

College Students' Polytabacco Use, Cigarette Cessation, and Dependence

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Objectives: We examined patterns of tobacco and electronic cigarette (e-cigarette) use among college students. Differences in sociodemographic characteristics between non-users of these products and 4 mutually exclusive groups of tobacco/e-cigarette users were assessed. Differences in cigarette cessation attempts and dependence between exclusive cigarette smokers and users of cigarettes and at least one alternative tobacco product also were examined. **Methods:** Participants were 5468 18-29 year-old students from 24 colleges in Texas who completed an online survey. **Results:** Multiple-product use was more prevalent than single-product use. All 4 current tobacco/e-cigarette-user groups were more likely than non-users to be men and older. College students who

were younger when they smoked their first cigarette, and those reporting ever needing a cigarette, were more likely to be multiple-product users than cigarette-only users. There were no group differences in cigarette cessation attempts or any other variables. **Conclusions:** Using multiple products is associated with some indicators of dependence, but does not seem to aid or deter college students' smoking cessation attempts. Longitudinal research is needed given that transitions in tobacco/e-cigarette use continue throughout young adulthood.

Key words: cigarette cessation attempts; cigarette dependence; non-cigarette products; polytabacco use; tobacco use among young adults

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Whereas cigarette use in the United States (US) has been declining,¹ the use of alternative products, such as cigars and electronic nicotine delivery systems (ENDS, also referred to as e-cigarettes) has been increasing.^{2,3} Young adults have the highest prevalence of use of alternative products.⁴ Approximately 22% of

18-34 year-olds reported ever using at least one non-combustible product (ie, e-cigarettes, chewing tobacco/dip/snuff, snus or dissolvables) in 2012 and 52% reported ever using at least one combustible non-cigarette product (ie, cigars, pipes, little cigars/cigarillos, bidis, or hookah).⁵ Young adults also are more likely than older adults to be concurrent users of multiple products,^{6,7} and data from the National Survey on Drug Use and Health showed that multiple-tobacco product use increased significantly from 2002 to 2012 for 18-25 year-olds, but not for those over 25.⁸

One group of young adults at elevated risk for multiple-product use is college students.^{9,10} The college years, and young adulthood more generally, are characterized by instability and change in multiple domains of behavior, including tobacco and e-cigarette use¹¹ (hereafter referred to as tobacco use, for brevity). Not only are there new users of tobacco products in young adulthood, but it is during this developmental period when addiction is often solidified for existing users.^{12,13} The

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2011 Legacy Young Adult Cohort Study showed that 32% of 18-34 year old young adult tobacco ever users reported initiating use of one of 10 tobacco products after the age of 18 and 39% of regular users reported progressing to regular use during young adulthood.¹⁴ Initiation and sustained use of tobacco by young adults, including college students, may be due, in part, to the lack of regulation of the majority of non-cigarette alternatives, coupled with the tobacco industry's focus on this population,¹⁵ their youngest legal targets. Despite their increased risk for initiation of and addiction to tobacco products, relatively little research examines the use of multiple tobacco products among young adult college students.

Cigarette smokers are more likely than non-cigarette smokers to use alternative tobacco products.^{4,16} Cigarette smokers may use alternative tobacco products because they are perceived to be less harmful than cigarettes and because marketing messages indicate they can be used as substitutes for cigarettes.^{17,18} However, no tobacco product is completely safe. Moreover, concurrent use may result in increased nicotine exposure¹⁹ and, in turn, to addiction for light and intermittent smokers, most notably among young adults.¹² Cigarette smokers also may use alternative tobacco products to quit smoking cigarettes,²⁰ even though there is little evidence that alternative tobacco products aid in long-term cessation. A few studies report that adults who are concurrent users of cigarettes and at least one alternative tobacco product are more likely than exclusive cigarette users to make a quit attempt.^{6,20,21} There is limited research, however, on young adult multiple-tobacco users' attempts to quit smoking.

