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The role of smokeless tobacco use in smoking persistence among male college students

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Abstract

Background—Significant changes in the tobacco industry have led to heightened concern about co-use of cigarettes and smokeless tobacco (SLT) products.

Objectives—The aim of this study was to assess whether male cigarette smokers who also used SLT products, in the first semester of their first year of college, were more or less likely than male cigarette smokers who did not use SLT products to still be smoking by the first semester of their senior year.

Methods—Using a longitudinal, observational study, we followed a cohort of undergraduate students from 11 four-year universities in North Carolina and Virginia through their college career. Mixed-effects logistic regression analysis was conducted to estimate the likelihood of being a current smoker fall of senior year for male students who used both cigarettes and SLT at baseline, compared to those who only smoked cigarettes, after adjustment for potential confounders ($n = 274$).

Results—At baseline, 67.2% of participants were smoking cigarettes only (no SLT use) and 32.8% were dual users (cigarettes and SLT). A total of 62% were still smoking at senior year. Dual users were 30% more likely to be current smokers senior year compared to cigarette only users, although this difference was not statistically significant. Having at least one friend who smoked cigarettes and heavier cigarette smoking at baseline were significantly related to senior year smoking.

Conclusions—Our findings do not support the argument that SLT use may help male college smokers discontinue their smoking habit. In fact, it may contribute to smoking persistence.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

Keywords

Cigarette smoking; college student; co-use; smokeless tobacco; substitution; United States

Introduction

The landscape of smokeless tobacco (SLT) manufacturing and marketing has changed dramatically over the past 20 years. The major changes include Reynolds American's 2006 acquisition of Conwood Holdings (now named American Snuff) and Altria's (the parent company of Phillip Morris) 2009 acquisition of U.S. Smokeless Tobacco Company (1). Two of the three leading SLT companies in the United States, with a 2011 combined market share of 73%, are now owned by the two largest cigarette manufacturers (2).

New SLT products have been developed, introduced into test markets, or released nationally, supplementing the products that have long been on the market (chewing tobacco and snuff). These new products (for the US market) include snus, which is a moist snuff, originating in Sweden and Norway. It is most commonly packaged in small pouches, and is used like moist snuff, but does not require spitting. Snus products include R. J. Reynolds' Camel Snus and Philip Morris's Marlboro Snus, Copenhagen pouches, and Skoal Snus (3). The introduction of snus marked the first time that cigarette brands were used on SLT products. Dissolvable tobacco products, which come in the form of sticks, strips, or orbs, and contain finely milled tobacco that is processed in a way that eliminates the need to spit, entered test markets in 2009 (RJR's product line) and 2011 (Altria's product line) (3,4).

The entry of cigarette manufacturers into the SLT arena, as well as the development of new SLT products, has been accompanied by significant shifts in marketing and advertising strategies. Magazine advertising, which had historically been focused on men's magazines with themes appealing to males, has evolved to include general adult magazines, and appeal to both genders (5).

These market changes have been accompanied by changes in sales patterns. For example, sales of moist snuff products (a category which includes snus) in convenience stores increased by 65.6% between 2005 and 2011 (6).

These changes in the landscape of SLT manufacturing, marketing, and sales have been accompanied by rising concerns – and debates – about co-use of SLT products and cigarettes. There is widespread agreement that SLT products pose significant health hazards (7,8). Both SLT use and cigarette smoking adversely affect vascular and metabolic parameters (e.g. blood pressure, insulin resistance, fibrinogen levels, etc.) (7). In an additive fashion, dual tobacco use can increase exposure to carcinogenic tobacco-specific nitrosamines (9). However, there is disagreement about whether co-use of SLT and cigarettes may help cigarette smokers wean themselves from cigarettes – as suggested by the experience of Norway and Sweden with snus (10,11), or enable smokers to sustain their habit, since they can switch between cigarette use (at home or in other situations where smoking is permitted) and SLT use – especially use of new, less obtrusive products (8,9). Marketing for snus, in particular, often promotes dual use with cigarettes. For example,

Brock and colleagues found that 47.9% of Marlboro and 11.4% of Camel direct-to-consumer coupon mailings promoted snus alongside cigarettes (12).

