of smoking—Other antecedents of smoking were measured using previously validated scales. Temptation to try smoking was assessed using 8 items from the scale developed by Velicer and colleagues (1990) and Ling and colleagues (1994). Answer choices ranged from *I am not at all tempted to try smoking* to *I am very tempted to try smoking* (Cronbach’s alpha = 0.94) (Paiva, Amoyal, Johnson, & Prochaska, 2014). Number of friends who smoke was assessed by asking “How many of your friends smoke?” (Shete & Wilkinson, 2017). Agreeing with the pros of smoking was measured using 5 items such as “People my age who smoke get more respect from others” (Cronbach’s alpha = 0.81). Agreeing with the cons of smoking was measured using 6 items such as “Smoking makes teeth yellow” (Cronbach’s alpha = 0.89). Both scales included answer choices ranging from *definitely disagree* to *definitely agree* (Krigel et al., 2017). Sensation seeking was measured using the validated scale from Arnett (1994). Six items were used, such as: “When I listen to music, I like it to be loud”. Answer choices ranged from *does not describe me at all* to *describes me very well* (Cronbach’s alpha = 0.78) (Sagoe, Andreassen, Molde, Torsheim, & Pallesen, 2015). Depression was measured using 6 items from the adolescent-form of the Centre for Epidemiological Studies Depression Scale (CES-D) (Cronbach’s alpha = 0.75) (Kolajova, 2016; Poulin, Hand, & Boudreau, 2005).

2.2.5. Additional survey measures—The survey asked about age, gender, race/ethnicity, the highest level of education of the mother, father, and/or legal guardian, smoking status of the father or male guardian and mother or female guardian, smoking status of any siblings, average school grades (A, B, C, D, or F), and number of detentions/suspensions obtained at school in the past year.

2.3. Statistical Analysis

Analyses were conducted using STATA 14. First, we calculated the Kaiser-Meyer-Olkin value to determine if the data were suitable for factor analysis (Tabachnick & Fidell, 1996). In order to determine the factor structure (hypothesis 1), we conducted a factor analysis with varimax rotation on the 7 items. Items were deemed acceptable with factor loadings of 0.40

or greater. We calculated the total ASCOS score by averaging the items (score ranged from 1 to 5).

We used Cronbach's alpha to determine internal reliability (hypothesis 1). In addition, seven Cronbach's alphas were computed when each of the seven ASCOS items was removed from the scale. Item-total correlations (correlations between each item and the total test score) allowed to confirm the internal consistency of the scale.

Validity-testing was conducted on the basis of associations between ASCOS and the following common antecedents of smoking behavior: susceptibility to smoke, temptation to try smoking, number of friends who smoke, agreeing with the pros of smoking, agreeing with the cons of smoking, sensation seeking, and depression (hypotheses 2). For each measured continuous predictor, multiple regression analysis was conducted to test if the predictor correlates with ASCOS. Also, a series of logistic regression models adjusting for multicollinearity were conducted to test hypothesis 3, with ASCOS and the single-item curiosity measure as predictors of susceptibility to smoke cigarettes, cigars, and hookah. All models controlled for participant characteristics that are found to be related to smoking curiosity. The Huber/White sandwich estimator was used to correct all variance estimates for heteroskedasticity.

3. Results

3.1. Participants

Table 3 presents respondents' socio-demographic characteristics. There was a marginal significant difference between age groups $F(2, 98) = 2.60, p = 0.08$, and genders $F(1, 100) = 3.10, p = 0.08$, with respect to smoking curiosity. There were no significant differences in other characteristics with respect to smoking curiosity. Results from Table 3 agree with the results from previous research (Portnoy, Wu, Tworek, Chen, & Borek, 2014). Approximately 56% of participants were male, and the majority (85.1%) were of Hispanic or African-American ethnicity (Table 3). All participants in this study completed ASCOS ($M=1.76, SD=0.79$). The average scores for ASCOS items ranged between 1.42 and 2.49.

3.2. Factorial Structure and Reliability of ASCOS

ASCOS exhibited a single factor structure, supporting hypothesis 1 (Table 4). Item 3 ("What effect it would have on me") loaded lowest at 0.51, and item 4 ("How the product feels") loaded highest at 0.90. Factor loadings for all items were greater than 0.40, which allowed us to retain all items. The single-factor structure explained 96.31% of the variance.