Although established smokers may use alternative tobacco products, like e-cigarettes, as substitutes for cigarettes or to aid with quitting, existing research is conflicting regarding differences in level of cigarette dependence between exclusive cigarette smokers and concurrent users of cigarettes with at least one other product. Moreover, this research has been conducted exclusively with adults. Thus, whereas one study showed that adult men who were concurrent cigarette and smokeless tobacco users were more likely than cigarette-only users to report smoking within 30 minutes of waking,¹⁹ another found that adult men and women who were concurrent users of cigarettes with at least one other product (ie, smokeless tobacco, cigars, or pipes) were less likely than cigarette-only users to report smoking within 30 minutes of waking. These polyusers also had a lower probability of strong cravings for cigarettes.⁸ Given these conflicting findings and lack of research on the dependence symptoms of young adult multiple-tobacco product users, some of whom are transitioning from light and intermittent to regular use,¹² additional studies are needed to examine differences in cigarette dependence symptoms between young adults who are exclusive cigarette users and those

who are concurrent users of cigarettes and at least one other product.

The tobacco landscape continues to change and the diversity of tobacco products available today is greater than ever before. The increasing diversity underscores the need to consider the full complement of non-cigarette alternative products available to consumers. Understanding the pattern of use among college students is particularly important, given this group represents 40% of 18-24 year-old young adults,²² a population at elevated risk for exclusive and concurrent use of alternative products.^{4,6} Yet, there is limited research on college students' multiple-tobacco product use and most existing studies consider only a limited number of alternative products. The present study extends existing research by examining 18-29 year-old college students' patterns of use of cigarettes, e-cigarettes, cigars/cigarillos/little cigars, hookah, and smokeless tobacco including snuff/dip/chew and snus. First, we examined differences in sociodemographic characteristics between current non-users of any tobacco product and 4 mutually exclusive groups of current, or past 30-day, tobacco-using young adults. These 4 groups consisted of: current users of only one alternative product; current users of more than one alternative product; current users of cigarettes only; and current users of cigarettes and at least one alternative product. Next, we conducted a series of analyses examining differences between exclusive cigarette smokers and concurrent users of cigarettes and at least one alternative tobacco product on number of smoking cessation attempts and symptoms of cigarette dependence. We also examined differences between the 2 groups on quantity and frequency of cigarettes smoked and in age of initiation of cigarette use. Age of initiation was assessed because earlier initiation is positively associated with symptoms of dependence.²³

METHODS

Participants

Participants were 5468 young adult students attending one of 24 2- and 4-year colleges in Texas and involved in the baseline wave (November 2014-February 2015) of the Marketing and Promotions across Colleges in Texas project (Project M-PACT), a rapid response surveillance study. Students were 18-29 years old (mean age = 20.49; standard deviation = 2.36) and more than half were women (63.4%). Regarding race/ethnicity, 36.3% of students were non-Hispanic white, 31.1% were Hispanic/Latino, 8.1% were African-American/black, 16.9% were Asian, and 7.5% reported other race/ethnicity or reported 2 or more races/ethnicities. The present study excluded data from an additional 14 students who were missing large amounts of data.

To participate in the project, participants were required to be full- or part-time degree- or certificate-seeking undergraduate students attending a 4-year college or a vocational/technical program at

a 2-year college. Recruitment at 2-year colleges was limited to students enrolled in vocational/technical programs (eg, welding, air conditioning and cooling, etc.) because they have an elevated prevalence of cigarette use²⁴ and, as such, are at elevated risk for the use of alternative tobacco products. Participants also were required to be 18-29 years old. However, for those who were 26-29 year-olds, recruitment was restricted to lifetime tobacco users. Lifetime tobacco use was defined by having ever smoked at least 100 cigarettes, or at least 20 cigars, or having ever used smokeless/spit/chewing tobacco at least 20 times. Because the larger project aimed to examine transitions in tobacco use and initiation is unlikely to occur after the age of 26,¹³ lifetime non-tobacco users over the age of 26 were excluded from participation. To ensure adequate numbers of tobacco users, 347 18-25 year-old lifetime tobacco users were oversampled.

Procedure

To ensure recruitment of adequate numbers of students from each college, only schools with a minimum enrollment of 2500 students were considered for inclusion, and 2-year colleges were required to have students enrolled in vocational/technical programs. A total of 65 colleges were identified in 4 target cities (Austin, Dallas/Fort Worth, Houston, and San Antonio). Three colleges of each type were selected from each city, for a total of 6 per city, to comprise a total of 24 colleges (12 2-year colleges with vocational programs and 12 4-year colleges).