College students are an appropriate population in which to examine the issue of whether using SLT products, along with cigarette smoking, has an influence on continued smoking over time. SLT products and promotional efforts have been targeted at college students and other young adults (13–15), making them a key population for understanding how SLT is used alongside of, or as a replacement for, cigarettes. Furthermore, policies on college campuses may only regulate smoking in buildings and on campus grounds – not SLT use – creating an environment where situational switching between products allows smokers to maintain their habit (16).

This paper assesses whether male current cigarette smokers who also use SLT products, in the first semester of their first year of college, are more or less likely than cigarette smokers who do not use SLT products to still be smoking by the first semester of their senior year.

Methods

Sample

Data used in the analyses presented below were collected as part of the *Smokeless Tobacco Use in College Students study*. The objective of the study was to examine trajectories and patterns of SLT use over the course of undergraduate students' college careers. A cohort of students from 11 colleges, seven in North Carolina and four in Virginia (nine public and two private), was recruited in the students' first year of college to participate in surveys throughout their college career (4,17).

In order to identify the cohort of college students, a screener survey was fielded in fall 2010 among all freshmen in the participating schools. A total of 10 528 students completed the screener survey (17). The cohort was constructed by inviting selected respondents from the screener survey to participate in the fall 2010 survey and subsequent surveys over the course of their undergraduate careers. Past-year SLT users, those at elevated risk of becoming SLT users (i.e. lifetime SLT users and current smokers), and males were oversampled. There were 4902 eligible students who were invited to participate in the longitudinal cohort study of which 3146 (64.2%) completed the baseline fall 2010 survey (for a complete description of cohort recruitment [4]).

The data presented in this paper are from the first (freshman) and sixth (senior year) waves of the study, which took place in fall 2010 and fall 2013, respectively. For the sixth wave, 2516 of the 3146 baseline participants completed the survey (retention rate: 80%). Due to low rates of SLT use among female students in our sample, the analyses presented in this paper were restricted to male cigarette smokers who completed both the baseline and final wave of the survey. The final sample available for analysis was 274.

Procedure

Both surveys were web-based, and took approximately 15–20 min to complete (4). Members of the cohort were invited to participate via email, which included a secure link to the survey

website. Up to five email reminders, a phone call, and a text message were sent to remind students to complete the survey. Those who completed the baseline survey received a \$15 incentive, which escalated by \$5 with each wave of the survey. Students who completed wave 6 received a \$40 incentive. The Wake Forest School of Medicine Institutional Review Board, and, where requested, the Institutional Review Board of the college or university providing contact information for freshman students, approved the study protocol. A Certificate of Confidentiality was obtained from the U.S. Department of Health and Human Services in order to provide additional protection of privacy.

Measures

The outcome variable for the analyses presented below is current (past 30 day) cigarette smoking assessed at the sixth wave of the cohort survey (i.e. fall 2013 – which corresponds to first semester of senior year for students who were on track to graduate in 4 years). Participants were asked whether they had ever used cigarettes, with response categories of “Yes, past week,” “Yes, past month, but more than a week ago,” “Yes, past year, but more than a month ago,” “Yes, more than a year ago,” and “No, never.” Those responding that they had used cigarettes in the past week or in the past month were classified as current cigarette smokers.

A similar approach was used to create our key predictor variable of interest, which indicated whether, at baseline, the student was a current user of cigarettes only (“cigarette only” users) or current user of both cigarettes and one or more smokeless tobacco products (“cigarettes + SLT” users). Current cigarette only users were those who reported smoking cigarettes in the past month, but no use of SLT during the past month (although they could have used SLT more than a month ago). Current cigarette + SLT were those who reported using both cigarettes and at least one SLT product in the past month (defined to include chewing tobacco, moist snuff (“dip”), snus, or dissolvable tobacco products).

