



## Short Communication

## Intention to quit smoking and polytobacco use among college student smokers

Karen M. Butler<sup>a,\*</sup>, Melinda J. Ickes<sup>b</sup>, Mary Kay Rayens<sup>a</sup>, Amanda T. Wiggins<sup>a</sup>, Kristin Ashford<sup>a</sup>, Ellen J. Hahn<sup>a</sup><sup>a</sup> University of Kentucky College of Nursing, 751 Rose Street, Lexington, KY 40536-0232, United States<sup>b</sup> University of Kentucky Department of Kinesiology and Health Promotion, College of Education, 111 Seaton, Lexington, KY 40506-0219, United States

## ARTICLE INFO

## Keywords:

Universities  
Students  
Smoking  
Tobacco products  
Smoking cessation

## ABSTRACT

Little is known about polytobacco use in college students. One nationally representative survey indicated 51.3% of tobacco-using college students used more than one product, which may increase risk of tobacco-related disease and premature death. The purpose of this study was to examine the association of intention to quit smoking (ITQS) cigarettes with polytobacco use status, controlling for frequency of tobacco product use and cigarette smoking intensity as measured by cigarettes per day (CPD). Data are from a larger quasi-experimental study conducted at a large state university in the Southeastern United States. Analysis is based on the combined sample of current smokers from two randomly selected cohorts surveyed two months apart. Polytobacco users ( $n = 52$ ) were as likely as cigarette-only users ( $n = 81$ ) to intend to quit smoking. Compared to students who used tobacco products 1–9 days per month, students using 10–29 days per month or daily reported higher ITQS. Higher intensity smokers ( $> 10$  CPD) were 71% less likely to indicate ITQS, compared to lower intensity smokers ( $\leq 10$  CPD) ( $p = .025$ ). College student polytobacco users were as likely as those using only cigarettes to intend to quit smoking. Interventions are needed to target college student polytobacco users as well as cigarette smokers as both groups may intend to quit. Smokers using 10 or fewer CPD and those who use tobacco products daily or 10–29 days per month may be more motivated to quit than college students who smoke with more intensity but who use tobacco products less frequently.

## 1. Introduction

Approximately 10.1% of college students report having smoked cigarettes in the past 30 days; 12.6% have smoked cigarettes in their lifetime (American College Health Association, 2015a). Little is known about the full extent of tobacco use, including polytobacco use, among college students (Rigotti et al., 2000) especially as emerging non-combustible tobacco products gain popularity (American College Health Association, 2015a). We defined polytobacco use as the concurrent use of cigarettes and other tobacco products including smokeless tobacco, hookah, and cigars. A nationally representative survey of college students indicated that 51.3% of tobacco-using college students used more than one product (Rigotti et al., 2000). In a smaller sample, Latimer et al. (2014) found alternate tobacco product use among college students to be prevalent. Males, underclassmen, and racial/ethnic minorities may be more at risk for polytobacco use (Butler et al., 2016). Polytobacco users report more dependence symptoms (Latimer et al., 2014) than those who smoke only cigarettes or use only smokeless

tobacco (Post et al., 2010). Polytobacco use may increase the risk of tobacco-related disease and premature death.

Intention to change a behavior, or one's perceived likelihood of changing a behavior, is the most proximate predictor of behavior (Ajzen, 1991). In this study, intention to quit using tobacco is the endpoint, with the eventual goal of tobacco abstinence. Research on intention to quit smoking among college student smokers is limited, due in part to differences in smoking patterns, motivation, tobacco use histories, and self-identification as a smoker. Pinsker et al. (2014) found that among current college student smokers, there were differences in cigarettes smoked per day (CPD), recent quit attempts, self-identification as a smoker, and motivation to quit. Levinson et al. found that 56.3% of college students denied being smokers despite current smoking behavior, and that half of them considered themselves social smokers (Levinson et al., 2007).

There is need to better understand quit patterns among college smokers to prevent the onset of the major tobacco-related diseases. This study of college student smokers examined the association of intention

\* Corresponding author.

E-mail address: [Karen.Butler@uky.edu](mailto:Karen.Butler@uky.edu) (K.M. Butler).

to quit smoking cigarettes with polytobacco use status, controlling for tobacco product use frequency and CPD. We hypothesized that college student polytobacco users would report lower intention to quit smoking compared to cigarette-only users.