Eligible students attending the 24 colleges were recruited to participate in the online survey via email invitation, which described the purpose of the study and included a link to an eligibility survey. Eligible students who wished to participate in the study provided informed consent and then completed the online survey. Overall, 13,714 students were eligible to participate in the study, and of these, 40% (N = 5482) provided consent and completed the survey. This rate of participation is similar to, or exceeds, other online studies of college students.^{25,26}

Measures

Nine tobacco control experts initially reviewed measures for the current study. However, all final item modifications were conducted through an iterative process of cognitive interviewing²⁷ with 25 young adults who were not part of the study.²⁸

Current cigarette and alternative tobacco product use. Current or past 30-day use of 5 products (cigarettes, smokeless tobacco/snus, cigars/cigarillos/little cigars, hookah, and e-cigarettes) was assessed with items adapted from the Youth Tobacco Survey²⁹ and the Population Assessment of Tobacco and Health (PATH) Survey.³⁰ Current use of cigarettes and smokeless tobacco was assessed with: "During the past 30 days, on how many days did you smoke/use ____?" Cur-

rent use of cigars/cigarillos/little cigars and hookah was assessed with: "During the past 30 days, how many days did you smoke ____ as intended (ie, with tobacco)?" Current use of e-cigarettes was assessed with: "During the past 30 days, have you used any ENDS product (ie, an e-cigarette, vape pen, or e-hookah), even one or 2 puffs, as intended (ie, with nicotine cartridges and/or e-liquid/e-juice)?"

Participants were categorized into 5 tobacco usage groups based on the past 30-day use items: (1) Non-users reported using all 5 products on 0 days; (2) Non-cigarette single product users reported using cigarettes on 0 days in the past 30 days, but reported using one alternative product on one or more days; (3) Non-cigarette polytobacco users reported using cigarettes on 0 days in the past 30 days, but reported using at least 2 other products on one or more days; (4) Cigarette-only users reported using cigarettes on one or more days in the past 30 days and using all other products on 0 days; and (5) Cigarette polytobacco users reported using cigarettes on one or more days in the past 30 days and at least one other product on one or more days.

Quit smoking attempts. Number of past 12-month smoking cessation attempts was adapted from the National Health Interview Survey³¹ and was assessed with the following item: "During the past 12 months, how many times have you stopped smoking cigarettes for one day or longer in an attempt to quit?" Response options ranged from "0" to "10" times and "more than 10 times," which was coded as 11.

Quantity of cigarettes smoked per day. Number of cigarettes per day also was adapted from PATH and asked respondents who smoked cigarettes on at least one day in the past month: "On average, on those xx days, how many cigarettes did you usually smoke each day?" Response options ranged from 1-30.

Age at first cigarette use. Age at first use was adapted from the PATH survey and asked participants: "How old were you the first time you smoked part or all of a cigarette?" Response options ranged from 10 or under (coded as 10) to 29-years-old, or "I don't remember how old I was," which was treated as missing data (N = 6).

Cigarette dependence symptoms. Three symptoms of cigarette dependence were examined. Two symptoms were drawn from the Hooked on Nicotine Checklist.³² Respondents were asked: "Have you ever felt like you really needed a cigarette?" and "Have you ever had a strong craving to smoke a cigarette?" Response options for both items were "no" (0) or "yes" (1). The final symptom was adapted from the Fagerstrom Test for Nicotine Dependence³³ and asked respondents: "How soon after you wake up do you typically smoke your first cigarette of the day?" Responses were: "within 5 minutes," "6-30 minutes," "31-60 minutes," "60 or more minutes," or "I am not a daily cigarette

smoker.” The item was recoded into a dichotomous variable so that participants who smoked their first cigarette within 30 minutes of waking were coded “1” and all others were coded as “0.”

Sociodemographic variables. Sex, age, race/ethnicity and type of college were included as covariates. Race/ethnicity was measured with 2 items. Respondents were asked: “Are you Hispanic or Latino/a?” to assess ethnicity. Response options included “No,” “Yes, I am Mexican, Mexican-American, or Chicano/a,” and “Yes, I am some other Hispanic or Latino/an ethnicity not listed here.” Respondents were then asked: “What race or races do you consider yourself to be? Check all that apply.” Response options were “white,” “black or African-American,” “Asian,” “American Indian or Alaska Native,” “Native Hawaiian or other Pacific Islander,” and “Other.” A race/ethnicity variable was created by combining these 2 questions. All students who reported being of Hispanic or Latino/a ethnicity were given a code of Hispanic and the remaining students were given codes that represented the selected race. Students who indicated more than one race were coded as “other.”

