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The relationships between sensation seeking and a spectrum of e-cigarette use behaviors: Cross-sectional and longitudinal analyses specific to Texas adolescents

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Abstract

Introduction—Sensation seeking is strongly associated with cigarette use in adolescents. However, few studies have investigated its relationship with adolescent e-cigarette use. This study examined cross-sectional and longitudinal associations between sensation seeking and a variety of e-cigarette use behaviors among Texas adolescents.

Methods—This study utilized two waves of data collected 6 months apart through the Texas Adolescent Tobacco and Marketing Surveillance System (TATAMS) in 2014–2015 (n = 2,488/N = 461,069). TATAMS employs a complex probability-sampling design and is representative of students in 6th, 8th and 10th grades from five counties surrounding the four largest cities in Texas (Houston, Dallas/Ft. Worth, San Antonio, Austin). Weighted multivariable logistic regression was used to examine the cross-sectional and longitudinal associations between sensation seeking and susceptibility to e-cigarette use, ever e-cigarette use, and current (past 30 day) e-cigarette use.

Results—In the cross-sectional analyses, higher mean sensation seeking scores were associated with higher odds of both susceptibility to e-cigarette use and ever e-cigarette use (AOR = 1.25, 95% CI = 1.07, 1.47; AOR = 1.24, 95% CI = 1.08, 1.43, respectively). For the longitudinal analyses, only the association between higher mean sensation seeking scores and transition to ever e-cigarette use remained statistically significant (AOR = 1.45, 95% CI = 1.01, 2.08). There were no significant associations between sensation seeking and current e-cigarette use in either the cross-sectional or longitudinal analyses.

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Contributors

Dr. Case conducted all statistical analyses and wrote the manuscript. Dr. Harrell served as Principal Investigator for the TATAMS study and contributed to the conceptualization of the manuscript and provided feedback throughout the writing process. Dr. Perez provided statistical consultation for the project and served as statistician for the TATAMS study. Dr. Loukas helped with the initial conceptualization of the manuscript and provided feedback for all drafts. Dr. Wilkinson and Dr. Springer provided guidance for the analyses and edited the manuscript. Dr. Creamer and Dr. Perry were involved in editing all versions of the manuscript. Dr. Perry also serves as Principal Investigator for the entire Texas Tobacco Center of Regulatory Science. All authors contributed to and have approved the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

Conclusions—Higher sensation seeking scores were consistently and significantly related to experimentation with e-cigarette use among Texas adolescents. Future interventions (e.g., communication campaigns) should target high sensation seeking adolescents to reduce initiation of e-cigarette use among this population.

Keywords

Sensation seeking; Electronic cigarettes; Adolescents

1. Introduction

E-cigarette use among adolescents has increased rapidly in recent years, with research finding that the prevalence of both ever and current, or past 30-day, e-cigarette use now exceeds that of cigarette use among U.S. middle and high school students (Arrazola et al., 2015; Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2015; Kann, 2016; Singh, 2016). Such increases are alarming, particularly given concerns that e-cigarette users may transition to other tobacco products, such as cigarettes or other combustible tobacco products (Barrington-Trimis et al., 2016; Dutra & Glantz, 2014; Leventhal et al., 2015; Primack, Soneji, Stoolmiller, Fine, & Sargent, 2015; Wills et al., 2016). Emerging longitudinal research seems to support this claim, with recent studies indicating that adolescents who report ever e-cigarette use are more likely to experiment with cigarettes and other combustible product use compared to non-users (Barrington-Trimis et al., 2016; Leventhal et al., 2015; Primack et al., 2015; Wills et al., 2016). Identifying factors associated with the onset and progression of e-cigarette use among adolescents will be critical for future prevention programs and communication campaigns designed to reduce the burden of e-cigarette and other tobacco product use.