In order to assess smoking frequency at baseline, participants were asked “during the past 30 days, on how many days did you smoke cigarettes?” Response options were: “0 days,” “1–2 days,” “3–5 days,” “6–9 days,” “10–14 days,” “15–19 days,” “20–29,” and “all 30 days.” Based on the distribution of responses, the following categories were created for the analyses: 1 or 2 days, 3–14 days, and 15+ days.

Demographic variables measured at baseline included race (white or non-white, with white being the reference category), Hispanic ethnicity (reference = non-Hispanic), and mother’s education (reference = no college degree). Sensation seeking was measured using the Brief Sensation Seeking Scale (18,19). The scale measures agreement, using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), with eight statements (e.g. “I would like to explore new places and prefer friends who are exciting and unpredictable.”). Higher levels of sensation seeking are indicated by higher scores. The Cronbach’s alpha for this scale in our sample was 0.791. Affiliation with Greek letter organizations (yes vs. no) and friend and family cigarette smoking were measured at senior year. Peer cigarette smoking was assessed with the item, “how many of your four closest friends smoke cigarettes?” (0–4; coded as 0 vs. 1 or more). Family cigarette use was captured by asking “not including yourself, does anyone in your family currently smoke cigarettes?” (yes vs. no).

In addition to data from the cohort survey, we used Lee and colleagues' (2012) tobacco free policy score to assess the policy environment on each campus (16). Following procedures used by Lee and colleagues (16), we conducted an online search of each school's policy handbook and website for smoking and tobacco policies. Two team members scored each institution's policy based on the procedures used by Lee and colleagues (2012). The policy score is based on summing 13 items on campus smoking and tobacco-use policies related to the indoor and outdoor campus environment (e.g. ban on tobacco use in campus housing, ban on tobacco use in campus vehicles, smoking areas required to be a specified distance from buildings); bans on tobacco advertising and product sales; and if these policies include all tobacco products or just smoking. Total scores could range from 0–13, with higher scores indicating more comprehensive tobacco-free policies. For analysis purposes, following Lee and colleagues, the sum for each school was divided by 13 (range 0–1) (16).

Finally, a question asking SLT users about their reasons for using these products was included in the survey. A separate question was asked for each type of SLT product the participant indicating using (chewing tobacco, dip/snuff, snus, and dissolvable tobacco products). Response categories included: "It helps me keep my weight down," "It makes me look cool," "It relaxes or calms me," "It is better than smoking cigarettes," "It is really hard to quit," "My friends use it," "People in my family use it," "I enjoy it," "It is stimulating," "I am bored," "I am stressed," "It facilitates thinking," "It helps me concentrate," "I can use it in places where cigarette smoking is not allowed," and "It is helping or has helped me quit smoking." The participant answering the question could mark all that apply. We provide data from the baseline survey on reported reasons for use.

Statistical analysis

Descriptive statistics were used to characterize the sample of current male cigarette smokers at freshman year. Baseline prevalences of cigarette and SLT use among males were weighted to account for the oversampling of lifetime SLT users and current smokers so that estimates would generalize to the screened population of male freshman students. Sampling weights were calculated independently for each school within each cell of the sampling frame according to history of tobacco use. Weights were then scaled using the approach used by Pfefferman and colleagues in order to account for the complex survey design (i.e. students were sampled within schools) (20). A mixed-effects logistic regression analysis was conducted in order to estimate the likelihood of being a current smoker fall of senior year for students who used both cigarettes + SLT fall of freshman year compared to those who only smoked cigarettes fall of freshman year. This analysis adjusted for individual, peer and family factors associated with cigarette smoking. Since it is widely agreed that potential within-school clustering should be accounted for in analyses involving individuals nested within schools (21,22), school was included as a random-effect, using GLLAMM in Stata Version 12. We used multiple imputations by chained equations to handle missing covariate data (23,24). Twenty imputed datasets were generated using ICE in Stata Version 12. Results of the GLLAMM analysis on each of the datasets (274 observations each) were combined using MICOMBINE. Sensitivity analyses were conducted comparing results of analyses using multiple imputation and analyses restricted to the 237 participants with complete data on covariates. Parameter estimates were nearly identical, and there were no

differences in whether or not variables were statistically significant. Adjusted odds ratios and 95% confidence intervals are presented.