## 2. Methods

This study was part of a larger study to evaluate the impact of an 8-week *CDC Tips from Former Smokers* television campaign conducted at a large public university in the Southeastern U.S. (Ickes et al., 2016) Two cohorts of students were surveyed two months apart prior to and after the campaign. We combined the sample of current smokers from these two cohorts for this analysis. Approval was obtained from the university's Institutional Review Board.

### 2.1. Participants

Two cohorts of randomly-selected students (5000 each) aged 18 or older were provided by the University Registrar. Each sample was representative (i.e., sex and academic status) of the population of 26,139 undergraduate and graduate students enrolled in Spring 2013. The two cohorts were sent a link to online surveys in February and April 2013, respectively. A total of 1593 students participated (15.9% overall response rate). Only current cigarette smokers were included in this analysis ( $n = 133$ ; 8.3% of survey completers).

### 2.2. Procedures

Students were invited via university email to participate in an online survey using Qualtrics software (Qualtrics Inc., 2013), assigning participants a unique code to protect confidentiality. Follow-up emails were sent to non-responders one and two weeks after the initial invitation. All survey completers were eligible for a drawing to win a \$25 gift card.

### 2.3. Measures

#### 2.3.1. Demographic and personal characteristics

Demographic information included age (in years), sex (male/female), and academic status ("Lower undergraduate" [freshman, sophomore], "Upper undergraduate" [junior, senior], and "Graduate"). Cohort (pre- vs. post-campaign) was recorded as an indicator for exposure to the campaign.

#### 2.3.2. Current cigarette and polytobacco use

Those who smoked at least 100 cigarettes in their lifetime and had smoked within the last 30 days were current cigarette smokers (Centers for Disease Control and Prevention, 2009). Current smokers who reported using at least one other form of tobacco (i.e., hookah, smokeless tobacco or cigars) in the last 30 days were classified as polytobacco users. Participants who had used only cigarettes in the past 30 days were considered cigarette-only users.

#### 2.3.3. Frequency of tobacco product use and cigarette smoking intensity

Participants were asked five items: 'In the past 30 days, on how many did you use hookah/cigarettes/smokeless/cigars?' (American College Health Association, 2015b) Categories were combined with responses ranging from "1–9 days," "10–29 days," or "daily." For each polytobacco user, the frequency of tobacco use variable was coded using the most often-used product. Cigarette smoking intensity, or CPD, was assessed by asking, 'During the last 30 days, how many cigarettes did you smoke on a typical day when you smoked cigarettes?' Responses were categorized as "10 or fewer CPD" (lower intensity) or "> 10 CPD" (higher intensity) (Okuyemi et al., 2002).

#### 2.3.4. Intention to quit smoking (ITQS)

Participants were asked to respond to the statement best describing their plans to quit smoking (yes/no). Those who were 'thinking about quitting in the next 6 months' or 'planning to quit in the next 30 days' were classified as "yes;" those who were not thinking about quitting or responded, "does not apply," were classified as "no." (Prochaska and DiClemente, 1983)

### 2.4. Data analysis

Descriptive analyses summarized variables; bivariate analysis of ITQS was accomplished using nonparametric tests (chi-square test of association or Fisher's exact test). Predictors of ITQS were assessed using logistic regression. Cohort was included in the model to test for differences in ITQS between the two groups. In addition to the main effects, the initial model included the interaction between CPD and frequency of use. The interaction was not significant, and was not retained in the final analysis. The Hosmer-Lemeshow lack-of-fit test was not significant; the model fit the data well ( $\chi^2 = 8.4$ ,  $p = .40$ ). The variance inflation factors were  $< 2$ , suggesting lack of multicollinearity. To further examine the relationship of tobacco product use frequency and CPD with ITQS, the Mantel-Haenszel test was used. Bivariate nonparametric tests assessed the association between frequency of use and ITQS for each level of smoking intensity (i.e., lower vs. higher). Analysis was conducted using SAS; an alpha of 0.05 was used.

## 3. Results

Slightly more than half of the sample were female (50.8%). The largest academic status subgroup comprised lower undergraduates (43.8%), with the rest equally divided between upper undergraduates (27.7%) and graduate students (28.5%). Half were in the pre-campaign cohort (50.4%). More than half (54.9%) reported they intended to quit smoking in the next 6 months or sooner.