Although the literature regarding factors associated with e-cigarette use in adolescents is nascent, current research suggests certain factors such as older age, lower parental education, other tobacco product use, and family and peer tobacco/e-cigarette use, among others, are associated with increased e-cigarette use behaviors among adolescents (Camenga et al., 2014; Cooper, Case, & Loukas, 2015; Krishnan-Sarin, Morean, Camenga, Cavallo, & Kong, 2015; Wills, Knight, Williams, Pagano, & Sargent, 2015). In addition to demographic and psychosocial factors, personality factors that predispose adolescents to e-cigarette use are important to identify. One particularly relevant personality factor is sensation seeking. Sensation seekers desire stimulation and arousal, and thus, participate in activities that provide such experiences (Roberti, 2004; Zuckerman, 1979). Research has found that sensation seeking is an important factor associated with cigarette use behaviors in adolescents, including: susceptibility to use, ever use, and transition to current use (Doran et al., 2011; Frankenberger, 2004; Kong et al., 2013; Thrasher, Niederdeppe, Jackson, & Farrelly, 2006). Results from studies like these have been subsequently utilized to inform cigarette smoking prevention campaigns, such as the truth® campaign which employs high sensation-seeking messages to target youth at risk for cigarette smoking (Davis, Farrelly, Messeri, & Duke, 2009; Sargent, Tanski, Stoolmiller, & Hanewinkel, 2010). Importantly, however, the truth® campaign does not currently address e-cigarette use.

To date, five studies have examined the association between sensation seeking and e-cigarette use behaviors, providing preliminary indication that high sensation seeking is associated with ever e-cigarette use in adolescents (Hampson, Andrews, Severson, & Barckley, 2015; Hanewinkel & Isensee, 2015; Primack et al., 2015; Thrasher et al., 2016; Wills et al., 2015). In a cross-sectional study of Hawaiian adolescents, Wills et al. (2015) found that mean sensation seeking scores were significantly higher for 1) ever e-cigarette only users as compared to non-users, and 2) ever dual users of both e-cigarettes and conventional cigarette users as compared to e-cigarette only users. In one of the only longitudinal studies to examine the association, researchers found that sensation seeking at fifth grade was associated with ever use of e-cigarettes at seventh grade among German adolescents (Hanewinkel & Isensee, 2015). Finally, in a recent study conducted by Hampson et al. (2015), researchers found that sensation seeking scores in adolescence were correlated with lifetime use of e-cigarettes in young adulthood using data from the Oregon Youth Substance Use Project.

Importantly, several gaps in the literature need to be addressed to further clarify the role of sensation seeking on e-cigarette use behaviors among adolescents. Namely, research is needed to examine the associations between sensation seeking and the continuum of e-cigarette use behaviors, including susceptibility to use, as well as current use. To date, all studies have only considered ever e-cigarette use, which is only a marker for experimentation. This continuum of use has been conceptualized as stages of behaviors including non-use, susceptibility to use, initiation of use, experimentation, and regular use (Pierce, Choi, Gilpin, Farkas, & Merritt, 1996; U.S. Department of Health and Human Services, 1994, 2012). As noted in the 2012 Surgeon General's Report, it is important to examine factors associated with all stages of use as all experimenters do not necessarily progress to regular users (U.S. Department of Health and Human Services, 2012). Ultimately, in applying lessons learned from cigarette use in adolescents, it is necessary to identify factors associated with different stages of use to inform the development of future interventions.

This study examined the cross-sectional and longitudinal associations between sensation seeking and a spectrum of e-cigarette use behaviors among urban Texas adolescents. We hypothesized that high sensation seeking would be associated with higher odds of susceptibility to e-cigarette use, ever e-cigarette use, and current e-cigarette use.

2. Material and methods

2.1. Study design and participants

The present study examined data from baseline and the six month follow-up survey of the Texas Adolescent Tobacco and Marketing Surveillance System (TATAMS). TATAMS is a three-year longitudinal study that measures use of tobacco products; personality, cognitive, affective, and social factors that may be associated with them; and exposure to marketing of tobacco products. Participants included adolescents in 6th, 8th and 10th grades at baseline from a representative sample of schools in five counties that surround the four largest cities in Texas, including Austin, San Antonio, Houston, and Dallas/Fort Worth. These major metropolitan areas are among the top five fastest growing cities in the United States at

present and represent over 40% of the state's population (Texas State Library and Archives Commission, 2015a, 2015b; U.S. Census Bureau, 2016). A description of the sampling design and school recruitment is provided elsewhere (Pérez et al., 2015).

