



Measurement and predictive value of susceptibility to cigarettes, e-cigarettes, cigars, and hookah among Texas adolescents

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ABSTRACT

Susceptibility to cigarette smoking, defined as the lack of a firm commitment not to smoke in the future, begins in childhood and is a phase in the transition from never to ever use of cigarettes. While a consistent and validated predictor of cigarette use, little research has assessed whether the susceptibility construct applies equally well across other tobacco products. Baseline data were collected in 2014–2015 from a representative sample of ($n = 2844$) middle and high school students in five counties surrounding the four largest cities in Texas, (49% female and mean age 13.13 years, with subsequent waves at 6, 12, and 18 months. Confirmatory factor analysis examined the appropriateness of a three-item susceptibility measure (product-specific curiosity, intention to use, and peer influence) across product types and ethnic groups (Hispanic versus non-Hispanic). Logistic regression examined whether product specific susceptibility at baseline predicted future product initiation. At baseline, 11.5%, 17.0%, 17.4% and 29.4%, of adolescent never users were susceptible to cigars, cigarettes, hookah and e-cigarettes, respectively; significantly more Hispanic than non-Hispanic adolescents were susceptible to e-cigarettes (32.4% versus 26%, $p < 0.01$) and cigarettes (19.9% versus 13.9%, $p < 0.05$). Product-specific items were significantly and consistently associated with the respective underlying susceptibility product construct and across ethnic groups ($p < 0.001$ for all). Susceptibility to e-cigarettes (AOR = 2.28–6.64) or any combustible product (cigarettes, hookah, cigars; AOR = 3.38–5.20) significantly predicted subsequent ever use. This study confirms the appropriateness of the susceptibility construct across four tobacco product types and ethnic groups, and the utility of susceptibility in predicting future product use among adolescents.

1. Introduction

Use of conventional tobacco products, like cigarettes and cigars, has decreased in recent years among adolescents, while use of tobacco products, like e-cigarettes and hookah, continues to increase (Singh et al., 2016). These trends and the growing popularity of specific products call for identifying risk factors that predict product use initiation. Numerous studies have demonstrated susceptibility to cigarettes among never smoking adolescents is associated with increased risk of experimentation with cigarettes and becoming an established smoker (Jackson, 1998; Jackson & Dickinson, 2004; Nodora et al., 2014; Pierce, Choi, Gilpin, Farkas, & Merritt, 1996; Pierce, Distefan, Kaplan, & Gilpin, 2005; Spelman et al., 2009; Strong et al., 2015; Unger, Johnson, Stoddard, Nezami, & Chou, 1997). Limited research suggests that susceptibility to e-cigarettes or hookah independently predicts future e-cigarette (Bold, Kong, Cavallo, Camenga, & Krishnan-Sarin, 2017) or hookah use (Lipkus, Reboussin, Wolfson, & Sutfin, 2015), respectively, and that susceptibility to cigarettes predicts future e-cigarette and cigar use (Cole, Kennedy, Chaurasia, & Leatherdale, 2017). Still, few studies have examined product-specific susceptibility measures in predicting future use of products other than cigarettes.

Susceptibility, which reflects the lack of a firm commitment not to

use tobacco products in the future, is a critical construct, predictive of tobacco use and amenable to intervention. Research examining the initial susceptibility construct based on behavioral intentions, peer influence, and self-efficacy (Pierce et al., 1996) demonstrated that comprehensive community anti-smoking media programs, are effective in altering and suppressing adolescents' susceptibility to smoking (Meshack et al., 2004). A revised measure of the susceptibility construct, which incorporated curiosity with behavioral intentions and peer influence, demonstrated little loss in internal consistency, but a reduction in predictive validity and accuracy (Pierce et al., 2005). To date, a few studies have assessed whether the original susceptibility to cigarettes construct (Pierce et al., 1996) also can be adapted to measure susceptibility to other products, like e-cigarettes, hookah, and cigars (e.g., Bold et al., 2017; Lechner et al., 2018), and none have examined the susceptibility construct that includes curiosity. Yet, recent survey data suggest that the most common reason for adolescents to try e-cigarettes is out of curiosity (Kong, Morean, Cavallo, Camenga, & Krishnan-Sarin, 2015; Patrick et al., 2016). Thus, utilizing a susceptibility construct that includes curiosity might be particularly useful to our understanding of susceptibility to non-cigarette tobacco products.