Nearly half (44.4%) reported using at least one form of tobacco in addition to cigarettes. Polytobacco use status was unrelated to ITQS in the bivariate analysis. Frequency of use for the most often-used tobacco product and CPD were unrelated to ITQS in the bivariate analysis. Nearly one-third (33.1%) used at least one form of tobacco 1–9 days per month; 32.3% used at least one tobacco product 10–29 days per month; and 34.6% used at least one form of tobacco daily. Three-fourths smoked 10 or fewer CPD (75.2%).

Significant predictors of ITQS included sex, academic status, frequency of tobacco product use, and smoking intensity ( $\chi^2 = 25.2$ ,  $p = .002$ ; see Table 1). ITQS was not predicted by cohort or polytobacco use status. Males were 64% less likely than females to intend to quit smoking ( $p = .016$ ). Lower undergraduates were 214% more likely to intend to quit than graduate students ( $p = .029$ ). There was no difference in ITQS between upper undergraduate and graduate students. Compared with those who used tobacco product(s) on 1–9 days in the last month, daily users were 399% more likely to indicate ITQS ( $p = .004$ ), and those who used 10–29 days in the last month were 247% more likely to intend to quit ( $p = .011$ ). Higher intensity smokers ( $> 10$  CPD) were 71% less likely than lower intensity smokers ( $\leq 10$  CPD) to indicate ITQS ( $p = .025$ ).

Though the interaction between use frequency and CPD was not significant in the logistic model, a complex relationship exists among ITQS, frequency of product use, and smoking intensity. We examined the relationship between ITQS and use frequency between those who were lower intensity ( $\leq 10$  CPD) and higher intensity ( $> 10$  CPD) smokers; the Mantel-Haenszel test was significant ( $\chi^2 = 10.9$ ,  $p = .001$ ). Although there was increasing likelihood of ITQS with more days of use per month, this association was significant only among lower intensity, not higher intensity smokers.

**Table 1**  
Multivariate logistic regression modeling intention to quit ( $n = 130$ ).

	Odds ratio (OR)	95% Confidence interval for OR	<i>p</i>
Sex			
Male	0.36	0.16–0.83	.016
Female	Ref	Ref	
Academic status			
Lower undergraduates	3.14	1.13–8.75	.029
Upper undergraduates	1.86	0.67–5.26	.24
Graduate	Ref	Ref	
Cohort			
Pre	0.99	0.45–2.20	.98
Post	Ref	Ref	
Frequency of product use			
Daily	4.99	1.65–15.05	.004
10–29 days	3.47	1.33–9.01	.011
1–9 days	Ref	Ref	
Smoking intensity			
> 10 CPD	0.29	0.10–0.86	.025
10 or fewer CPD	Ref	Ref	
Polytobacco use			
Polytobacco user	0.90	0.38–2.12	.81
Cigarette-only user	Ref	Ref	

#### 4. Discussion

College student polytobacco users were as likely as cigarette-only users to intend to quit smoking cigarettes, refuting our hypothesis. Miller and colleagues found that polytobacco users reported increased self-efficacy in their ability to quit (Miller et al., 2014), which may help explain similar ITQS among polytobacco users and cigarette-only users. Despite similar ITQS, studies show that polytobacco users are less successful at quitting. Concomitant cigarette and smokeless tobacco users were less likely to stop using tobacco than smokers or smokeless tobacco users, perhaps due to enhanced withdrawal symptoms (Post et al., 2010). Future research is needed to determine what additional factors are associated with ITQS among college student polytobacco users.

Those most likely to indicate ITQS were lower intensity smokers who used tobacco frequently. This finding is in partial contrast to the literature. Berg et al. reported that less frequent smoking was correlated with readiness to quit among current college student smokers (Berg et al., 2012). However, readiness to quit smoking and ITQS may not be the same constructs. Standardized measurement of quit constructs is needed, along with examination of other variables which may be associated with ITQS in this population (e.g., smoking motives, confidence in quit ability, social smoking).