ASCOS showed relatively high internal reliability, with a Cronbach's alpha of 0.83 (Table 4). Cronbach's alpha could not be improved by dropping any of the items. Cronbach's alpha remains the same by dropping Item 3 or Item 7. Item-total correlation indicated relatively high correlations between each item and the total score, with the lowest correlation being 0.66 (Item 3).

3.3. Validity of ASCOS

Overall, multiple regression models controlling for demographics, indicated that all considered antecedents of smoking predict ASCOS, except for agreeing with the cons of smoking (Table 5).

3.4. Scale Comparative Validity

Logistic regression models indicated that both ASCOS and the single-item curiosity to smoke cigarettes predict separately susceptibility to smoke cigarettes (Models 1 and 2; Table 6). However, when both measures are in the model, only ASCOS predicts susceptibility to smoke cigarettes, and explains 21% of the variance (Model 3A). Similar results are obtained when predicting susceptibility to smoke cigars. When both measures are in the model, only ASCOS predicts susceptibility to smoke cigars, and explains 30% of the variance (Model 3B). Both ASCOS and the single-item curiosity to smoke hookah predicted separately susceptibility to smoke hookah (Table 6). When both measures are in the same model, the relationship between the single-item measure and susceptibility maintains significance, with 31% of the variance explained (Model 3C). However, the relationship between ASCOS and susceptibility becomes marginal (Table 6).

4. Discussion

The current study is the first to develop and test a scale (ASCOS) that measures adolescent smoking curiosity. ASCOS was theoretically informed and proved to be appropriate for adolescent report. Unlike the traditional single-item curiosity measure, ASCOS takes advantage of several indicators of curiosity, including general interest, intrinsic motivation to try a product, the exploration of smoking senses and effects, and social factors. Overall, ASCOS: (1) is a reliable single-factor scale, (2) is associated with antecedents of smoking behavior, and (3) has a stronger relationship with smoking susceptibility than the traditional single-item measure.

While ASCOS presents different aspects of adolescent smoking curiosity, it still holds a single-factor structure, with acceptable factor loadings for all items (i.e., above 0.40). ASCOS also showed acceptable internal reliability, with a Cronbach's alpha of 0.83. Dropping any individual item does not increase alpha value, indicating that researchers can apply ASCOS with all its items.

Despite the stable single-factor structure, some items may form separate novel and promising indicators of smoking curiosity. While presenting acceptable loading scores, items 3 (What effect it would have on me), 6 (What people would think of me), and 7 (Why other people like smoking) loaded lowest during factor analysis (i.e., between 0.50 and 0.60). Items 6 and 7 describe curiosity about social factors, and item 3 describes curiosity about smoking effects. On the other hand, the remaining items describe curiosity about the product and the act of smoking in general. As a result, with additional items on smoking effects and social factors, factor analysis may result in new dimensions of curiosity. Future research can make use of the current findings in order to advance ASCOS by testing a wide

range of items and reach a final version that involves several dimensions. Nevertheless, the current ASCOS has proven to be a reliable brief measure.

Validity-testing indicated that ASCOS is associated with antecedents of smoking, including temptation to try smoking, number of friends who smoke, agreeing with the pros of smoking, sensation seeking, and depression. Agreeing with the cons of smoking was not significantly related to ASCOS. This may be explained by the fundamental conceptualization of decisional balance. Adolescents' agreement with the cons of smoking is indicative of a negative attitude toward smoking. However, negative attitude does not necessarily negate a state of curiosity. On the other hand, agreeing with the pros of smoking involves support for the behavior, which can facilitate curiosity. Further research on such relationships may allow the building of conceptual pathways that highlight the role of curiosity in smoking prevention.

Further validity-testing was conducted by inspecting the relationship between ASCOS and susceptibility to smoke; the closest predictor of smoking initiation (Bogdanovica et al., 2017; Choi et al., 2001; Nodora et al., 2014). Overall, ASCOS had a stronger relationship with susceptibility than the traditional single-item curiosity measure. This result was confirmed for susceptibility to smoke cigarettes and cigars, but not hookah. When controlling for the single-item measure, ASCOS exhibited marginal relationship with susceptibility to smoke hookah. This relationship was significant when the model did not adjust for multicollinearity. Nevertheless, it is crucial for future research to examine smoking curiosity to hookah, considering the relative novelty of the product in the United States. Future work may consider adding the single-item measure to ASCOS, and check if it would boost the scale's predictive power. Also, future work can examine test-retest reliability and conduct stronger validity-testing by inspecting associations with smoking behavior.