Data Analysis

Multinomial logistic regression models using Mplus 7.3³⁴ were first fit to examine differences on the sociodemographic variables of sex, age, race/ethnicity, and college type between current non-users of any tobacco or e-cigarette product and the 4 groups of current tobacco-using students (current users of only one alternative product, current users of more than one alternative product, current users of cigarettes only, and current users of cigarettes and at least one alternative product). The 5-group tobacco usage variable (with non-user as the reference group) was included as the dependent variable in the first set of analyses and regressed on each of the sociodemographic variables in separate models. We attempted to fit multilevel multinomial models to accommodate the non-independence of participants within the 24 schools. However, the multilevel multinomial models, which included 4 random intercepts (ie, intercepts for the 4 tobacco use groups vs the reference category, non-users), did not converge. We subsequently fit null multinomial models in which each intercept had a random effect in separate models. The intercept variability was not statistically significant in any of the 4 models indicating that there was no variability in the proportions of tobacco use groups across the 24 colleges. Thus, we treated each of the intercepts as fixed effects in the multinomial models.

Second, multilevel logistic regression models, in which the model intercept was allowed to vary across colleges, were fit to examine differences between exclusive cigarette smokers and concurrent users of cigarettes and at least one alternative tobacco product in quantity and frequency of cigarettes smoked, age of initiation of cigarette use,

Table 1
Prevalence of Current Tobacco Use
Patterns among Alternative Tobacco
Product Users (N = 1640)

Single alternative product use	N = 552	
Hookah	241	43.7%
E-cigarette	200	36.2%
Cigar	92	16.7%
Smokeless tobacco	19	3.4%
Two or more alternative products used ^a	N = 303	
E-cigarette + hookah	152	50.2%
E-cigarette + cigar + hookah	46	15.2%
Cigar + hookah	36	11.9%
E-cigarette + cigar	32	10.6%
Cigarettes and at least one alternative used ^a	N = 785	
Cigarette + e-cigarette	170	21.7%
Cigarette + e-cigarette + hookah	138	17.6%
Cigarette + hookah	96	12.2%
Cigarette + cigar	92	11.7%

Note.
a = Only the 4 most prevalent combinations are presented.

number of cigarette cessation attempts in the past year, and presence of the 3 dependence symptoms. These analyses also were conducted with MPlus 7.3.³⁴ The dependent variable for these analyses was the dichotomous cigarette-only versus concurrent user variable, and each independent variable was evaluated in separate multilevel models that included sex, age, race/ethnicity, and type of college (2- vs 4-year institution) as covariates. One should note that although we oversampled participants based on lifetime tobacco use, the data were not weighted because our goal was to test associations between variables rather than to generate state or national prevalence estimates.²⁵

RESULTS

Prior to examining study questions, a series of descriptive analyses were conducted. Overall, 36.8% of all participants reported use of cigarettes or alternative tobacco products during the past 30 days with nearly one-third (29.9%) of the sample reporting current use of at least one alternative product. Almost 16% of participants were current users of alternative products, but not cigarettes. Considering all tobacco and e-cigarette products, 19.9% of our sampled students were multiple-tobacco product users, whereas 16.9% were single-

Table 2
Sociodemographic Characteristics of the 5 Tobacco Usage Groups

	Total (N = 5468)	Non-user (N = 3454)	Single alternative product (N = 552)	Two or more alternatives (N = 303)	Cigarette only (N = 374)	Cigarette + alternative product(s) (N = 785)
Sex (% men)	36.6	31.1	40.7	45.0	39.8	51.0
Mean age in years	20.49	20.26	20.68	20.22	21.49	20.98
(Standard Deviation)	(2.36)	(2.18)	(2.46)	(2.11)	(2.76)	(2.68)
Race/Ethnicity						
% White	36.3	34.4	37.9	37.3	42.0	40.9
% Hispanic	31.1	29.9	31.3	31.7	37.2	33.4
% Asian	16.9	19.4	14.9	15.2	10.7	11.0
% Black	8.1	9.0	7.4	8.9	4.8	5.7
% Others	7.5	7.3	8.5	6.9	5.3	9.0

Note.

