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COLLEGE STUDENTS' INTEREST IN TRYING DISSOLVABLE TOBACCO PRODUCTS

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Abstract

Background—Dissolvable tobacco products (DTPs) have been introduced into test markets in the U.S. We sought to gauge level of interest in trying these products and correlates of interest among potential consumers.

Methods—A web-based survey of freshman at 11 universities in North Carolina (NC) and Virginia (VA) was conducted in fall 2010. Multivariable logistic regression analyses were used to identify correlates of students' likelihood to try DTPs.

Results—Weighted prevalence of likelihood to try DTPs was 3.7%. Significant correlates of likelihood to try included male gender, current cigarette smoking, current snus use, sensation seeking, lifetime illicit drug use, and perceived health risk of using DTPs. Among current smokers, current snus use, current use of chewing tobacco, and considering quitting smoking were associated with likelihood to try DTPs.

Conclusions—While overall interest in trying these products was low, current users of cigarettes and snus were much more likely than others in trying a free sample. Some current

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smokers may consider DTPs to be an aid to smoking cessation, although the population-level impact of introducing these products is unknown.

Keywords

smokeless tobacco; college students; experimentation

1. INTRODUCTION

A new generation of smokeless tobacco products has entered the U.S. market, and grown in popularity, over the past several years. Snus, a moist snuff originating in Sweden and Norway, was the first such product to enter the U.S. market. Snus is packaged in small pouches, and is used like moist snuff, but doesn't require spitting. Snus products include R.J. Reynolds' Camel Snus and Philip Morris' Marlboro Snus, Copenhagen pouches, and Skoal Snus, among others. In the span of 7 years, snus has gone from being an exotic product in the U.S. (but used extensively in Sweden; Norberg et al., 2011), to a product introduced, accompanied by significant marketing efforts, in multiple test markets, to a nationally available product, with widespread recognition, especially in the young adult age group (Regan et al., 2012; Loukas et al., 2012).

In January, 2009, RJ Reynolds (RJR) introduced Camel Dissolvables (DTPs) in three U.S. test markets (in Indiana, Ohio, and Oregon). These products are in the form of dissolvable strips (lasting five minutes or less), orbs (pellets that last about 15 minutes) and sticks (slightly larger than a toothpick, lasting 15 to 20 minutes; Seidenberg et al., 2011; CNN Money, 2008). They contain finely milled tobacco, and are designed to dissolve in the mouth, eliminating the need to spit (Seidenberg et al., 2011). In addition to nicotine, they contain flavoring compounds, sweeteners, binders, and humectants (Rainey et al., 2011).

In March 2011, Altria, parent company of Philip Morris (PM) introduced Marlboro Sticks and Skoal Sticks into test markets in Kansas. That same month, RJR, which had pulled its DTPs from test markets in December, 2010, introduced redesigned orbs, strips, and sticks, in new packaging, into test markets in and around Charlotte, NC and Denver, CO (Campaign for Tobacco-Free Kids). In the test markets where they have been sold to date, both the RJR and PM products cost less than cigarettes (CNN Money, 2008).

Research on the health effects of DTPs is in its infancy. Stepanov and colleagues (2012, 2011) conducted a laboratory analysis of potentially harmful constituents in dissolvables, including levels of tobacco-specific N-nitrosamines (TSNAs), polycyclic aromatic hydrocarbons, total nicotine, and unprotonated nicotine. In discussing the potential impact on public health, they identified potential risks of toxicity and carcinogenicity. For adult users, there is the potential for chronic exposure to two of the most carcinogenic TSNAs (NNN and NNK). For children, there is the danger of accidental nicotine poisoning (Connolly et al., 2010).

Stepanov (2012) also considered the evidence on the addictiveness of these products. She concluded that, for current smokers, there is the potential for sustained tobacco use, as these products may serve as "an alternative in situations where smoking is not allowed."

Moreover, for new tobacco users, there is the potential for addiction and graduation to cigarette smoking. Additional research has focused on nicotine, pH, TSNA, and metals levels for Camel, Skoal, and Marlboro DTPs (Watson, 2012; Evans, 2012). Despite this recent laboratory research, a recent review concluded that "more clinical research is needed as well as standardized clinical evaluation processes to understand the health effects of DTPs" (Chen and Jacobson, 2012). Similarly, in a review of the published literature on smokeless tobacco (SLT) use and cardiovascular disease, Piano and colleagues (2010) concluded that there are no data on cardiovascular disease or other health risks associated with use of DTPs. Based on the extant literature, sparse as it is, there is little reason to doubt that for any individual user, exclusive use of DTPs, like use of other SLT products, poses far less risk than exclusive use of cigarettes (Rodu, 2011). However, in order to understand the overall public health significance of a product, it is imperative to understand its population effects, including its impact on the use of other products. Mejia and colleagues (2010) argue that to evaluate the health impact of SLT promotion, it is necessary to know, in a population, the proportion of non-users who will initiate either cigarette use or SLT use, and, within these categories of users, what proportions will continue to use, become dual users, or quit using.