To identify possible selection bias, we examined the wave 6 participation rates by all model covariates that were measured at baseline. There was no significant difference in wave 6 participation by current SLT use, race, mother's education, or sensation seeking score. However, Hispanics were more likely to participate at wave 6 (89.3%) than non-Hispanics (72.4%; $F = 5.9$; $p = 0.035$), and males who smoked cigarettes at least 15 days per month were less likely to participate at wave 6 (65.7%) compared to males who smoked 3–14 days per month (79.8%; $F = 4.2$; $p = 0.030$).

Results

At baseline, 67.2% ($n = 184$) of male current smokers were cigarette only users and 32.8% ($n = 90$) were cigarette + SLT users (see Table 1). The majority of baseline male cigarette smokers were white (87.5%), non-Hispanic (91.2%), had a mother with a college education (64.3%), and had average sensation seeking scores for the college population (mean = 3.6). At senior year, the majority of the sample was not affiliated with a Greek organization (67.9%) and did not have a family member who smoked cigarettes (67%). The majority had friends who smoked cigarettes (75.8%). A little over a third (36.7%) of the sample reported smoking cigarettes 1–2 days a month, 37.8% 3–15 days a month, and 25.5% 15 or more days a month. The average tobacco free policy score across the 11 institutions was 0.35, with scores ranging from 0.15–0.62.

Among the cigarette + SLT users ($n = 90$), the most commonly reported reasons for use were “I enjoyed it,” which was reported by 80.6% of current users of chewing tobacco ($n = 29$), 70.0% of users of dip/snuff ($n = 112$), and 74.5% of users of snus ($n = 70$) (only one participant reported using dissolvable tobacco products, so we do not report data on reasons for use). The second most common reason for use was that “it relaxed or calmed me” (58.3% of chewing tobacco users [$n = 21$], 67.9% of dip/snuff users [$n = 108$], and 60.6% of snus users [$n = 50$]). A substantial number of snus users reported a motivation that “I could use it in places where cigarette smoking was not allowed” (50%, $n = 47$).

Overall, 62.0% ($n = 170$) of our sample of male current cigarette smokers were still current smokers senior year. Of those who were cigarette + SLT users, 66.7% were still smoking senior year, compared to 59.8% of cigarette only users. After adjustment for potential confounders (listed in Table 1), cigarette + SLT users freshman year were 30% more likely to be current smokers senior year compared to cigarette only users. However, this difference was not statistically significant (AOR = 1.30; CI = 0.73, 2.35). Having a friend who smokes cigarettes (AOR = 4.82; CI = 2.54, 9.16) and smoking 15 or more days per month (compared to 1 or 2 days at baseline) (AOR = 2.48; CI = 1.16, 5.27) were both significantly associated with an increased likelihood of smoking senior year (see Table 2).

Discussion

Co-use of cigarettes and SLT products is an important concern, because of the serious health hazards of both products, and because it is not known whether SLT use has an influence on

the persistence of smoking behavior. College students are an important population in which to examine this question, as they have been the target of tobacco advertising, and because the regulatory environment on many campuses may encourage situational switching between smoking (which is typically prohibited in buildings on campus, and often near the entrances to buildings, as well) and SLT use (which may or may not be prohibited, but which is a less obtrusive behavior than smoking).

In our sample of male college students from 11 colleges, smoking was markedly persistent over time. A total of 62% of first semester, first-year students were still smoking by the first semester of their senior year. This in itself is cause for concern, and points to the need for effective regulatory practices as well as smoking cessation services on college campuses (25,26). And while there is little data on this question to date, an obvious concern is whether smoking is equally likely to persist as young adults transition from college to the next stage in their lives, whether it involves continuing education, employment, childrearing, or unemployment (27).

