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Correlates of smokeless tobacco use among first year college students

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Abstract

Objective—Smokeless tobacco (SLT) use is associated with specific adverse health effects. Knowledge of student tobacco use, including SLT, may guide inquiry into other risky health behaviors, and provide opportunities for health education of students.

Design—An incentivized email invitation to complete a web-based survey was sent to students at 11 colleges and universities in North Carolina and Virginia.

Methods—In autumn 2010, emails were sent to all first-year students ($n=29,536$) at 11 colleges and universities in North Carolina and Virginia, inviting them to participate in a brief web-based survey to be used to establish a cohort for the parent study evaluating tobacco use over 4 years. Survey items elicited demographic characteristics, tobacco use and other health behaviors.

Results—A total of 10,520 (36%) students responded. Past 30 day smoking and SLT use were 12% and 3%, respectively. Logistic regression analysis revealed that male gender (Adjusted Odds Ratio [AOR] = 11.6, 95% Confidence Interval [CI] = 8.16–16.59); current smoking (AOR = 5.5, 95% CI = 4.21–7.10), ever use of alcoholic energy drinks (AOR = 4.8, 95% CI = 3.63–6.43), and 5 days vs. < 3 days of physical activity a week (AOR = 1.5, 95% CI = 1.07–2.01) predicted risk of past 30 day SLT use.

Conclusion—While SLT use is relatively uncommon, knowledge of significant correlations between student tobacco use, including SLT and other risky health behaviors, might guide clinicians' inquiry and provide opportunities for health education of students.

Keywords

Smokeless tobacco; cigarette smoking; college students; alcoholic energy drink; sleep; physical activity

Introduction

Tobacco use remains the leading cause of avoidable mortality in the USA, responsible for over 440,000 deaths annually largely due to cardiovascular disease and cancer (Centers for

Disease Control and Prevention, 2008, 2011). Even though the rate of decline in use has stalled in the last 5–10 years, the prevalence of smoking has dramatically declined over the past five decades. In addition, use among young adults aged 18–25 remains higher than in the general adult population (34.2% versus 19.3%, respectively) (Substance Abuse and Mental Health Services Administration, 2010a). Particularly among individuals 18–25 years old with some college education, the prevalence of smoking has not significantly changed over the past 2 years. Smokeless tobacco (SLT) use by males in this age range who were full-time college students also increased significantly from 2008 to 2009, from 8.5% to 12.7% (Substance Abuse and Mental Health Services Administration, 2010a). The 2010 rates of smokeless tobacco use in this age group was also 14 times higher in men than in women (11.4% vs. 0.8%) (Substance Abuse and Mental Health Services Administration, 2010b).

Evidence suggests that tobacco products, including smokeless tobacco products, are marketed in ways to promote awareness among youth and young adults (Biener et al., 2004; Elkin et al., 2010; Hahn et al., 2008; Lee et al., 2012; Ling and Glantz, 2002; Mejia and Ling, 2010; Ridner et al., 2011; Rigotti et al., 2000; Sepe et al., 2002; Wetter et al., 2004). Such marketing includes promotions at bars and night clubs (Biener et al., 2004; Hahn et al., 2008; Ling and Glantz, 2002; Mejia and Ling, 2010; Ridner et al., 2011; Rigotti et al., 2000;), displays on college campuses (Lee et al., 2012; Rigotti et al., 2000;), postings on the Internet and YouTube (Elkin et al., 2010), and advertisements in neighborhoods and stores with highly specific characteristics (e.g. minority neighborhoods and neighborhoods with numerous bus shelters) (Ammerman and Nolden, 1995). College students are also a target of such marketing (Rigotti et al., 2000), and since college is a time when students transition from trying tobacco to regular use (Rigotti et al., 2000; Thompson et al., 2010; Wetter et al., 2004), research on tobacco use—including smokeless tobacco use—among college students should help inform cessation, regulation and tobacco control policy efforts in this population (Hahn et al., 2008; Lee et al., 2012). Such a focus is all the more relevant with the recent implementation by the US Food and Drug Administration (FDA) of the Family Smoking Prevention and Tobacco Control Act (US Food and Drug Administration, 2013). This legislation seeks not only to regulate cigarettes, but also both currently available smokeless tobacco products (e.g. chewing tobacco and snuff) as well as emerging products such as dissolvable oral tobacco (Battelle Centers for Public Health, 2012).