Data collection occurred during 2014 and 2015; follow-up was staggered such that the time between surveys averaged 6 months. All analyses were conducted using sampling weights; the cross-sectional analyses utilized baseline sampling weights to generalize the findings back to the population from which it was drawn and to adjust for school-level clustering (Pérez et al., 2015). Sampling weights used in the longitudinal analyses were adjusted for non-response bias at follow-up, thus the final sample generalizes back to the entire population at baseline from which it was drawn (Pérez et al., 2015). At baseline and follow up, 3907 and 2488 adolescents participated in the study, respectively (weighted retention rate of 60.9%). After adjustment for non-response, the sampling frame for both surveys represented a total of 461,069 adolescents in Texas. Of the adolescents who completed both baseline and follow-up, 51.1% were male, 29.1% were White, non-Hispanic/other, 53.9% were Hispanic, and 17.0% were African American. The mean age of participants was 13.4 years; roughly two-thirds (66.9%) of the adolescents were in 6th (n = 699) or 8th grade (n = 807) at baseline. In addition, 81.7% of participants reported middle or high subjective economic status (includes "living comfortably" and "very well off").

2.2. Measures

2.2.1. Outcome variables

2.2.1.1. Susceptibility to e-cigarette use: Susceptibility to e-cigarette use was measured using the following three questions: "Do you think you will use the following products (e-cigarettes) in the next 12 months?"; "If one of your close friends were to offer you one of the following products (e-cigarettes), would you use it?"; and "Have you ever been curious about using an e-cigarette?"(Pierce, Distefan, Kaplan, & Gilpin, 2005; Strong et al., 2014). Response options were "definitely not (1)," "probably not (2)," "probably yes (3)," and "definitely yes (4)." Susceptibility to e-cigarette use was restricted to never users of e-cigarettes at baseline. Never users of e-cigarettes at baseline who responded "definitely not (1)" to all three of the questions regarding susceptibility to e-cigarette use were classified as non-susceptible, otherwise participants were classified as susceptible at baseline (Pierce et al., 1996). For the longitudinal analyses, non-susceptible adolescents at baseline were classified as non-susceptible or susceptible at follow-up, replicating the procedure described above. Thus, change in susceptibility to use was operationalized as a dichotomous variable corresponding to participants who were non-susceptible at both baseline and follow-up versus those participants who were non-susceptible at baseline who became susceptible at follow-up.

2.2.1.2. Ever e-cigarette use: Ever e-cigarette use was assessed using the question: "Have you ever used an e-cigarette, even one or two puffs?" (National Institutes of Health, 2015). Response options were "yes" and "no." Participants who responded "no" at baseline were classified as never users, participants who responded "yes" were classified as ever users. For the longitudinal analyses, never users at baseline were then classified as never or ever users at follow-up. Transition to ever use was operationalized as a dichotomous variable

corresponding to never users at baseline and follow-up versus never users at baseline who became ever users at follow-up.

2.2.1.3. Current e-cigarette use: Current e-cigarette use was assessed using the question, "During the past 30 days, on how many days did you use e-cigarettes? Please enter the number of days (0 to 30 days)" (National Institutes of Health, 2015). Response options, therefore, could range from 0 days to 30 days. Participants who indicated at least 1 day of use in the past 30 days at baseline were classified as current users, while those who indicated 0 days of use in the past 30 days were classified as non-current users. This approach is consistent with other recent studies (Barrington-Trimis et al., 2015; Bunnell et al., 2014; Mantey, Cooper, Clendennen, Pasch, & Perry, 2016). For the longitudinal analyses, non-current users who reported ever use at baseline were then classified as non-current or current users at follow-up. Transition to current use was operationalized as a dichotomous variable corresponding to non-current ever users at baseline and follow-up versus non-current ever users at baseline who became current users at follow-up.

2.2.2. Exposure variable

2.2.2.1. Sensation seeking: Sensation seeking at baseline served as the exposure variable for all analyses. The measure of sensation seeking was adapted from the Brief Sensation Seeking Scale 4, which consists of four items with five-point response options ranging from "strongly disagree" to "strongly agree" (Stephenson, Hoyle, Palmgreen, & Slater, 2003). A mean composite score was generated corresponding to the sum of the items divided by the total number of items completed. Potential mean sensation seeking scores ranged from 1 to 5, with a mean of 2.92 (standard error = 0.06). Participants who completed at least two of the items were included in the analyses. The scale reliability coefficient for the present study indicated acceptable internal consistency (alpha = 0.85).