One advantage of ASCOS is that it measures curiosity to all three combustible products (i.e., cigarettes, cigars, and hookah) at the same time. As a result, the scale can capture overall curiosity level regardless of the product. Nonetheless, in the future, we plan to apply ASCOS as a measure of curiosity for each product individually. This will allow us to further validate the scale for each product. Also, considering the increased use of novel nicotine delivery systems (e.g., electronic-cigarettes), the expansion of the scale to such addictive behaviors may be valuable.

One limitation of self-report instruments is the hesitation some respondents may have in using extreme values in a Likert-type scale. This is particularly the case for tobacco use among adolescents, considering the legal concerns in the United States (Curti, Shang, Ridgeway, Chaloupka, & Fong, 2015). In the current study, none of the participants reported extreme curiosity levels (i.e., greater than 4 out of 5). This is expected with smoking curiosity (Portnoy et al., 2014). While, our analyses have corrected for heteroskedasticity, future research may consider novel approaches to coding ASCOS in order to correct for this skewness. For instance, researchers may test the psychometrics of a dichotomous version of ASCOS. ASCOS can also benefit from further testing with a larger adolescent population.

Nevertheless, in demographics, the current adolescent sample is representative of the larger adolescent population in Houston (Kann, 2016).

Finally, we hope that researchers and practitioners will find ASCOS to be easy to administer and useful as an assessment tool for smoking curiosity. Measures of critical constructs such as ASCOS are crucial to the development of tailored interventions. By applying ASCOS, researchers can design smoking prevention programs that may reduce smoking curiosity. Through longitudinal trials, smoking curiosity can be assessed over time, in order to intervene at the right time. Also, practitioners working with adolescents at-risk of smoking can use ASCOS to detect meaningful curiosity levels, and ultimately take necessary steps to reduce curiosity. Notably, the relatively short form of ASCOS is practical as opposed to long scales that can burden adolescent respondents and be difficult to interpret. ASCOS can facilitate the accurate assessment of each adolescent and allows the design of an intervention that is appropriate to their needs. In particular, practitioners do not only learn about the extent of curiosity, but they can also identify the kind of curiosity that is unique to the adolescent (e.g., general interest, exploration of the senses, interest in smoking effects, and social curiosity). With such information on hand, it becomes possible to take tailored actions for smoking prevention.

Acknowledgments

The authors wish to thank the advising committee from the University at Buffalo, the State University of New York (Buffalo, New York) for their contributions to the success of this study, including Hua Wang, PhD, Mark Frank, PhD, and Lance Rintamaki, PhD.

Role of Funding Sources

Research reported in this publication was supported by the National Cancer Institute of the National Institutes of Health under Award Number R25CA057730 (Principal Investigator: Shine Chang, PhD) and by the Cancer Center Support Grant CA016672 (Principal Investigator: Ronald DePinho, MD). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

References

- Arnett J. Sensation seeking: A new conceptualization and a new scale. *Personality and Individual Differences*. 1994; 16(2):289–296. DOI: 10.1016/0191-8869(94)90165-1
- Bogdanovica I, McNeill A, Britton J. Cohort study investigating the effects of first stage of the English tobacco point-of-sale display ban on awareness, susceptibility and smoking uptake among adolescents. *BMJ Open*. 2017; 7(1):e012451.doi: 10.1136/bmjopen-2016-012451
- Brick LA, Redding CA, Paiva AL, Velicer WF. Intervention effects on stage transitions for adolescent smoking and alcohol use acquisition. *Psychology of Addictive Behaviors*. 2017; 31(5):614.doi: 10.1037/adb0000302 [PubMed: 28714725]
- Camp CJ, Rodrigue JR, Olson KR. Curiosity in young, middle-aged, and older adults. *Educational Gerontology*. 1984; 10(5):387–400. DOI: 10.1080/0380127840100504
- Case KR, Harrell MB, Pérez A, Loukas A, Wilkinson AV, Springer AE, Perry CL. The relationships between sensation seeking and a spectrum of e-cigarette use behaviors: Cross-sectional and longitudinal analyses specific to Texas adolescents. *Addictive Behaviors*. 2017; 73:151–157. DOI: 10.1016/j.addbeh.2017.05.007 [PubMed: 28521240]
- Choi WS, Gilpin EA, Farkas AJ, Pierce JP. Determining the probability of future smoking among adolescents. *Addiction*. 2001; 96(2):313–323. DOI: 10.1046/j.1360-0443.2001.96231315.x [PubMed: 11182877]