To date, data on the appeal, likelihood to try, and initiation and use of the new wave of DTPs being test marketed are very sparse. In a 2009 consumer survey of adults, Regan and colleagues (2012) assessed awareness and trial of DTPs. Despite these DTPs having only recently come onto the market, and even then, limited to a few test markets, 10.4% of respondents reporting having heard of DTPs, and 0.5% had tried them. Factors that were positively associated with having heard of DTPs included being male (OR=1.6), Black (OR=1.5), lower income (<$15,000 compared to ≥ $65,000; OR=2.2), and younger age (18–24 year olds versus 65 and over; OR=4.0). Fewer than 1% of individuals in this national sample reported having tried DTPs. Romito and colleagues (2011) conducted a survey on Camel dissolvables awareness, attitudes, and use in a convenience sample of 243 college students and dental patients in the (then) Indianapolis test market. Product awareness was reported by 42% of respondents, and trial by 3%. Males, and current and former smokers, showed the highest rates of interest and trial. Finally, in a survey of a nationally representative sample of U.S. adults, McMillen and colleagues (2012) found that 0.6% had tried DTPs. Males and nondaily smokers had somewhat higher rates of use than others (1.2% and 2.7%, respectively).

It is known that smokeless tobacco products, including snus, are intentionally marketed to college students and other young adults (Choi and Forster, 2012; Campaign for Tobacco-Free Kids; Klein, 2007). New products, including snus and, potentially, DTPs, if they are released nationally, may allow current smokers to get nicotine in places where smoking is not permitted (Choi and Forster, 2012), a condition that is increasingly the norm on college campuses. In this study, we assessed college students' willingness to try a free sample of DTPs. We sought to gauge the overall level of interest in trying these products, and to identify demographic and behavioral characteristics that are associated with interest in trying. In particular, given debates about whether new SLT products are likely to appeal to nonusers of cigarettes (as "starter" products), or to current users of cigarettes (either as aids to quitting or as a means to maintain their nicotine habit, alternating between smokeless

tobacco use and smoking, depending on situational factors), we examined current use of various tobacco products as potential correlates of likelihood to try DTPs.

2. METHODS

2.1 Sample

Data presented in this paper are from the Smokeless Tobacco Use in College Students study. The goal of the overall study is to assess trajectories and correlates of smokeless tobacco 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. Eleven colleges and universities are 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 ranges from 4,024 to 23,730.

To identify potential members of the cohort, we conducted a screener survey in the fall of 2010 (for details on procedure of the screener survey see Spangler et al. (under review). Across 11 schools, 10,528 freshmen age 18 or older completed the screener survey in early fall 2010. Two weeks after the screener survey, the screener survey data were used to create a sampling frame of students eligible for the cohort, which was stratified by school, gender, and history of tobacco use. To ensure an adequate number of students at risk, students who ever used smokeless tobacco (SLT), current smokers and males were oversampled at each school. The total number of students invited into the cohort across all campuses was 4,910, of which 3,146 (64.2%) joined the cohort and completed the baseline fall 2010 survey.

2.2 Procedure

Participants in the cohort survey completed a 15–20 minute web-survey in fall 2010 (from which the data for this paper are drawn), and are asked to participate in similar surveys annually or biannually through the fall of their senior year. Students were sent an email invitation, which included information about the survey and a link to a secure website where the survey could be completed. Non-responders received up to five email reminders, a phone call and a text reminder. Participants received a $15 incentive for completion of the survey. The study protocol was approved by the Wake Forest School of Medicine Institutional Review Board, and, where requested, by the Institutional Review Board of the college or university providing contact information for freshman students. Additional privacy protection was secured by the issuance of a Certificate of Confidentiality by the U.S. Department of Health and Human Services.

2.3 Measures

The analyses presented below included variables reflecting students' demographic characteristics, personality characteristics, and use of alcohol, tobacco, and illicit drugs. These variables were selected based on past research on smokeless tobacco use, in particular, use of new smokeless products, such as snus (Biener and Bogen, 2009; Biener et al., 2011; Loukas et al., 2012; Regan et al., 2012).

Demographic variables included gender (reference = female), age (reference = over 18), race (white or non-white; white is the reference category), Hispanic ethnicity (reference = non-Hispanic), mother with college degree (reference = no college degree), and father with college degree (reference = no college degree). Sensation seeking, which is defined as the tendency to seek novel and thrilling experiences, has been found to be associated with adolescent experimentation with smoking. The Brief Sensation Seeking Scale (Hoyle et al., 2002; Stephenson et al., 2003) was used to assess sensation seeking. We also included a measure of spending money in an average month (reference = < $100).

Measures of alcohol use and drug use were included in the analyses. These included binge drinking in the past 30 days (5 drinks for males, 4 for females, in the last drinking occasion), marijuana use in the past 30 days, and lifetime illicit drug use (including cocaine, meth, hallucinogens, rohypnol, ecstasy, heroin and opioids).