2.2.3. Covariates—Covariates included gender (National Institutes of Health, 2015), grade level (National Institutes of Health, 2015), race/ethnicity (National Institutes of Health, 2015), subjective economic status (Gore, Aseltine, & Colten, 1992; Springer, Selwyn, & Kelder, 2006), current use (past 30 day use) of other tobacco products (National Institutes of Health, 2015), current (past 30 day use) alcohol use (Centers for Disease Control and Prevention, 2015), and peer and household use of tobacco products (National Institutes of Health, 2015). Given the small number of 6th grade students who transitioned to e-cigarette use, 6th and 8th grades were combined to increase sample size. All covariates were considered time-invariant and measured at baseline.

2.3. Statistical analysis

Weighted multivariable logistic regression analyses were conducted to determine the cross-sectional associations between mean sensation seeking scores and e-cigarette use behavior at baseline after adjusting for covariates. Separate models were conducted for each of the three different outcome variables. Next, separate weighted logistic regression models were conducted to explore the longitudinal associations between mean sensation seeking scores at baseline and 1) change in susceptibility to e-cigarette use at follow-up, 2) transition to ever use at follow-up, and 3) transition to current use at follow-up, after adjusting for covariates.

All analyses were conducted using sampling weights. Analyses were conducted using Stata 14.0 (College Station, TX).

Analyses for this study were restricted to participants with complete data on all variables in the analyses. For the cross-sectional analyses, 351 participants were excluded for missing data for a final sample of 3556 who represented 414,264 Texas adolescents. Furthermore, for the susceptibility to e-cigarette use outcome, analyses were restricted to never users of e-cigarettes (n = 2,879) who represented 327,202 Texas adolescents. In the longitudinal analyses, for change in susceptibility to e-cigarette use, analyses were restricted to non-susceptible never e-cigarette users at baseline (n = 1,284) who represented 223,693 Texas adolescents. For transition to ever use, analyses were restricted to never e-cigarette users at baseline (n = 1,929) who represented 344,585 Texas adolescents. Finally, for transition to current use, analyses were restricted to non-current ever users at baseline (n = 163) who represented 32,262 Texas adolescents.

3. Results

At baseline, 30.9% of never e-cigarette users were susceptible to future e-cigarette use (sample size “n” = 892; weighted population size “N” = 100,928). Furthermore, 19% of participants reported ever e-cigarette use (n = 621; N = 78,713) and 7.3% reported current e-cigarette use (n = 234; N = 30,115). Among non-susceptible never e-cigarette users at baseline (n = 1,284; N = 223,693), 10.5% became susceptible never users at follow-up (n = 151; N = 23,387); among never e-cigarette users at baseline (n = 1,929; N = 344,585), 3.0% became ever users at follow-up (n = 56; N = 10,302); and among non-current ever users at baseline (n = 163; N = 32,262), 15.3% became current users at follow-up (n = 31; N = 4,927).

Results for the multivariable logistic regression analyses for the cross-sectional associations are presented in Table 1. After adjusting for covariates, adolescents with higher mean sensation seeking scores had significantly higher odds of being susceptible to e-cigarette use as compared to adolescents with lower mean sensation seeking scores (AOR = 1.25, 95% CI = 1.07, 1.47). Similarly, adolescents with higher mean sensation seeking scores had significantly higher odds of ever e-cigarette use (AOR = 1.24, 95% CI = 1.08, 1.43) as compared to adolescents with lower mean sensation seeking scores. No significant relationship with current use was observed.

Results for the multivariable logistic regression analyses for the longitudinal associations are presented in Table 2. After adjusting for covariates, adolescents with higher mean sensation seeking scores at baseline had significantly higher odds of initiating e-cigarette use at follow-up as compared to adolescents with lower mean sensation seeking scores (AOR = 1.45, 95% CI = 1.01, 2.08). No statistically significant relationships with susceptibility to use e-cigarettes or current e-cigarette use were observed.