- Comeau N, Stewart SH, Loba P. The relations of trait anxiety, anxiety sensitivity, and sensation seeking to adolescents' motivations for alcohol, cigarette, and marijuana use. *Addictive Behaviors*. 2001; 26(6):803–825. DOI: 10.1016/S0306-4603(01)00238-6 [PubMed: 11768546]
- Costello AB, Osborne JW. Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation*. 2005; 10(7):1–9.
- Curti D, Shang C, Ridgeway W, Chaloupka FJ, Fong GT. The use of legal, illegal and roll-your-own cigarettes to increasing tobacco excise taxes and comprehensive tobacco control policies: findings from the ITC Uruguay survey. *Tobacco Control*. 2015; 24(3):17–24. DOI: 10.1136/tobaccocontrol-2014-051890
- Dahl RE. Adolescent brain development: a period of vulnerabilities and opportunities. Keynote address. *Annals of the New York Academy of Sciences*. 2004; 1021(1):1–22. DOI: 10.1196/annals.1308.001 [PubMed: 15251869]
- DeLorme DE, Kreshel PJ, Reid LN. Lighting up young adults' autobiographical accounts of their first smoking experiences. *Youth & Society*. 2003; 34(4):468–496. DOI: 10.1177/0044118X03034004004
- Ding L, Pallonen U, Migneault J, Velicer W. Development of a measure to assess adolescents' temptation to smoke. *Annals of Behavioral Medicine*. 1994; 16:S175.
- Fluharty M, Taylor AE, Grabski M, Munafò MR. The association of cigarette smoking with depression and anxiety: a systematic review. *Nicotine & Tobacco Research*. 2016; 19(1):3–13. DOI: 10.1093/ntr/ntw140 [PubMed: 27199385]
- Grossnickle EM. Disentangling curiosity: Dimensionality, definitions, and distinctions from interest in educational contexts. *Educational Psychology Review*. 2016; 28(1):23–60. DOI: 10.1007/s10648-014-9294-y
- Jawaid A, Zafar A, Rehman T, Nazir M, Ghafoor Z, Afzal O, Khan J. Knowledge, attitudes and practice of university students regarding waterpipe smoking in Pakistan. *The International Journal of Tuberculosis and Lung Disease*. 2008; 12(9):1077–1084. [PubMed: 18713508]
- Kaczmarek ŁD, B czkowski B, Enko J, Baran B, Theuns P. Subjective well-being as a mediator for curiosity and depression. *Polish Psychological Bulletin*. 2014; 45(2):200–204. DOI: 10.2478/ppb-2014-0025
- Kann L. Youth risk behavior surveillance—United States, 2015. *MMWR Surveillance Summaries*. 2016; 65doi: 10.15585/mmwr.ss6506a1
- Kashdan TB, Rose P, Fincham FD. Curiosity and exploration: Facilitating positive subjective experiences and personal growth opportunities. *Journal of Personality Assessment*. 2004; 82(3): 291–305. DOI: 10.1207/s15327752jpa8203_05 [PubMed: 15151805]
- Khalil GE, Wang H, Calabro KS, Mitra N, Shegog R, Prokhorov AV. From the experience of interactivity and entertainment to lower intention to smoke: A randomized controlled trial and path analysis of a web-based smoking prevention program for adolescents. *Journal of Medical Internet Research*. 2017; 19(2)doi: 10.2196/jmir.7174
- Khazaei-Pool M, Pashaei T, Koen P, Jafari F, Alizadeh R. Decisional balance inventory (dbi) adolescent form for smoking: Psychometric properties of the Persian version. *BMC Public Health*. 2017; 17(1):507.doi: 10.1186/s12889-017-4425-2 [PubMed: 28545471]
- Kim YH, Kim KW, Kang MO, Kim NH. A phenomenological study on smoking experience in female adolescents. *Child Health Nursing Research*. 2010; 16(1):10–19. DOI: 10.4094/jkachn.2010.16.1.10
- Kingston S, Rose M, Cohen-Serrins J, Knight E. A qualitative study of the context of child and adolescent substance use initiation and patterns of use in the first year for early and later initiators. *PLoS one*. 2017; 12(1):e0170794. DOI: doi.org/10.1371/journal.pone.0170794. [PubMed: 28122018]
- Kolajova, M. Faculty of Graduate Studies Online Theses. Dalhousie University; 2016. Non-medical prescription opioid use among high-school adolescents in atlantic canada. 2018
- Krigel SW, Grobe JE, Goggin K, Harris KJ, Moreno JL, Catley D. Motivational interviewing and the decisional balance procedure for cessation induction in smokers not intending to quit. *Addictive Behaviors*. 2017; 64:171–178. DOI: 10.1016/j.addbeh.2016.08.036 [PubMed: 27619008]