Usage groups based on current, or past 30-day, tobacco (cigarettes, smokeless tobacco/snus, cigars/cigarillos/little cigars, hookah) or e-cigarette use. Alternative products include all products, except cigarettes.

product users. Although 6.8% of participants reported exclusive use of cigarettes during the past 30 days, more than twice as many (14.4%) reported concurrent use of cigarettes and at least one alternative product.

Patterns of tobacco use were examined across the 3 groups of participants reporting use of alternative tobacco products (Table 1). The most prevalent alternative tobacco product used by participants who were exclusive users of only one alternative product was hookah, followed by e-cigarettes, cigars, and then smokeless tobacco. Among current users of more than one alternative product, the most prevalent combination of products was e-cigarettes + hookah, with half of this group reporting use of both these products in the past 30 days. The other combinations of products were each reported by fewer than 15% of this group. Finally, among current users of cigarettes and at least one alternative product, the most prevalent patterns were cigarettes + e-cigarettes, cigarettes + e-cigarettes + hookah, cigarettes + hookah, and cigarettes + cigars.

Table 2 shows the sociodemographic characteristics of the 5 usage groups and Table 3 shows the multinomial regression results examining sociodemographic differences between the current non-users of tobacco group and the 4 tobacco-user groups. All 4 current tobacco-user groups were more likely than current non-users of any tobacco product to be men. Compared with current non-users, users of only one alternative product, cigarette-only users, and concurrent users of cigarettes and at least one other product were also more likely to be older, and there was no age dif-

ference between non-users and users of 2 or more alternative products. There were relatively few differences across the groups in race/ethnicity. However, compared with non-users, the 2 cigarette-using groups (ie, cigarette-only users and those who used cigarettes and at least one alternative product) were less likely to be black, and all the tobacco user groups were less likely to be Asian than non-users except users of 2 or more non-cigarette alternatives.

In the second set of analyses among cigarette-only users and users of cigarettes and at least one other product, we examined the roles of quantity and frequency of cigarettes smoked, number of cessation attempts in the past year, the 3 cigarette-dependence symptoms, and age of cigarette initiation (Table 4). Results from multilevel logistic regression analyses indicated that age of first cigarette use and the dependence symptom of "ever needed a cigarette" were associated with using cigarettes and at least one other product (ie, multiple-product use). Students who were younger when they smoked their first cigarette and those reporting ever needing a cigarette had greater odds of multiple-product use in comparison to cigarette-only users. There were no differences between the 2 groups on past 30-day frequency or quantity of cigarettes smoked, number of quit attempts, odds of strong craving for cigarettes, or use of cigarettes within 30 minutes of waking.

DISCUSSION

Our study contributes to the understanding of multiple-tobacco use by examining 18-29 year-old college students' patterns of use of cigarettes,

Table 3
Multinomial Logistic Regression Analyses Examining Differences among Tobacco Usage Groups on Sociodemographic Factors (N = 5468)

	Single alternative product ^a	Two or more alternative products ^a	Cigarette only ^a	Cigarette + alternative product(s) ^a
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Sex				
Women	REF	REF	REF	REF
Men	1.52 (1.26 - 1.83)	1.81 (1.43 - 2.30)	1.47 (1.18 - 1.83)	2.31 (1.97 - 2.70)
Age in Years	1.21 (1.11 - 1.32)	.98 (.87 - 1.12)	1.57 (1.44 - 1.73)	1.34 (1.25 - 1.45)
Race				
White	REF	REF	REF	REF
Hispanic	.95 (0.76 - 1.18)	.98 (0.73 - 1.30)	1.02 (0.80 - 1.30)	.94 (0.78 - 1.13)
African-American	.75 (0.52 - 1.07)	.91 (0.59 - 1.41)	.44 (0.26 - 0.72)	.54 (0.38 - 0.75)
Asian	.69 (0.53 - 0.91)	.72 (0.51 - 1.03)	.45 (0.32 - 0.65)	.47 (0.37 - 0.61)
Other	1.06 (0.75 - 1.49)	.87 (0.54 - 1.42)	.60 (0.37 - 0.97)	1.04 (0.78 - 1.39)

Note.