4. Discussion

The present study examined the cross-sectional and longitudinal associations between sensation seeking and susceptibility to e-cigarette use, ever e-cigarette use, and current e-

cigarette use among Texas adolescents. Our hypotheses were partially confirmed, namely that higher mean sensation seeking scores were associated with significantly higher odds of ever e-cigarette use in the cross-sectional and longitudinal analyses. However, higher sensation seeking was not significantly associated with change in susceptibility to e-cigarette use in the longitudinal analyses. In addition, in both the cross-sectional and longitudinal analyses sensation seeking was not significantly associated with current e-cigarette use. Ultimately, results from this study indicate that the associations between sensation seeking and e-cigarette use behaviors differ by stage of e-cigarette use. Given these findings, future intervention campaigns should target high sensation seeking adolescents in order to prevent the onset of e-cigarette use. Additional research is needed to elucidate factors associated with sustained use of these products over time.

While this is the first study to date to examine the specific association between sensation seeking and susceptibility to e-cigarette use, the results from the present study support previous cross-sectional research examining the association with conventional cigarette use (Memetovic, Ratner, Gotay, & Richardson, 2016). Consistent with our findings, results from Memetovic et al. (2016) indicated that higher sensation seeking scores were associated with significantly higher odds of intention to use cigarettes after for covariates in a sample of eighth and ninth grade Canadian adolescents. To date, no study has examined factors associated with change in susceptibility to e-cigarette use, and research with respect to change in susceptibility to conventional cigarette use among adolescents has not examined sensation seeking as a predictor (Forrester, Biglan, Severson, & Smolkowski, 2007; Gritz et al., 2003; Weiss et al., 2006). Notably, both Forrester et al. (2007) and Gritz et al. (2003) found that different factors predicted change in susceptibility to smoking versus change in smoking behaviors (initiation of smoking, transition to regular smoking), thus suggesting that different mechanisms may influence change from one stage to another along the tobacco use continuum.

Results from the present study are consistent with previous research that has investigated the association between sensation seeking and ever use of tobacco products in adolescents (Hampson et al., 2015; Hanewinkel & Isensee, 2015; Hanewinkel, Isensee, Sargent, & -Morgenstern, 2011; Primack et al., 2015; Thrasher et al., 2016; Wills et al., 2015); however, much of the previous research has been cross-sectional. Similar to the longitudinal study conducted by Hanewinkel and Isensee (2015), the present study found that higher sensation seeking was associated with increased odds of ever e-cigarette use over time. The present study differs from previous research by specifically examining transitions to ever e-cigarette use among never e-cigarette users at baseline. This study also builds upon previous work conducted by Hampson et al. (2015) in that both sensation seeking and e-cigarette use was assessed among adolescents. Conversely, the Hampson et al. (2015) investigated risk factors during middle and high school and their subsequent association with alternative tobacco product use in young adulthood (ages 20 to 25). Thus, results from the present study, in conjunction with the Hampson et al. (2015) study, indicate that sensation seeking is an important proximal predictor for initiation of e-cigarette use among adolescents and young adults.

The results of the associations between sensation seeking and current e-cigarette use behaviors differed from our hypothesis; high sensation seeking was not associated with higher odds of current e-cigarette use. These results provide support for the view that sensation seeking may play more of a role in experimenting with e-cigarettes as opposed to regular use. As noted by Zuckerman (1990), while sensation seekers may be the first to experiment with a new product, they may ultimately lose interest over time. Thus, while sensation seeking may be associated with initiation of e-cigarette use, it may not be an important factor in sustained e-cigarette use over time. Importantly, the sample size of adolescents transitioning from ever to current users in the present study was small (n = 31, N = 4,927), thus, the lack of an association between sensation seeking and transition to current use may be due to the small sample size and not indicative of a lack of an association. Future longitudinal research is needed to confirm whether an association between sensation seeking and current e-cigarette use exists and to determine if high sensation seeking ever users continue to use e-cigarettes or if they switch to other substances.