We found that among those who tend to use tobacco with less frequency, ITQS was lower than among those who used more frequently. Social smoking is common among college students and is associated with lower frequency of tobacco use as well as lower ITQS and fewer recent quit attempts (Moran et al., 2004). Social tobacco users may have lower perceived risk for nicotine dependence and related health effects (Majchrzak et al., 2002) since they may not categorize themselves as “smokers” or “tobacco users.” (Moran et al., 2004).

Findings revealed that females and freshman and sophomores were more likely to indicate ITQS. Similarly, previous research highlights that females are more likely to want to quit (Harris et al., 2008). In contrast to our findings, these authors also found that older students are more likely to want to quit. Campus tobacco cessation services often target undergraduate students, but graduate students were as likely to ITQS as upper undergraduates. Targeted marketing and treatment programs are needed to reach graduate students. It is not known whether students use emerging tobacco products in an effort to stop smoking cigarettes; further study is warranted. Targeted interventions are needed to promote tobacco treatment, particularly for females, and

at every level of college.

Sole assessment of ITQS, without measuring whether students intended to quit using other forms of tobacco was a study limitation. Similarly, smoking intensity was only assessed for cigarettes since there is no standard measure for daily use intensity for other products. In addition, since use frequency was assessed for each product individually, we were only able to measure frequency for the most often-used product. Other limitations relate to the response rate and data collection method. While the overall response rate is similar to another e-mailed survey of university students (Dennison et al., 2014), prior research has demonstrated that response rates for in-person surveys on smoking exceed e-mailed ones (91% vs. 24%), and that non-responders are more likely to be current smokers (Norton et al., 2009). This may have been why the percent of current smoking in the sample (8.3%) is somewhat lower than typical college smoking rates (American College Health Association, 2015a). The e-mail format may have added bias, given that non-responders may differ significantly from completers (Sheehan, 2001). The response rate and e-mail format may have affected both external and internal validity. Another limitation was that the sample was a combination of two cohorts, one of which may have been more exposed to the CDC Tips ads; this concern was mitigated by including the cohort indicator in the multivariate analysis. And last, the nationally representative survey of college students cited is not recent; therefore, these numbers have likely changed in the interim. However, since that survey was completed, more emerging tobacco products have become available to this population and given the fact that they are drawn to new tobacco products (Johnston et al., 2008), it is not likely that the percentage has decreased.

In conclusion, unexpectedly, college student polytobacco users in this sample were as likely as those using only cigarettes to intend to quit smoking. Health care providers, health educators and others who design college-based tobacco treatment and prevention interventions need to target both polytobacco users and cigarette smokers. Tobacco treatment efforts need to target not only those who smoke fewer than 10 CPD; but also those who use tobacco products more frequently. Longitudinal studies assessing tobacco use patterns and intention to quit among college students are warranted.

#### Acknowledgments

This work was supported by the National Center for Advancing Translational Sciences, National Institutes of Health, through grant number UL1TR000117. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH. We would also like to thank University of Kentucky Department of Kinesiology and Health Promotion for providing the incentives for participation.

#### References

- Ajzen, I., 1991. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* 50, 179–211.
- American College Health Association, 2015a. American College Health Association-National College Health Assessment II: Reference Group Executive Summary Fall 2016. Hanover, MD. Retrieved from. <http://www.acha-ncha.org>.
- American College Health Association, 2015b. American College Health Association - National College Health Assessment II: Reference Group Undergraduates Executive Summary. ACHA, Hanover, MD Retrieved from. <http://www.acha-ncha.org>.
- Berg, C., Ling, P., Hayes, R., et al., 2012. Smoking frequency among current college student smokers: distinguishing characteristics and factors related to readiness to quit smoking. *Health Educ. Res.* 27, 141–150. <http://dx.doi.org/10.1093/her/cyr106>.
- Butler, K.M., Ickes, M., Rayens, M.K., Wiggins, A., Hahn, E.J., 2016. Polytobacco use among college students. *Nicotine Tob. Res.* 18, 163–169. <http://dx.doi.org/10.1093/ntr/ntv0>.
- Centers for Disease Control and Prevention, 2009. 2008 National Health Interview Survey (NHIS) Public Use Data Release: NHIS Survey Description. U.S. Department of Health and Human Services, editor, Hyattsville, MD.
- Dennison, O., Wu, Q., Ickes, M., 2014. Prevalence of HIV testing and associated risk factors in college students. *J. Am. Coll. Heal.* 62, 309–318. <http://dx.doi.org/10.1080/07448481.2014.899>.