The central question that this paper addresses is whether SLT use plays a role in the persistence of smoking. And, in fact, we found that 66.7% smokers who were SLT users at baseline were still smoking by the first semester of their senior year, compared to 59.8% of smokers who did not use SLT. After adjustment for covariates that have been used in past research to predict smoking, cigarettes + SLT users freshman year were 30% more likely to be senior year current smokers, compared to cigarette only users. However, this difference was not statistically significant. While we had a large total sample of college students (baseline $n = 3146$; fall senior year $n = 2546$), the number of male smokers at baseline, who also completed the first senior year survey, and for whom there was complete data at both waves, was limited to 274.

Despite the lack of statistical significance, the finding that users of cigarettes + SLT still had high rates of smoking senior year may have important clinical and policy implications. Co-use of these products may not only increase the likelihood of adverse health effects (9) but may also reflect a greater likelihood of future addiction (28). This increased level of nicotine addiction in turn implies a greater need for nicotine replacement therapy (NRT) for successful tobacco cessation, and prohibiting any tobacco use, rather than just smoking, in public places could discourage situational switching between combustible and smokeless tobacco products.

Co-use of cigarettes and SLT products is likely to remain a central topic in tobacco control and public health, given its prevalence – especially among young adults – as well as its relevance to current policy debates about “harm reduction” approaches. For example, the Food and Drug Administration’s Tobacco Products Scientific Advisory Committee recently recommended that the FDA deny a proposal from Swedish Match B to alter the warning label on its snus product to reflect modified risk, compared to cigarettes (FDA, 2015). Our results underscore the importance of not just weighing the health risk to an individual from using smokeless products, but also potential population-level effects on continued cigarette use.

Finally, we found that two factors were significantly associated with smoking persistence. The first of these, which is consistent with previous work on smoking among adolescents and young adults, was having friends who smoked (29–31). This finding points to the central role of social networks – which reflect both selection and socialization effects – in understanding smoking behavior. The second finding – also consistent with previous work (32) – is that heavier smokers at baseline (smoking on 15 more days in the previous month) were more likely than lighter smokers to still be smoking by senior year.

Limitations

This study is subject to a number of limitations. It relies on self-report of tobacco use, with no biochemical validation. As discussed in the *Methods* section, there is a modest level of selection bias in our sample of male baseline cigarette smokers who completed the wave 6 survey, compared to the pool of individuals who completed the survey at baseline. Finally, in contrast to many studies of college students, which are often limited to a single campus, our cohort was drawn from 11 colleges, including both public and private institutions, from two states. That said, the sample is regionally restricted (to two Southeastern states in the US), limiting generalizability to other states and countries, and to non-college populations. And, as discussed above, we had a limited sample of male smokers, limiting statistical power. Future work should examine the question of SLT's role in the persistence of smoking should be conducted with even larger samples, in order to provide abundant statistical power to reveal effects.

Conclusions

The study points to the possibility that SLT use may contribute to the high rates of persistent smoking among college students. The influence of SLT use, as well as the use of other tobacco products – notably electronic cigarettes – in understanding patterns of smoking experimentation, progression to regular smoking, and cessation—is a central question for future research.

References

1. Bialous SA, Peeters S. A brief overview of the tobacco industry in the last 20 years. *Tob Control*. 2012; 21:92–94. [PubMed: 22345228]
2. Centers for Disease Control and Prevention. Economic facts about U.S. tobacco production and use. *Smok Tob Use* 2014. Available at: http://www.cdc.gov/tobacco/data_statistics/fact_sheets/economics/econ_facts/ [last accessed 6 Feb 2015]
3. Seidenberg AB, Rees VW, Connolly GN. R.J. Reynolds goes international with new dissolvable tobacco products. *Tob Control*. 2012; 21:368–369. [PubMed: 21984408]
4. Wolfson M, Pockey JR, Reboussin BA, Suftin EL, Wagoner KG, Spangler JG. First-year college students' interest in trying dissolvable tobacco products. *Drug Alcohol Depend*. 2014; 134:309–313. [PubMed: 24309296]
5. Curry LE, Pederson LL, Stryker JE. The changing marketing of smokeless tobacco in magazine advertisements. *Nicotine Tob Res*. 2011; 13:540–547. [PubMed: 21436294]
6. Delnevo CD, Wackowski OA, Giovenco DP, Manderski MTB, Hrywna M, Ling PM. Examining market trends in the United States smokeless tobacco use: 2005–2011. *Tob Control*. 2014; 23:107–112. [PubMed: 23117999]