While sensation seeking was not associated with transition to current e-cigarette use, the results of the present study indicate that it may play an important role in the initiation of use. As stressed in the 2012 Surgeon General's Report, interventions are needed prior to initiation of tobacco use to prevent both initiation and escalation of use (U.S. Department of Health and Human Services, 2012). With the need for early intervention in mind, the present study has important implications for the implementation of health communication campaigns aimed to reduce initiation of e-cigarette use among adolescents. Sensation-seeking strategies which utilize characteristics of high-sensation messaging (for example, using dramatic graphics, fast-paced messaging, etc.) have been utilized in national media campaigns, such as the truth® campaign, to target high sensation seeking adolescents who are at risk of smoking cigarettes (Allen, Vallone, Vargyas, & Healton, 2009; Davis et al., 2009; Palmgreen, Donohew, Lorch, Hoyle, & Stephenson, 2001; Sargent et al., 2010). Given the findings from the present study which suggest that sensation seeking is associated with initiation of e-cigarette use among adolescents, future campaigns should utilize similar strategies to dissuade adolescents from experimenting with alternative tobacco products, such as e-cigarettes.

4.1. Strengths and limitations

The present study is not without its limitations. First, our analyses were limited to 6th, 8th and 10th grade students residing in four Texas cities. Results may not generalize outside of this area, though they are consistent with prior research (Hampson et al., 2015; Hanewinkel & Isensee, 2015; Wills et al., 2015). In addition, given the short period of follow-up in the present study, only a small number of participants transitioned from ever e-cigarette use to current e-cigarette use, which may have precluded us from detecting meaningful associations between sensation seeking and transition to current e-cigarette use. Finally, all items were measured via self-report, therefore, students may have under-reported their sensation seeking tendencies or e-cigarette use behaviors. However, given that the survey was self-administered away from teachers or school staff, it is unlikely that adolescents underreported their behaviors due to social-desirability bias.

In contrast to the limitations, there are also numerous strengths to the present study. First, the study utilized a well-validated measure of sensation seeking that has been used in previous studies involving adolescents (Martins, Storr, Alexandre, & Chilcoat, 2008; Sargent et al., 2010; Stephenson, Velez, Chalela, Ramirez, & Hoyle, 2007). Additionally, this is one of the first longitudinal studies to examine the association between sensation seeking and change in e-cigarette use behaviors across time among adolescents.

5. Conclusions

This study contributes to the emerging body of research examining factors associated with e-cigarette use behaviors among adolescents. Consistent with prior research, our results suggest sensation seeking is consistently associated with experimenting with e-cigarette use. Importantly, however, the associations between sensation seeking and becoming susceptible to e-cigarette use and transition to current use were not significant after adjusting for covariates. These results provide preliminary evidence that different factors may influence transitions from one stage of tobacco use to another. Future research is needed to further explore potential differences in factors associated with transition in stages of e-cigarette use behaviors to identify opportunities for appropriate interventions. In addition, findings from the study provide support for utilizing sensation-seeking strategies in communication campaigns and in prevention programs to prevent the uptake of e-cigarette use among adolescents.

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Table 1

Cross-sectional associations between sensation seeking and e-cigarette use behaviors at baseline among Texas adolescents; TATAMS, 2014–2015.

	Susceptibility to use (n = 2,879/N = 327,202) AOR (95% CI)[a]	**Ever use (n = 3,556/N = 414,264) AOR (95% CI)[a]**	**Current use (n = 3,556/N = 414,264) AOR (95% CI)[a]**
Sensation seeking	**1.25 (1.07, 1.47)**	**1.24 (1.08, 1.43)**	1.08 (0.86, 1.36)
Gender			
Female (reference)	1	1	1
Male	0.87 (0.64, 1.19)	1.05 (0.73, 1.50)	1.09 (0.74, 1.60)
School grade level			
6th/8th (reference)	1	1	1
10th	1.19 (0.92, 1.54)	**2.47 (1.69, 3.60)**	**2.18 (1.43, 3.31)**
Race/ethnicity			
White, non-Hispanic/Other(reference)	1	1	1
Hispanic or Latino	1.20 (0.90, 1.62)	1.30 (0.92, 1.85)	1.36 (0.81, 2.28)
African American	1.24 (0.88, 1.75)	1.29 (0.91, 1.85)	0.88 (0.49, 1.56)
Subjective economic status			
Low (reference)	1	1	1
Middle/high	0.79 (0.56, 1.12)	0.92 (0.64, 1.34)	0.90 (0.56, 1.46)
Current other tobacco product use[b]			
No (reference)	1	1	1
Yes	1.74 (0.80, 3.79)	**10.98 (5.84, 20.64)**	**9.54 (5.45, 16.68)**
Current alcohol use			
Non-user (reference)	1	1	1
Current users	**3.18 (1.96, 5.18)**	**2.22 (1.43, 3.44)**	1.69 (0.87, 3.29)
Household tobacco use[c]			
No (reference)	1	1	1
Yes	**1.41 (1.06, 1.86)**	**1.55 (1.16, 2.09)**	**1.67 (1.03, 2.70)**
Peer tobacco use[d]			
No (reference)	1	1	1
Yes	**4.24 (3.09, 5.81)**	**4.46 (3.01, 6.60)**	**3.85 (2.33, 6.35)**