Additionally, no studies have assessed whether the susceptibility construct (Pierce et al., 2005) functions equally across ethnic groups.

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Table 1Demographics and susceptibility to e-cigarettes and combustible tobacco products among Hispanic and non-Hispanic never users at baseline, TATAMS ($n = 2844$; $N = 318,097$).

Variable	Hispanic	Non-Hispanic	Total
	% (95% CI)	% (95% CI)	% (95% CI)
Sex			
Female	47.7 (41.1–54.5)	50.3 (45.1–55.5)	49.0 (43.7–54.3)
Male	52.3 (45.5–58.9)	49.7 (44.5–54.9)	51.0 (45.7–56.3)
Grade			
6	39.8 (28.4–52.5)	36.6 (23.6–52.0)	38.3 (26.9–51.1)
8	35.3 (24.4–48.0)	34.4 (20.2–51.9)	34.9 (23.7–47.9)
10	24.9 (15.1–38.3)	29.0 (18.4–42.7)	26.9 (17.7–38.6)
Age (mean, SE)	13.14 (0.19)	13.12 (0.19)	13.13 (0.17)
Family SES			**
High	15.8 (12.9–19.3)	25.2 (18.7–33.0)	20.3 (16.2–25.1)
Middle	64.4 (61.2–67.5)	61.6 (56.2–66.7)	63.1 (60.2–65.9)
Low	19.8 (16.8–23.2)	13.2 (10.1–17.2)	16.6 (14.1–19.6)
Susceptibility to e-cigarettes items^a			
Have you ever been curious about smoking/using e-cigarettes?	26.9 (23.5–30.7)	22.2 (19.0–25.9)	24.7 (21.9–27.7)*
Do you think you will use e-cigarettes in the next 12 months?	10.5 (8.3–13.1)	8.0 (6.1–10.4)	9.3 (7.6–11.3)
If one of your close friends were to offer you an e-cigarette, would you use it?	17.9 (15.1–21.1)	13.0 (10.7–15.6)	15.6 (13.6–17.7)*
Susceptibility to e-cigarettes (derived)^b	32.4 (28.7–36.3)	26.0 (22.3–30.1)	29.4 (26.2–32.7)**
Susceptibility to cigars (large cigars, cigarillos, and little filtered cigars) items^a			
Have you ever been curious about smoking/using cigars?	7.6 (5.6–10.3)	7.0 (5.3–9.0)	7.3 (6.0–8.8)
Do you think you will use cigars in the next 12 months?	4.3 (2.8–6.5)	3.2 (2.2–4.6)	3.8 (2.8–5.0)
If one of your close friends were to offer you a cigar, would you use it?	7.4 (5.0–10.8)	4.5 (3.2–6.2)	6.0 (4.6–7.8)
Susceptibility to cigars (derived)^b	12.8 (9.7–16.7)	10.2 (7.9–13.0)	11.5 (9.5–13.9)
Susceptibility to hookah items^a			
Have you ever been curious about smoking/using hookah?	14.7 (11.8–18.2)	12.5 (9.6–16.2)	13.7 (11.3–16.4)
Do you think you will use hookah in the next 12 months?	6.9 (5.0–9.4)	5.3 (3.6–7.6)	6.1 (4.6–8.1)
If one of your close friends were to offer you hookah, would you use it?	9.8 (7.6–12.6)	7.8 (5.8–10.5)	8.9 (7.2–10.9)
Susceptibility to hookah (derived)^b	18.8 (15.2–23.1)	15.7 (12.1–20.2)	17.4 (14.6–20.6)
Susceptibility to cigarettes items^a			
Have you ever been curious about smoking/using cigarettes?	13.3 (10.8–16.4)	10.0 (8.3–12.1)	11.8 (10.1–13.7)*
Do you think you will use cigarettes in the next 12 months?	5.1 (3.4–7.4)	3.9 (2.8–5.4)	4.5 (3.5–5.8)
If one of your close friends were to offer you cigarettes, would you use it?	8.4 (5.8–12.0)	6.2 (4.6–8.2)	7.3 (5.7–9.3)
Susceptibility to cigarettes (derived)^b	19.9 (15.6–25.0)	13.9 (11.5–16.7)	17.0 (14.4–20.0)*
Susceptibility to any combustible tobacco product (derived)^b	29.1 (24.5–34.1)	22.9 (18.8–27.7)	26.2 (22.7–29.9)*