- Labib N, Radwan G, Mikhail N, Mohamed MK, El Setouhy M, Loffredo C, Israel E. Comparison of cigarette and water pipe smoking among female university students in Egypt. *Nicotine & Tobacco Research*. 2007; 9(5):591–596. DOI: 10.1080/14622200701239696 [PubMed: 17454715]
- Laucht M, El-Faddagh M, Hohm E, Schmidt MH. Association of the DRD4 exon III polymorphism with smoking in fifteen-year-olds: a mediating role for novelty seeking? *Journal of the American Academy of Child & Adolescent Psychiatry*. 2005; 44(5):477–484. DOI: 10.1097/01.chi.0000155980.01792.7f [PubMed: 15843770]
- Leventhal AM, Strong DR, Kirkpatrick MG, Unger JB, Sussman S, Riggs NR, Audrain-McGovern J. Association of electronic cigarette use with initiation of combustible tobacco product smoking in early adolescence. *JAMA*. 2015; 314(7):700–707. DOI: 10.1001/jama.2015.8950 [PubMed: 26284721]
- Litman JA, Collins RP, Spielberger CD. The nature and measurement of sensory curiosity. *Personality and Individual Differences*. 2005; 39(6):1123–1133. DOI: 10.1016/j.paid.2005.05.001
- Miech, RA., Johnston, LD., O'Malley, PM., Bachman, JG., Schulenberg, JE. Monitoring the Future national survey results on drug use, 1975– 2014: Volume I, Secondary school students. 2015. Retrieved from <http://monitoringthefuture.org/pubs.html#monograp>
- National Institute on Drug Abuse. NIDA infofacts: High school and youth trends. 2012. Retrieved from <http://www.drugabuse.gov/related-topics/trends-statistics/monitoring-future/trends-in-prevalence-various-drugs>
- Nodora J, Hartman SJ, Strong DR, Messer K, Vera LE, White MM, Pierce JP. Curiosity predicts smoking experimentation independent of susceptibility in a US national sample. *Addictive Behaviors*. 2014; 39(12):1695–1700. DOI: 10.1016/j.addbeh.2014.06.002 [PubMed: 25117844]
- Paiva AL, Amoyal NR, Johnson JL, Prochaska JO. Adolescent substance use initiation: Correlates of the profiles of prevention. *The Journal of Early Adolescence*. 2014; 34(8):1033–1057. DOI: 10.1177/0272431613519497
- Pallonen UE, Prochaska JO, Velicer WF, Prokhorov AV, Smith NF. Stages of acquisition and cessation for adolescent smoking: an empirical integration. *Addictive Behaviors*. 1998; 23(3):303–324. DOI: 10.1016/S0306-4603(97)00074-9 [PubMed: 9668929]
- Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Merritt RK. Validation of susceptibility as a predictor of which adolescents take up smoking in the United States. *Health Psychology*. 1996; 15(5):355. doi: 10.1037/0278-6133.15.5.355 [PubMed: 8891714]
- Pierce JP, Distefan JM, Kaplan RM, Gilpin EA. The role of curiosity in smoking initiation. *Addictive Behaviors*. 2005; 30(4):685–696. DOI: 10.1016/j.addbeh.2004.08.014 [PubMed: 15833574]
- Plummer BA, Velicer WF, Redding CA, Prochaska JO, Rossi JS, Pallonen UE, Meier KS. Stage of change, decisional balance, and temptations for smoking: Measurement and validation in a large, school-based population of adolescents. *Addictive Behaviors*. 2001; 26(4):551–571. DOI: 10.1016/S0306-4603(00)00144-1 [PubMed: 11456077]
- Portnoy DB, Wu CC, Tworek C, Chen J, Borek N. Youth curiosity about cigarettes, smokeless tobacco, and cigars: prevalence and associations with advertising. *American Journal of Preventive Medicine*. 2014; 47(2):S76–S86. DOI: 10.1016/j.amepre.2014.04.012 [PubMed: 25044199]
- Poulin C, Hand D, Boudreau B. Validity of a 12-item version of the CES-D [Centre for Epidemiological Studies Depression scale] used in the National Longitudinal Study of Children and Youth. *Chronic Diseases and Injuries in Canada*. 2005; 26(2–3):65.
- Prochaska JO, Velicer WF, Rossi JS, Goldstein MG, Marcus BH, Rakowski W, Rosenbloom D. Stages of change and decisional balance for 12 problem behaviors. *Health Psychology*. 1994; 13(1): 39. doi: 10.1037/0278-6133.13.1.39 [PubMed: 8168470]
- Sagoe D, Andreassen CS, Molde H, Torsheim T, Pallesen S. Prevalence and correlates of anabolic–androgenic steroid use in a nationally representative sample of 17-year-old Norwegian adolescents. *Substance Use & Misuse*. 2015; 50(2):139–147. DOI: 10.3109/10826084.2014.958859 [PubMed: 25265519]
- Shete SS, Wilkinson AV. Identifying demographic and psychosocial factors related to the escalation of smoking behavior among Mexican American adolescents. *Preventive Medicine*. 2017; 99:146–151. DOI: 10.1016/j.ypmed.2017.02.018 [PubMed: 28235542]