n = sample size, N = weighted sample size, AOR = adjusted odds ratio, CI = confidence interval.

Bolded indicates statistical significance, $p < 0.05$.

[a] Adjusted for all other covariates in the model.

[b] Current use of cigarettes, hookah, large cigars/little filtered cigars/cigarillos, or smokeless tobacco.

[c] Current household use of cigarettes, e-cigarettes, hookah, large cigars/little filtered cigars/cigarillos, or smokeless tobacco.

[d] Peer use of cigarettes, e-cigarettes, hookah, large cigars/little filtered cigars/cigarillos, or smokeless tobacco.

Table 2

Longitudinal associations between sensation seeking at baseline and change in e-cigarette use behaviors at six month follow-up among Texas adolescents; TATAMS 2014–2015.

	Susceptibility to Use (n = 1,284/N = 223,693) AOR (95% CI)[a]	**Ever Use (n = 1,929/N = 344,585) AOR (95% CI)[a]**	**Current Use (n = 163/N = 32,262) AOR (95% CI)[a]**
Sensation seeking score	0.95 (0.76, 1.20)	**1.45 (1.01, 2.08)**	1.14 (0.65, 2.01)
Gender			
Female (reference)	1	1	1
Male	0.62 (0.37, 1.05)	1.07 (0.55, 2.10)	2.23 (0.68, 8.03)
School grade level[b]			
6th/8th (reference)		1	–
10th	1.29 (0.70, 2.39)	**3.40 (1.51, 7.67)**	–
Race/ethnicity			
White, non-Hispanic/Other (reference)	1	1	1
Hispanic	0.87 (0.58, 1.30)	1.00 (0.50, 2.00)	0.55 (0.17, 1.75)
African American	1.09 (0.56, 2.10)	**0.29 (0.10, 0.80)**	0.69 (0.12, 4.08)
Subjective economic status			
Low (reference)	1	1	1
Middle/high	1.45 (0.61, 3.45)	1.62 (0.40, 6.56)	1.85 (0.47, 7.28)
Current other tobacco product use[c]			
No (reference)	1	1	1
Yes	0.77 (0.06, 9.58)	2.32 (0.38, 14.29)	2.42 (0.44, 13.33)
Current alcohol use			
Non-users (reference)	1	1	1
Current alcohol users	1.50 (0.53, 4.19)	2.28 (0.80, 6.46)	2.38 (0.96, 5.93)
Household tobacco use[d]			
No (reference)	1	1	1
Yes	1.50 (0.80, 2.84)	0.63 (0.25, 1.54)	**3.25 (1.04, 10.17)**
Peer tobacco use[b,e]			
No (reference)	1	1	–
Yes	**2.94 (1.64, 5.26)**	**3.13 (1.32, 7.41)**	–

n = sample size, N = weighted population size, AOR = adjusted odds ratio, CI = confidence interval.

Bolded indicates statistical significance, $p < 0.05$.

[a] Adjusted for all other covariates in the model.

[b] Removed from current e-cigarette use model due to instability of the estimates.

[c] Current use of cigarettes, hookah, large cigars/little filtered cigars/little filtered cigars/cigarillos, or smokeless tobacco.

[d] Current household use of cigarettes, e-cigarettes, hookah, large cigars/little filtered cigars/cigarillos, or smokeless tobacco.

[e] Peer use of cigarettes, e-cigarettes, hookah, large cigars/little filtered cigars/cigarillos, or smokeless tobacco.