7. Lee PN, Hamling J. Systematic review of the relation between smokeless tobacco and cancer in Europe and North America. *BMC Med.* 2009; 7:36. [PubMed: 19638245]
8. Tomar SL, Fox BJ, Severson HH. Is smokeless tobacco use an appropriate public health strategy for reducing societal harm from cigarette smoking? *Int J Environ Res Public Health.* 2009; 6:10–24. [PubMed: 19440266]
9. Timberlake DS. Are smokers receptive to using smokeless tobacco as a substitute? *Prev Med.* 2009; 49:229–232. [PubMed: 19631684]
10. Pedersen W, von Soest T. Tobacco use among Norwegian adolescents: from cigarettes to snus. *Addiction.* 2014; 109:1154–1162. [PubMed: 24521070]
11. Ramström LM, Foulds J. Role of snus in initiation and cessation of tobacco smoking in Sweden. *Tob Control.* 2006; 15:210–214. [PubMed: 16728752]
12. Brock B, Schillo BA, Moilanen M. Tobacco industry marketing: an analysis of direct mail coupons and giveaways. *Tob Control.* 2015; 24:505–508. [PubMed: 25052861]
13. Katz SK, Lavack AM. Tobacco related bar promotions: insights from tobacco industry documents. *Tob Control.* 2002; 11:192–101. [PubMed: 11893819]
14. Klein, J. Tobacco targets: students concerned about free smokeless tobacco offered in bars. 2007. Available at: http://www.chicoer.com/ci_5842371?source=most_emailled [last accessed 17 Nov 2008]
15. Rigotti NA, Moran SE, Wechsler H. US college students' exposure to tobacco promotions: prevalence and association with tobacco use. *Am J Public Health.* 2005; 95:138–144. [PubMed: 15623874]
16. Lee JG, Goldstein AO, Klein EG, Ranney LM, Carver AM. Assessment of college and university campus tobacco-free policies in North Carolina. *J Am Coll Health.* 2012; 60:512–519. [PubMed: 23002799]
17. Spangler J, Song E, Pockey J, Suffin EL, Reboussin BA, Wagoner K, Wolfson M. Correlates of smokeless tobacco use among first year college students. *Health Educ J.* 2014; 73:693–701. [PubMed: 25484378]
18. Hoyle RH, Stephenson MT, Palmgreen P, Lorch EP, Donohew R. Reliability and validity of a brief measure of sensation seeking. *Personal Individ Differ.* 2002; 32:401–414.
19. Stephenson MT, Hoyle RH, Palmgreen P, Slater MD. Brief measures of sensation seeking for screening and large-scale surveys. *Drug Alcohol Depend.* 2003; 72:279–286. [PubMed: 14643945]
20. Pfeffermann D, Skinner C, Holmes D, Goldstein H, Rasbash J. Weighting for unequal selection probabilities in multilevel models. *J R Stat Soc Ser B.* 1998; 60:123–140.
21. Murray DM, Hannan PJ. Planning for the appropriate analysis in school-based drug-use prevention studies. *J Consult Clin Psychol.* 1990; 58:458–468. [PubMed: 2212183]
22. Donner A, Birkett N, Buck C. Randomization by cluster sample size requirements and analysis. *Am J Epidemiol.* 1981; 114:906–914. [PubMed: 7315838]
23. Little, RJA.; Rubin, DB. Statistical analysis with missing data. Vol. 2. Wiley-Interscience; Hoboken, NJ: 2002.
24. Royston P, Carlin JB, White IR. Multiple imputation of missing values: new features for mim. *Stata J.* 2009; 9:252–264.
25. Lee JGL, Goldstein AO, Kramer KD, et al. Statewide diffusion of 100% tobacco-free college and university policies. *Tob Control.* 2010; 19:311–317. [PubMed: 20472575]
26. Sutfin EL, McNamara RS, Blocker JN, Ip EH, O'Brien MC, Wolfson M. Screening and brief intervention for tobacco use by student health providers on college campuses. *J Am Coll Health.* 2012; 60:66–73. [PubMed: 22171731]
27. Tanner JL, Arnett JJ. Approaching young adult health and medicine from a developmental perspective. *Adolesc Med State Art Rev.* 2013; 24:485–506. [PubMed: 24654544]
28. Grøtvedt L, Forsén L, Stavem K, Graff-Iversen S. Patterns of snus and cigarette use: a study of Norwegian men followed from age 16 to 19. *Tob Control.* 2013; 22:382–388. [PubMed: 22634571]