a = Reference group is current non-tobacco users. Tobacco usage groups based on current, or past 30-day, tobacco (cigarettes, smokeless tobacco/snus, cigars/cigarillos/little cigars, hookah) or e-cigarette use. Alternative products include all products, except cigarettes.

e-cigarettes, cigars/cigarillos/little cigars, hookah, and smokeless tobacco. Findings indicated that multiple-product use is relatively prevalent among the college students in our sample, with almost one out of 5 reporting concurrent use of 2 or more tobacco/e-cigarette products. Consistent with research showing that exclusive use of cigarettes is less common than multiple-product use,⁶ more than twice as many students concurrently used cigarettes and at least one alternative product compared with exclusive cigarette use. In fact, the group comprising students who currently used cigarettes and at least one other product was the most prevalent tobacco-using group in our college student sample. Moreover, e-cigarettes and hookah were the most commonly used alternative products, reflecting their increasing prevalence among college students.^{35,36} The popularity of hookah is particularly problematic because college students perceive less harm associated with use of this combustible product than with cigarettes,³⁷ although it has similar negative health consequences.³⁸

The results of our examination of sociodemographic differences were also consistent with prior research on college students,^{9,39} indicating that men are more likely than women to be current users of any alternative tobacco product, either alone or in combination with other products. Older college students were more likely than younger ones to use one or more tobacco products, with only one exception. There was no age difference between

users of more than one alternative product and non-tobacco users. The lack of age difference between students who used one or more alternative products and non-tobacco users may be due, in part, to experimental use of non-cigarette products by younger college students. For example, Fielder, Carey and Carey⁴⁰ reported that hookah use among college women peaked in the second month of college and then declined across the year. Younger students may be particularly likely to be attracted to alternative products because they are perceived to be less risky than cigarettes⁴¹ and available in a variety of flavors that mask the harshness and taste of tobacco.⁴² Nonetheless, longitudinal research is needed to determine if alternative tobacco-product use by college students decreases across time, or if it increases risk for the sustained use of tobacco and/or the initiation of cigarettes. Finally, there were relatively few racial/ethnic differences. However, where there were differences, findings corroborated other research showing that white young adults are more likely than racial/ethnic minority young adults to use cigarettes and/or alternative tobacco products,¹⁴ perhaps reflecting varying tobacco marketing strategies across racial/ethnic groups.⁴³

Although alternative tobacco products are marketed as substitutes for cigarettes,¹⁸ there is limited information on differences between exclusive cigarette users and concurrent users of cigarettes and at least one other product on indicators of

Table 4
Differences in Quantity and Frequency of Cigarette Use, Cigarette Cessation Attempts, Cigarette Dependence Symptoms, and Age of Cigarette Initiation across Cigarette Only Users (N = 374) and Users of Cigarettes and at Least One Alternative Product (N = 785)

	B	SE	Odds Ratio	95 % CI
Quantity and Frequency of Cigarettes Smoked				
Number of cigarettes each day	0.09	0.11	1.09	0.87 - 1.36
Number of days during the past 30 days	0.05	0.06	1.05	0.93 - 1.19
Smoking Cessation Attempts				
Number of quit attempts in past 12 months	0.08	0.07	1.08	0.94 - 1.24
Cigarette Dependence Symptoms				
Ever strong craving for a cigarette ^a	0.25	0.14	1.28	0.97 - 1.69
Ever needed a cigarette ^a	0.35	0.14	1.40	1.07 - 1.86
Use within 30 minutes after awake ^b	0.12	0.23	1.13	0.72 - 1.76
Age of First Use of Cigarettes	-0.05	0.03	0.95	0.90 - 1.00

Note.

B = regression estimate; SE = standard error. Reference group is multiple-product user (ie, user of cigarettes and at least one alternative product). Separate multilevel logistic regression models were conducted for each independent variable, while controlling for sex, age, race/ethnicity, and school type (2-year vs 4-year college).

a = Coded: 0 = no, 1 = yes.

b = Coded: 0 = use later than 30 minutes after awake, 1 = use within 30 minutes after awake.

cutting down and attempting to quit smoking, especially among young adult populations like college students. Findings extend existing research on older adults by showing no differences between the 2 groups of college students on quantity or frequency of cigarettes smoked or number of cessation attempts in the past year. Thus, cigarette users who also used alternative tobacco products were *not* more likely than cigarette-only users to use a greater amount of cigarettes or to attempt to quit smoking cigarettes. Null findings regarding cessation attempts are consistent with those of Kasza et al,⁷ but inconsistent with those indicating that cigarette multiple-product users are more likely than exclusive cigarette smokers to report at least one quit attempt in the past year.^{6,20} Inconsistent findings across studies may be due to varying definitions of multiple-tobacco use (ie, examination of varying types of alternative tobacco products), and underscore the need for additional research examining how and why cigarette smokers concurrently use alternative tobacco products.