Tobacco use among college students may also be related to a number of other health behaviors. These include alcoholic energy drink use (Arria et al., 2010), sleep (Vail-Smith et al., 2009), and physical activity (Nicole et al., 2010). In a widely cited study, Zuckerman and Kuhlman (2000) note that patterns of brain dopamine and monoamine oxidase metabolism link risk-taking behaviors (in this case, alcoholic energy drinks). These actions can affect students' academic success and general wellbeing, as well as predict lifelong health behaviors (Newton, 2006). Nonetheless, for college clinicians to offer optimum care and health education to students, knowledge of the interconnections between adverse health behaviors is necessary. This is particularly true since no study which we are aware of has looked at these potential correlates in the same population.

As part of a longitudinal cohort study of college students at 11 North Carolina (NC) and Virginia (VA) colleges and universities, we gathered data from first-year college students ($n = 10,520$) in the first month of their freshman year (fall, 2010). These data were collected from a brief web survey to screen students for eligibility for inclusion into the cohort, which will be followed during all 4 years of college. This paper focuses on correlates of SLT use from this initial screening.

Methods

Sample

The data presented in this paper are from a screener survey used to establish a cohort of college students for the Smokeless Tobacco Use in College Students Study. The goal of the overall study is to assess trajectories and correlates of SLT use in a cohort of college students by surveying them each semester beginning in their freshman year and continuing through the fall of their senior year. Colleges in NC and VA with freshman enrollment of 1000 or more were considered eligible for participation. Military schools, single-gender schools, and seminaries or “Bible” schools were excluded. Historically black colleges and universities were also excluded due to low prevalence of tobacco use among black college students (Sutfin et al., 2012). Of the 11 colleges and universities participating in the study, seven are located in North Carolina and four are in Virginia. Nine are public schools and two are private. Five schools are in rural communities, four are in suburban communities, and two are in urban communities. Undergraduate enrollment ranged from 4024 to 23,730 in 2009, the year prior to the screener survey.

Procedure

In fall 2010, emails were sent to all first-year students at each of the 11 participating colleges ($N = 29,536$). The email invited students to participate in a web survey, which had 10 questions and took approximately 5 minutes to complete. Participants were considered eligible if they were at least 18 years of age, enrolled as a full-time student in the first semester of their first year, had an email address available from the school's registrar, and were not employees of Wake Forest University. Non-responders were sent up to three reminder emails. All email correspondence contained links to a secure server where the survey could be completed. Completers were eligible for a raffle, in which 10 students per school won a US\$100 Visa debit card. The study protocol was approved by the Wake Forest School of Medicine Institutional Review Board (IRB). Three schools also required approval from their own IRBs. Additional privacy protection was secured by issuance of a Certificate of Confidentiality by the Department of Health and Human Services.

Measures

The goal of the brief screener survey was to identify correlates of SLT use, while at the same time masking this goal to respondents so that results would not be biased (e.g. only tobacco users responding). In addition, the survey had to remain brief to encourage participation. Thus, the survey was entitled Assessment of the College Experience, or ACE. Students were asked their age, gender, class year and status (full or part time). Respondents were asked if they used SLT in the past month, past year, more than a year ago or never.

Cigarette smoking, a known correlate of SLT use (Backinger et al., 2008), was defined as use within the past 30 days. To blind the goal of the survey, students were also asked distractor questions which we knew had not been evaluated previously and which we hypothesized would be related to SLT use due to previous studies: physical activity (Nicole et al., 2010), hours of sleep (Vail-Smith et al., 2009), and ever use of alcoholic energy drinks (Arria et al., 2010). Measures of physical activity were derived from national adult recommendations (Haskell et al., 2007), and categorized as less than 3 days, 3–4 days and 5 or more days of vigorous activity per week. Based on current research on college students' sleep, academic success and health (Pilcher et al., 1997; Trockel et al., 2000), sleep was categorized as less than 7 hours, 7–8 hours and more than 8 hours per night. An item asking about ever use of alcoholic energy drinks was also included in the survey (O'Brien et al., 2008).