- Stone MD, Audrain-McGovern J, Leventhal AM. Association of anhedonia with adolescent smoking susceptibility and initiation. *Nicotine & Tobacco Research*. 2017; 19(6):738–742. DOI: 10.1093/ntr/ntw177 [PubMed: 28486706]
- Strong DR, Hartman SJ, Nodora J, Messer K, James L, White M, Pierce J. Predictive validity of the expanded susceptibility to smoke index. *Nicotine & Tobacco Research*. 2014; 17(7):862–869. DOI: 10.1093/ntr/ntu254 [PubMed: 25481915]
- Subramaniam M, Shahwan S, Fauziana R, Satghare P, Picco L, Vaingankar JA, Chong SA. Perspectives on smoking initiation and maintenance: a qualitative exploration among Singapore youth. *International Journal of Environmental Research and Public Health*. 2015; 12(8):8956–8970. DOI: 10.3390/ijerph120808956 [PubMed: 26264011]
- Tabachnick, BG., Fidell, LS. *Using multivariate statistics*. 3. New York, NY: HarperCollins College Publishers; 1996.
- Velicer WF, Diclemente CC, Rossi JS, Prochaska JO. Relapse situations and self-efficacy: An integrative model. *Addictive Behaviors*. 1990; 15(3):271–283. DOI: 10.1016/0306-4603(90)90070-E [PubMed: 2378287]

Highlights

- Overall, ASCOS is a reliable single-factor measure of smoking curiosity.
- Validity-testing indicated that ASCOS is associated with antecedents of smoking.
- ASCOS is a better predictor of susceptibility than the single-item measure.

Table 1

Common predictors of adolescent smoking initiation

Predictors	Description	References
Susceptibility to smoke	This is an index to identify adolescents who are predisposed to smoke. It is measured based on intention to smoke and social influence.	(Nodora et al., 2014; Pierce et al., 1996; Stone et al., 2017)
Agreeing with the pros of smoking	This is a dimension of the decisional balance concept that indicates support for the reasons to smoke and the benefits of smoking.	(Khazaee-Pool et al., 2017; Plummer et al., 2001; Prochaska et al., 1994).
Agreeing with the cons of smoking	This is a dimension of the decisional balance concept that indicates a support for the reasons not to smoke and the disadvantage of smoking.	(Khazaee-Pool et al., 2017; Plummer et al., 2001; Prochaska et al., 1994).
Temptation to try smoking	This is a measure of how tempted adolescents are to try smoking during high-risk situations (e.g., when stressed and while with friends at a party).	(Brick et al., 2017; Pallonen et al., 1998; Plummer et al., 2001).
Sensation seeking	This is a trait indicating individuals' tendency to pursue sensory pleasure and excitement, by seeking novelty, complexity, and intense sensations. Sensation seekers love experience for its own sake, and may take risks in the pursuit of such experience.	(Camp et al., 1984; Case et al., 2017)
Depression	This is a psychiatric illness characterized by a series of symptoms such as depressed mood or loss of interest or pleasure.	(Kaczmarek et al., 2014)