Note: CI = confidence interval, SE = standard error. All frequencies and means are weighted to account for complex survey design. Never users represent adolescents who have never used any of the four product types. n represents the observed sample size, N represents the weighted sample size. “Any combustible” includes cigarettes, cigars, and hookah. * $p < 0.05$, ** $p < 0.01$ for Chi-square test of Hispanic versus non-Hispanic across categories of the item.

^a For set of items, % (95% CI) represents the proportion of adolescents who said anything other than “not at all curious” to the first item and “definitely not” to the second two items.

^b For items, % (95% CI) represents the proportion of adolescents classified as susceptible.

Hispanic adolescents who have never smoked report greater intentions to smoke cigarettes in the future compared to white peers (Bunnell et al., 2015) and greater curiosity about e-cigarettes (Margolis, Nguyen, Slavitt, & King, 2016). In addition, Hispanic adolescents are more susceptible to cigarettes (Fulmer et al., 2015; Gritz et al., 2003), e-cigarettes (Singh et al., 2016; U.S. Department of Health and Human Services, 2016), and hookah (Trinidad et al., 2017), compared to non-Hispanic white adolescents. This is a concern because comparatively, Hispanics are the youngest ethnic group in the nation, with a large proportion of the Hispanic population (roughly a third) being under the age of 18 years (Patten, 2016), and Hispanic youth report a higher prevalence of e-cigarette use in middle school in the past 30 days compared to non-Hispanic youth of all races (Singh et al., 2016). Considering existing tobacco-related health disparities (Centers for Disease Control and Prevention, 2018) and the expected near doubling of the Hispanic population over the next 30 years (Krogstad, 2014), it is important to determine whether constructs predicting future use, like susceptibility, are applicable across ethnic groups. Such information can inform the development of culturally sensitive interventions and communication campaigns designed to reduce susceptibility and ultimately product use.

The goal of this study was to evaluate the utility of a three-item susceptibility construct adapted from Pierce et al. (2005), assessing curiosity, intention to use, and peer influence, in measuring susceptibility at baseline to four products (e-cigarettes, hookah, cigars, and

cigarettes) and in predicting future initiation of these products among Hispanic and non-Hispanic adolescent never users in grades 6, 8, and 10 in Texas. We hypothesized the measurement of susceptibility would apply equally across products, and each product-specific susceptibility construct would predict future use of each product. We also hypothesized the measurement of susceptibility constructs for each product would apply equally across Hispanic and non-Hispanic subgroups, though prevalence of susceptibility to each product may be higher for Hispanic adolescents.

2. Methods

2.1. Study design and participants

The Texas Adolescent Tobacco and Marketing Surveillance system (TATAMS) is a rapid response surveillance system that follows three population-based cohorts of adolescents, to represent developmental changes in tobacco use behaviors. A complex probability design was used to recruit 3907 students (n) in 79 middle and high schools in 4 major metropolitan areas of Texas (Austin, San Antonio, Dallas-Ft. Worth, & Houston); when sampling weights are applied in statistical data analyses, results are representative of 461,069 (N) students who were enrolled in the 6th, 8th, and 10th grades in 1969 middle and high schools in these cities during the 2014–15 academic year. Further details about TATAMS' sampling methods and recruitment are described

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