Statistical analysis

Sample demographics, school characteristics (e.g. size: < 5000; 5001–10,000; and >10,000), tobacco use and health-risk behaviors were summarized using descriptive statistics. Reported *p*-values for differences in sample characteristics between males and females are based on chi-squared statistics. Random-effects logistic regression models were used to fit a multivariable model of past 30 day SLT use that included demographics, school characteristics and other health-risk behaviors. School was treated as a random effect to account for intra-school correlation, since students within a school are likely to be more like one another than they are to be like students in other schools (Donner et al., 1981; Murray and Short, 1995, 1996). Adjusted odds ratios (OR) and their 95% confidence intervals (CI) were calculated for the independent variables. Models were estimated in SAS Version 9.2 and PROC GLIMMIX. A two-sided *p*-value <0.05 was considered statistically significant.

Results

A total of 10,520 students across the 11 schools participated, for a response rate of 36%. The majority of first-year students were 18 years old (92.5%) and female (63%). While most had never used SLT (90%), 7% reported ever use, but not within the past 30 days, and 3% reported past 30-day use. By gender, 7.2% of men and 0.6% of women had used SLT in the past 30 days ($p<0.001$). The prevalence of past 30-day cigarette smoking was 12% (16.8% of males and 9.8% of females, $p<0.001$). A higher proportion of men compared with women engaged in 5 or more days per week of vigorous physical activity (41.5% vs. 31.1%, respectively; $p<0.001$) and had ever used alcoholic energy drinks (30.8% vs. 28.6%, respectively; $p=0.02$). In addition, a greater percent of men (60.7%) compared with women (57.5%) slept 7–8 hours nightly, while the reverse was true for less than 7 hours of sleep (35.6% vs. 39.5%, respectively; $p<0.001$). There appeared to be a slight preponderance of women compared with men at smaller schools, while the opposite held true at larger schools ($p=0.04$). See Table 1 for descriptive statistics.

Multivariable random-effects logistic regression analysis results are reported in Table 2. All models controlled for gender. In addition, the models were run with male-only subjects with similar results. Being a man greatly increased the risk of past 30 day SLT use (Adjusted

Odds Ratio [AOR] = 11.6; 95% CI = 8.16–16.59). Current cigarette smokers were over five times more likely to have used SLT during the past 30 days (AOR = 5.5; 95% CI = 4.21–7.10). Students who had ever used alcoholic energy drinks were nearly five times more likely to be past 30 day SLT users (AOR = 4.8; 95% CI = 3.62–6.43). Also, students who participated in 5 or more days per week of physical activity were 1.5 times more likely to have used SLT during the past 30 days (AOR = 1.5; 95% CI = 1.07–2.01). No associations were found between SLT use and age, hours of sleep, or school size.

Discussion

In a large sample of first-year college students in North Carolina and Virginia, overall we found that the prevalence of smokeless tobacco use in the past 30 days was 3%, masking a 12-fold greater risk of use among males than females. Use of SLT also was associated with cigarette smoking, physical activity, and ever use of alcoholic energy drinks.

Our finding that men were nearly 12 times more likely compared with women to use SLT in the past 30 days is generally consistent with the 14-fold higher rate of SLT use among 18–25-year-old men compared with women in the National Survey of Drug Use and Health (NSDUH) (Substance Abuse and Mental Health Services Administration, 2010b). Indeed, men are more likely than women to use both cigarettes and smokeless tobacco (Biener et al., 2004). Past 30-day cigarette smokers were 5.5 times more likely to use SLT compared with non-smokers, implying a high degree of dual cigarette and smokeless use among current SLT users. Because men were more likely than women to use smokeless tobacco, we included gender as a control variable in our multivariable analysis, but ran analyses with and without gender achieving similar results.

Our findings among male students underscore at least two important issues. First, SLT use is largely a male phenomenon, and addressing this adverse health behavior should focus on this gender differential. For example, male students may use SLT preferentially in specific situations, such as at fraternity parties or playing sports (Emmons et al., 1998; Holly et al., 2005; Yusko et al., 2008). Addressing context of use, therefore, is also critical in helping male students change tobacco use behavior. Second, tobacco interventions by student health care providers should address not only cigarette smoking, but SLT use as well (Fiore et al., 2008). These points are particularly relevant since SLT is marketed toward young adults (Biener et al., 2004; Elkin et al., 2010; Hahn et al., 2008; Lee et al., 2012; Ling and Glantz, 2002; Ridner et al., 2011; Rigotti et al., 2000).