Table 2

Items for the adolescent smoking curiosity scale (ASCOS), ASCOS components, and readability scores

Items	Ease ^a	Grade ^b	Main components	References
1. I <i>want to know</i> how a cigarette, a cigar, or a hookah <i>tastes</i> .	89.0	4.9	Intrinsic motivation; need for knowledge; explore senses	(Grossnickle, 2016; Kashdan et al., 2004; Litman et al., 2005)
2. I am <i>interested in knowing</i> how smoking <i>feels</i> .	61.2	6.7	Intrinsic motivation; need for knowledge; explore senses	(Grossnickle, 2016; Kashdan et al., 2004; Litman et al., 2005)
3. I am <i>interested in knowing</i> what <i>effect</i> smoking would have on me.	67.7	6.7	Intrinsic motivation; need for knowledge; explore consequences (e.g., physical)	(Grossnickle, 2016; Kashdan et al., 2004; Litman et al., 2005)
4. I <i>want to know</i> how a cigarette, a cigar, or a hookah <i>feels</i> .	83.0	4.9	Intrinsic motivation; need for knowledge; explore senses	(Grossnickle, 2016; Kashdan et al., 2004; Litman et al., 2005)
5. I am <i>curious to know</i> what is <i>special</i> about smoking.	69.7	6.0	Need for knowledge; inherent novelty	(DeLorme, Kreshel, & Reid, 2003; Grossnickle, 2016; Kashdan et al., 2004; Kim, Kim, Kang, & Kim, 2010)
6. I am <i>interested in knowing</i> what <i>other people</i> would think of me if I tried smoking.	68.9	7.6	Intrinsic motivation; need for knowledge; social influence	(Grossnickle, 2016; Kashdan, Rose, & Fincham, 2004; Nodora et al., 2014; Pierce, Choi, Gilpin, Farkas, & Merritt, 1996; Stone et al., 2017)
7. I am <i>curious to know</i> why <i>other people</i> like smoking.	69.7	6.0	Intrinsic motivation; need for knowledge; social influence	(Grossnickle, 2016; Kashdan, Rose, & Fincham, 2004; Nodora et al., 2014; Pierce, Choi, Gilpin, Farkas, & Merritt, 1996; Stone et al., 2017)
Average readability scores	73.2	5.9		

Note.

^aIndicates the Flesch reading ease score.

^bIndicates the Flesch–Kincaid readability grade level. Answer choices were not at all, a little bit, somewhat, a lot, and very much.

Table 3

Participant characteristics, N = 101

Characteristics	Distribution, n (%)	ASCOS ^a , M (SD)	P value ^b
ASCOS score		–	–
1 – < 2	61 (60.8)		
1.2 – < 3	31 (30.4)		
3 – < 4	9 (8.8)		
4 – 5	0 (0.0)		
Age range, years			
12–13	64 (63.2)	1.89 (0.86)	.08
14–15	29 (28.7)	1.61 (0.62)	
16–17	8 (7.9)	1.34 (0.56)	
Gender			
Male	58 (56.8)	1.64 (0.74)	.08
Female	44 (43.5)	1.91 (0.84)	
Race/ethnicity			
Hispanic or African American	86 (85.1)	1.79 (0.76)	.53
Non-Hispanic, non–African American	15 (14.8)	1.65 (0.97)	
Educational level of mother			
High school or less	39 (39.0)	1.86 (0.77)	.41
College or more	61 (61.0)	1.72 (0.81)	
Educational level of father			
High school or less	52 (54.1)	1.78 (0.76)	.97
College or more	44 (45.8)	1.79 (0.85)	
Educational level of legal guardian			
High school or less	21 (33.3)	1.75 (0.60)	.54
College or more	42 (66.6)	1.63 (0.77)	
Smoking status of mother/female guardian			
Smoker	23 (22.8)	1.95 (0.88)	.20
Nonsmoker	78 (77.2)	1.71 (0.76)	
Smoking status of father/male guardian			
Smoker	31 (32.0)	1.82 (0.89)	.77
Nonsmoker	66 (68.0)	1.77 (0.76)	
Smoking status of siblings			
Smoker	15 (14.8)	1.88 (0.84)	.85
Nonsmoker	80 (79.2)	1.75 (0.79)	
I do not have a brother or sister	6 (6)	1.71 (0.89)	
Average school grades			
A	68 (66.6)	1.82 (0.80)	.35
B	29 (28.4)	1.72 (0.81)	
C	4 (3.9)	1.21 (0.34)	
D	1 (0.9)	1.00 (0.00)	