29. Chassin L, Presson CC, Pitts SC, Sherman SJ. The natural history of cigarette smoking from adolescence to adulthood in a midwestern community sample: multiple trajectories and their psychosocial correlates. *Health Psychol.* 2000; 19:223–231. [PubMed: 10868766]
30. Fujimoto K, Valente TW. Decomposing the components of friendship and friends' influence on adolescent drinking and smoking. *J Adolesc Health.* 2012; 51:136–143. [PubMed: 22824443]
31. Hitchman SC, Fong GT, Zanna MP, Thrasher JF, Laux FL. The relation between number of smoking friends, and quit intentions, attempts, and success: findings from the International Tobacco Control (ITC) Four Country Survey. *Psychol Addict Behav.* 2014; 28:1144–1152. [PubMed: 24841185]
32. Macy JT, Seo D-C, Chassin L, Presson CC, Sherman SJ. Prospective predictors of long-term abstinence versus relapse among smokers who quit as young adults. *Am J Public Health.* 2007; 97:1470–1475. [PubMed: 17600248]

Table 1Demographic and behavioral characteristics of male freshman smokers ($n=274$).

Characteristic ¹	<i>n</i> (%) or Mean (SD)
Cigarette only users	184 (67.2)
Cigarette +SLT users	90 (32.8)
Non-white ($n=272$)	34 (12.5)
Hispanic ($n=274$)	24 (8.8)
Mom at least some college ($n=266$)	171 (64.3)
Member of Greek letter organization at senior year ($n=262$)	84 (32.1)
Sensation seeking ($n=272$) ²	3.6 (0.67)
Friends smoke at senior year ($n=265$)	201 (75.8)
Family smokes at senior year ($n=273$)	90 (33.0)
Cigarette smoking frequency at baseline (past 30 days) ($n=270$)	
1–2 days	99 (36.7)
3–14 days	102 (37.8)
15+ days	69 (25.5)
Tobacco free policy score	0.35 (0.2)

¹ Sample sizes vary due to missing data on some covariates.

² Sensation seeking is measured using the Brief Sensation Seeking Scale, which uses 5-point Likert items (1=strongly disagree to 5=strongly agree) to measure agreement with 8 statements on participants' interest in engaging in high sensation activities. Higher scores on the scale indicate higher levels of sensation seeking.

Table 2

Mixed-effects logistic regression model results predicting current cigarette smoking at senior year ($n=274$).

Characteristic	AOR (95% CI)
Cigarettes+SLT user vs. cigarettes only users	1.30 (0.73, 2.35)
Non-white vs. white	1.39 (0.60, 3.24)
Hispanic vs. non-Hispanic	1.35 (0.49, 3.75)
Mom at least some college vs. less than college	0.79 (0.43, 1.43)
Member of Greek letter organization vs. non-member	1.44 (0.79, 2.63)
Sensation seeking	1.21 (0.81, 1.81)
Friends smoke vs. no friends who smoke	4.82 (2.54, 9.16)
Family smokes vs. no family who smoke	0.87 (0.48, 1.58)
Cigarette smoking frequency at baseline	
3–14 days vs. 1 or 2 days	1.15 (0.63, 2.12)
15+ days vs. 1 or 2 days	2.48 (1.16, 5.28)
Tobacco free policy score	0.37 (0.06, 2.05)