- Harris, J.B., Schwartz, S.M., Thompson, B., 2008. Characteristics associated with self-identification as a regular smoker and desire to quit among college students who smoke cigarettes. *Nicotine Tob. Res.* 10, 69–76. <http://dx.doi.org/10.1080/14622200701704202>.
- Ickes, M., Butler, K., Rayens, M.K., Noland, M., Wiggins, A., Hahn, E., 2016. Recall and believability of the tips from former smokers campaign among university students. *Am. J. Health Educ.* 47, 324–331. <http://dx.doi.org/10.1080/19325037.2016.1203>.
- Johnston, L., O'Malley, P., Bachman, J., Schulenberg, J., 2008. Monitoring the Future National Survey Results on Drug Use, 1975–2007: Volume II College Students and Young Adults Ages 19–45. Bethesda, MD, National Institutes of Health. [http://monitoringthefuture.org/pubs/monographs/vol2\\_2008.pdf](http://monitoringthefuture.org/pubs/monographs/vol2_2008.pdf).
- Latimer, L., Batanova, M., Loukas, A., 2014. Prevalence and harm perceptions of various tobacco products among college students. *Nicotine Tob. Res.* 16, 519–526. <http://dx.doi.org/10.1093/ntr/ntt174>.
- Levinson, A.H., Campo, S., Gascoigne, J., Jolly, O., Zakharyan, A., Tran, Z.V., 2007. Smoking, but not smokers: identity among college students who smoke cigarettes. *Nicotine Tob. Res.* 9, 845–852.
- Majchrzak, N., Park, E., Rigotti, N., 2002. Tobacco use by Massachusetts college students: a qualitative study. In: Annual Meeting, Society for Research in Nicotine and Tobacco; Savannah, GA.
- Miller, M.B., Lechner, W.V., Meier, E., Tucker, R.P., Wiener, J.L., 2014. Dual tobacco use among college students: contexts of use, self-perceptions, and attitudes toward quitting. *Subst. Use Misuse* 49, 700–707. <http://dx.doi.org/10.3109/10826084.2013.863345>.
- Moran, S., Wechsler, H., Rigotti, N., 2004. Social smoking among US college students. *Pediatrics* 114, 1028–1034.
- Norton, T.R., Lazev, A.B., Schnoll, R.A., Miller, S.M., 2009. The impact of email recruitment on our understanding of college smoking. *Addict. Behav.* 34, 531–535. <http://dx.doi.org/10.1016/j.addbeh.2009.03.017>.
- Okuyemi, K.S., Harris, K.J., Scheibmeir, M., Choi, W.S., Powell, J., Ahluwalia, J.S., 2002. Light smokers: issues and recommendations. *Nicotine Tob. Res.* S4, 103–112.
- Pinsker, E., Berg, C., Nehl, E., Prokhorov, A., Buchanan, T., Ahluwalia, J., 2014. Intent to quit among daily and non-daily college student smokers. *Health Educ. Res.* 28, 313–325. <http://dx.doi.org/10.1093/her/cys116>.
- Post, A., Gilljam, H., Rosendahl, I., Bremner, S., Galanti, M., 2010. Symptoms of nicotine dependence in a cohort of Swedish youths: a comparison between smokers, smokeless tobacco users and dual tobacco users. *Addiction* 105, 740–746. <http://dx.doi.org/10.1111/j.1360-0443.2009.02852.x>.
- Prochaska, J.O., DiClemente, C.C., 1983. Stages and processes of self-change of smoking: toward an integrative model of change. *J. Consult. Clin. Psychol.* 51, 390–395.
- Qualtrics Inc., 2013. Qualtrics Software. Provo, UT, Qualtrics Research Suite.
- Rigotti, N.A., Lee, J., Wechsler, H., 2000. US College students' use of tobacco products. *JAMA* 284, 699–705. <http://dx.doi.org/10.1001/jama.284.6.699>.
- Sheehan, K.B., 2001. E-mail survey response rates: a review. *J. Comput.-Mediat. Commun.* 6, 0. <http://dx.doi.org/10.1111/j.1083-6101.2001.tb00117.x>.