Characteristics	Distribution, n (%)	ASCOS ^a , M (SD)	<i>P</i> value ^b
Number of school detentions in past year			
None	53 (54.6)	1.72 (0.77)	.28
One or more	44 (45.4)	1.90 (0.81)	

^aASCOS: adolescent smoking curiosity scale.

^bSignificance testing with one-way analysis of variance. Missing values are not presented in this table.

Table 4

Exploratory Factor Analysis and Internal Reliability Testing for ASCOS

Items; curious about...	Factor loadings	Cronbach's alpha	Item-total correlation
1. How the product tastes	0.83	0.81	0.74
2. How smoking feels	0.81	0.81	0.74
3. What effect it would have on me	0.51	0.83	0.66
4. How the product feels	0.90	0.80	0.80
5. What is special about smoking	0.70	0.80	0.77
6. What people would think of me	0.58	0.81	0.73
7. Why other people like smoking	0.56	0.83	0.73
ASCOS Cronbach's alpha		0.83	

Table 5

Antecedents of smoking tested for association with smoking curiosity

Antecedents of Smoking	$r^{\ddagger}$	β (SE) ‡
Temptation to try smoking	0.43 ^a	0.41 (0.15) ^b
Number of friends who smoke	0.26 ^b	0.27 (0.02) ^b
Agreeing with the pros of smoking	0.40 ^a	0.41 (0.09) ^a
Agreeing with the cons of smoking	0.03	0.01 (0.08)
Sensation seeking	0.21 ^c	0.21 (0.07) ^c
Depression	0.29 ^b	0.23 (0.10) ^b

Note. Six multiple regression analyses controlling for age and gender.

‡ Indicates Pearson correlation coefficients.

‡ Indicates standardized coefficients followed by standard error.

^a $p < 0.001$;

^b $p < 0.01$;

^c $p < 0.05$

Table 6

Smoking curiosity predicting smoking susceptibility, OR (95% CI)

	Model 1A	Model 2A	Model 3A
Predicting susceptibility to smoke cigarettes			
ASCOS	3.85 (1.35 – 11.00) ^b	–	3.40 (1.22 – 9.47) ^b
Single-item curiosity to smoke cigarettes	–	1.68 (1.01 – 2.80) ^b	1.23 (0.75 – 2.03)
<i>R</i> ²	0.20	0.12	0.21
	Model 1B	Model 2B	Model 3B
Predicting susceptibility to smoke cigars			
ASCOS	7.58 (2.25 – 25.47) ^a	–	6.66 (2.05 – 21.58) ^a
Single-item curiosity to smoke cigars	–	2.44 (1.25 – 4.75) ^a	1.23 (0.62 – 2.44)
<i>R</i> ²	0.29	0.15	0.30
	Model 1C	Model 2C	Model 3C
Predicting susceptibility to smoke hookah			
ASCOS	5.56 (1.60 – 19.32) ^a	–	3.32 (0.93 – 11.82) ^c
Single-item curiosity to smoke hookah	–	4.49 (1.23 – 16.44) ^b	2.97 (1.08 – 8.18) ^b
<i>R</i> ²	0.22	0.26	0.31

Note. Nine logistic regression analyses predicting susceptibility to smoking different products. Models 1A, 1B, and 1C have only ASCOS as a predictor of susceptibility. Models 2A, 2B, and 2C have only the single-item curiosity measure as a predictor of susceptibility. Models 3A, 3B, and 3C have both ASCOS and the single-item curiosity measure as predictors of susceptibility.

^a *p* < 0.01;

^b *p* < 0.05;

^c *p* < 0.1