Students who reported engaging in physical activity 5 or more days a week were 50% more likely to be current SLT users. On the one hand, these current SLT-using students are likely meeting guidelines for adult physical activity (Haskell et al., 2007). On the other hand, there is increased use of SLT in the most physically active group. In evaluating 10,437 students attending 119 four-year colleges across the nation, Nelson and colleagues (2007) found that male students had a higher rate of vigorous physical activity than females (45.0% vs. 37.9%). In addition, in multivariable regression modeling, female students were less likely than males to participate in vigorous physical activity and more likely to be sedentary. Since our model controlled for gender, other factors might come into play in the relationship

between physical activity and SLT use. One such factor could be higher rates of SLT use among men. This would conceivably lead to higher rates of use among those participating in sports that are predominately played by men (e.g. baseball).

Alcoholic energy drink use is a known correlate of tobacco use. Ever use of alcoholic energy drinks likely correlates with these beverages' known association with tobacco use and other risky behaviors (Miller, 2008; Reed et al., 2007; Weldy, 2010). Indeed, alcohol use itself plays a causal role in tobacco use and can be used as a clinical indicator for tobacco misuse (McKee and Weinberger, 2013). Reed et al. (2007) found that any past 12 month alcohol consumption at least doubles the risk for subsequent smoking; 40 or more drinks in the past 12 months lifts this risk to 43-fold. Alcohol use is also associated with social smoking, for example, smoking only in social settings while consuming alcohol (Moran et al., 2004). The students who smoke socially in these settings typically have lower levels of nicotine addiction, do not see themselves as smokers, but nonetheless are experimenting with smoking and may progress on to regular smokers (Moran et al., 2004). While Rigotti et al. (2000) found cigarette and cigar smoking related to be related to social contexts ($p = 0.05$ and $p = 0.03$, respectively), they did not find such an association with SLT. While we did not specifically ask about social smoking, the correlation of SLT use with alcoholic energy use is consistent with social use of tobacco. The addition of alcohol to energy drinks might undesirably promote risky behavior for a number of reasons. These include the impairment of judgment without the recognition of this impairment by the individual; and the fact that more alcohol might be consumed because the caffeine keeps the individual awake longer, making prolonged consumption more likely (Weldy, 2010).

These findings are subject to a number of limitations. First, the response rate was 36%. However, this is similar to other web surveys of college students (An et al., 2007; Johnston et al., 2011; US Department of Education, 2006). Moreover, despite lower response rates, internet tobacco surveys among college students have been shown to be statistically similar to phone and mail surveys (An et al., 2007). Next, this study excluded colleges (e.g. Bible colleges and historically black universities) which likely had low prevalence of tobacco use. However, these schools would also likely be smaller in enrollment which may not have changed results. Another potential concern is the lower rate of tobacco use among students of the 11 schools we surveyed compared with the NSDUH (Biener et al., 2004; Substance Abuse and Mental Health Services Administration, 2010a, Substance Abuse and Mental Health Services Administration, 2010b). However, the latter is a household survey which asks about past 30-day smoking and asks if participants are enrolled in college. In contrast to our survey, which was carried out exclusively among 4-year college and university students, NSDUH includes 2-year community college students (Nicole et al., 2010). In addition, the lower rate of tobacco use found in our study might be due in part to the fact that we enrolled some schools regarded as more socially conservative than other colleges and universities. Therefore, tobacco use would likely be lower among these schools' students. Further, the lower SLT use rate might be a conservative estimate of the true 4-year college rate due to the study's focus on two states only. However, our data are consistent with those of the Monitoring the Future survey (An et al., 2007), an in-school study of the behaviors, attitudes, and values of American secondary school students, college students, and young

adults. That survey found past 30-day cigarette smoking to be 20% among young men and 14% among young women ages 18–25, which, compared with the NSDUH, is much closer to our respective estimates of 17% and 10% (Substance Abuse and Mental Health Services Administration, 2010a, 2010b). Finally, these data are cross-sectional in nature and cannot be used to infer causality. Since the longitudinal study focused on trajectories of use over the college career, and because collection of the longitudinal data is ongoing, the current study did not regress correlates of use in this paper with future SLT trajectories.