Findings also indicate that college students who used cigarettes and at least one other product were younger when they first tried cigarettes than their cigarette-only using peers and had a higher likelihood of ever needing cigarettes. Younger age of initiation is associated with increased odds of subsequent nicotine dependence,^{13,23} and needing a cigarette reflects a loss of autonomy over tobacco and

may be an early indicator of tobacco addiction.⁴⁴ Thus, compared with cigarette-only users, multiple-product users were more likely to report some indicators of dependence. However, there were no differences between the 2 groups on ever craving a cigarette, or time to first use after waking. Nonetheless, study findings must be interpreted by taking into consideration the relatively young age of the participants. On average, study participants were 20.5 years old and transitions from light and intermittent smoking to non-smoking or dependence will continue to occur into the mid-20s.¹² Thus, tracking the 2 cigarette-using groups, to determine if one is more likely to show subsequent transitions to cigarette cessation or dependence, will be an important next step. It also will be important to assess if there are changes in use and levels of dependence to the alternative products. Such information will allow future researchers to track the progression of multiple tobacco product use.

This study improved upon existing research by considering the full spectrum of alternative tobacco products in examining multiple tobacco use in a large sample of young adult college students, a population that is at increased risk for initiation of and addiction to tobacco products.^{12,14} Nonetheless, there are some limitations. First, the study is limited by its cross-sectional design, which does not allow us to determine the role of multiple-tobacco use in progression to dependence or to de-

termine if cessation is a consequence of quit attempts. Second, although our sample is racially/ethnically diverse and is drawn from 24 2- and 4-year colleges, findings cannot be generalized to other college students. Longitudinal research with state- and nationally-representative samples of college students is needed to confirm our findings and to identify potential transitions between cigarette and alternative tobacco product use. Lastly, this study is limited to college students and does not include young adults between 18 and 29 who do/did not attend college. However, by surveying those in both 4-year colleges and 2-year vocational programs, the study extends the research on traditional college students by including a particularly vulnerable population.

Despite these limitations, the study is among only a handful to examine cigarette cessation attempts and dependence among multiple-tobacco users, and fills a void in this area of research on college students. Although the number of past-year cigarette cessation attempts and most indicators of cigarette dependence were not associated with multiple-tobacco use, it is important to continue to track use of alternative products in this young sample given that transitions in tobacco use continue throughout young adulthood.^{12,14} Additional research on alternative tobacco products in combination with cigarettes is particularly necessary given that multiple-tobacco use is increasingly prevalent among young adults.⁸

The popularity of alternative tobacco products among young adult college students underscores the importance of the recent deeming of these products so that they are under the regulatory authority of the Food and Drug Administration. Deeming alternative products, such as e-cigarettes, cigars/cigarillos/little cigars, and hookah, will allow the development of policies that limit their distribution, manufacture, and marketing. The high rates of multiple-tobacco use in our sample, particularly among cigarette smokers, may be due to marketing messages that indicate alternative products can be used as substitutes for cigarettes.¹⁷ High rates also may be due to the availability of alternative tobacco products in various flavors, such as strawberry and grape, which are particularly appealing to light and intermittent tobacco users, such as young adults.¹² Regulations can be developed to limit both marketing and the availability of an unlimited number of flavors in these products, particularly to young adults who are continuing to show changes in their tobacco use.¹² Deeming also will allow development of educational campaigns that combat marketing messages, highlight the negative health consequences of using alternative tobacco products, and correct college students' misperceptions of alternative products, potentially leading to their decreased use.

Human Subjects Statement

Approval to conduct this research was provided

by the University of Texas at Austin IRB [Protocol Number: 2013-06-0034].

Conflict of Interest Statement

All authors of this article declare they have no conflicts of interest.

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