In sum, we have found that SLT use occurs among 7.2% of male college students and is associated with other health behaviors, including current cigarette smoking, alcoholic energy drink use, and physical activity. Remembering to ask about all tobacco use (not simply cigarette smoking) will be essential in tobacco cessation interventions in campus health clinics. This is particularly true for men, and in the context of marketing being targeted toward college students (Rigotti et al., 2000) and with the emergence of new, spitless tobacco products (Battelle Centers for Public Health, 2012). Asking every patient at every clinic visit about his or her tobacco use has been shown to increase providers' tobacco intervention and patients' quit attempts (Fiore et al., 2008). This approach is consistent with the American College Health Association's recommendations supporting evidence-based tobacco treatment among college students and supporting the promulgation of campus tobacco-free policies (American College Health Association, 2011). Finally, knowledge of health behaviors can provide guidance for campus health clinicians to improve preventive care, including counseling on tobacco cessation, alcohol misuse, physical activity and healthy sleep.

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Table 1

Characteristics of the sample of 10,484 students surveyed by email at 11 colleges and universities in NC and VA, by gender. Demographic characteristics by gender, $N=10484$.

Characteristics	Male ($n=3830$) n (%)	Female ($n=6510$) n (%)	Total ($N=10,340$) N (%)	p -value
Age				
18	3423 (89.4)	6136 (94.3)	9559 (92.4)	<.001
19+	407 (10.6)	374 (5.8)	781 (7.6)	<.001
Smokeless tobacco use				
Never	3051 (79.7)	6278 (96.4)	9329 (90.2)	<.001
Past 12 month or ever	502 (13.1)	195 (3.0)	697 (6.7)	<.001
Past 30 day	277 (7.2)	37 (0.6)	314 (3.0)	<.001
Past 30 day cigarette smoking	645 (16.8)	640 (9.8)	1,285 (12.4)	<.001
Ever use of alcoholic energy drink	1181 (30.8)	1863 (28.6)	3044 (29.4)	0.02
Physical activity (days per week)				
5 or more	1590 (41.5)	2026 (31.1)	3616 (35.0)	<.001
3–4	1291 (33.7)	2353 (36.1)	3644 (35.2)	<.001
Less than 3	949 (24.8)	2131 (32.7)	3080 (29.8)	<.001
Sleep (hours per night)				
More than 8	142 (3.7)	199 (3.1)	341 (3.3)	<.001
7–8	2323 (60.7)	3743 (57.5)	6066 (58.7)	<.001
Less than 7	1365 (35.6)	2568 (39.5)	3933 (38.0)	<.001
School size (undergraduate students)				
Small (<5000)	413 (10.8)	812 (12.5)	1,225 (11.9)	0.04
Medium (5001–10,000)	256 (6.7)	424 (6.5)	680 (6.6)	0.04
Large (>10,000)	3161 (82.5)	5274 (81.0)	8435 (81.6)	0.04

Table 2

Multivariable logistic regression analysis using proc GLIMMIX of predictors of past 30-day smokeless tobacco use among students participating in email survey at 11 colleges and universities in NC and VA, $N = 10,340$.

Covariate	Past 30-day SLT Use ($N = 10,340$)		
	AOR	95% CI	<i>p</i> -value
Male	11.6	8.16, 16.59	<.0001
Age (18 vs. 18)	1.38	0.94, 2.00	0.10
Current cigarette use	5.5	4.21, 7.10	<.0001
Ever use alcoholic energy drink	4.8	3.62, 6.43	<.0001
Physical activity (per week)			
5 days vs. < 3 days	1.5	1.07, 2.01	0.02
3–4 days vs. < 3 days	1.0	0.74, 1.45	0.85
Sleep (hours per night)			
7–8 hours vs. < 7 hours	1.1	0.84, 1.41	0.51
> 8 hours vs. < 7 Hours	0.8	0.39, 1.70	0.57
School size (undergraduate students)			
Small vs. Large	1.2	0.80, 1.74	0.41
Medium vs. Large	0.7	0.37, 1.23	0.20