We also included variables in the analyses that characterized students' current use of tobacco products. Students were asked if they had ever used each tobacco product (cigarettes, chewing tobacco, moist snuff ("dip"), snus, or DTPs), and provided with the following response options: "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." For the analyses presented below, a 30-day "current use" variable was constructed for each tobacco product by combining the response options "Yes, past week" and "Yes, past month, but more than a week ago."

To measure health risk perceptions associated with the use of DTPs, students indicated on a 1–10 scale (1 = very low risk, 10 = very high risk) their perception of the risk of these products for developing the following health problems: oral cancer or dental problems, other cancers, heart disease or stroke, and risk of addiction (adapted from Hatsukami et al., 2010). Scores on each of the items were summed to calculate a summary score of perceived health risk. We also included a measure that assessed whether the student had considered quitting smoking (a "yes" response to the question, "are you seriously thinking of quitting smoking cigarettes").

The outcome variable was constructed based on responses from a series of questions asking about dissolvables, which were accompanied by pictures of the leading dissolvable products on the market at the time (including Camel sticks, strips and orbs; and Stonewall and Arriva tablets). The pictures were accompanied by a lead-in statement, which said: "Another type of smokeless tobacco product which is not burned or smoked is called dissolvables. Several examples are shown here." Students were first asked, "Are you aware of this type of smokeless tobacco: dissolvables"; response categories were "Yes" and "No." A variable based on this question was included as a covariate in the multivariable analyses presented below (with "No" as the reference category). Students were then asked, "How likely would you be to try dissolvables if you were offered a free sample?" For the analysis presented below, the response categories of "Definitely yes" and "Probably yes" were combined to represent "yes," and "Probably no" and "Definitely no" responses were classified as "no."

2.4 Statistical Analyses

Because of the oversampling of lifetime SLT users, current smokers, and males, sampling weights were used in computing prevalence estimates and in regression analyses. Sampling weights were calculated independently for each school within each cell of the sampling frame according to gender and history of tobacco use, by dividing the number of individuals in each cell of the sampling frame by the corresponding number of individuals in the cohort. Weights were then scaled using the approach used by Pfefferman and colleagues (1998), in order to account for our complex survey design (i.e., students were sampled within schools). Thus, prevalence and regression estimates represent the entire screened population of freshman students. Descriptive statistics for demographic characteristics were not weighted, in order to accurately characterize the sample used in the analyses. Bivariate analyses were conducted, examining the associations between the predictor variables listed above with the outcome variable, likelihood to try DTPs. Variables that were significantly associated with the outcome variable at $p \leq .10$ were included in the multivariable models. Random-effects multivariable logistic regression analysis was conducted, accounting for both the sampling weights and the within-school correlation, using the statistical procedure GLLAMM in Stata Version 10. The binary dependent variable was the likelihood to try dissolvables. A secondary analysis was performed on current smokers only (this analysis excluded participants who reported past-30 day smoking but also reported having already quit smoking or not smoking regularly).

3. RESULTS

Table 1 presents data on the demographic and behavioral characteristics of the sample of college students from 11 universities. Slightly over half of the students are male, which reflects our oversampling of males in constructing the cohort. The vast majority of students are 18 years of age, reflecting the fact that we exclusively sampled freshmen. The remaining demographic characteristics and behavioral measures are typical of what is seen in samples of college students in the Southeastern region of the U.S., and is broadly reflective of the population of college students in the region (Wolfson et al., 2012).

Only 3.7% of students reported that they would “definitely” or “probably” try DTPs, if offered a free sample (data not shown in tables). In bivariate analyses, the following variables were not found to be associated at with likelihood to try DTPs at $p \leq .10$: awareness of DTPs, race, Hispanic ethnicity, mother’s education, and father’s education. These variables were excluded from the multivariable analyses reported below.

Table 2 presents the results of the multivariable analyses to identify predictors of students reporting that they would be likely to try a free sample. The first column in the table reports adjusted odds ratios and p-values based on analysis of the full sample, which includes both current smokers and nonsmokers. A number of variables were significantly associated with likelihood of trying DTPs. With respect to demographic characteristics, males were over twice as likely as females to report that they would be likely to try these products (AOR=2.2; CI=1.5–3.2). No other demographic characteristics were significantly associated with likelihood to try. Current use of other tobacco products, in particular, cigarettes and snus, was highly associated with likelihood of trying DTPs (AORs of 6.1; CI=3.7–10.0 and

6.8; CI=2.4–19.4, respectively); current use of chew and dip was not associated with likelihood to try. Among the behavioral and personality characteristics, sensation seeking score was associated with likelihood to try DTPs (AOR = 1.5; CI=1.1–2.2). Lifetime illicit drug use was also associated with likelihood to try (AOR = 1.9; CI=1.3–2.7), as was the perceived health risk of using DTPs (AOR = 0.9; CI=0.9–1.0), indicating that a perception of greater health risks was associated with a lower propensity to try DTPs).

The second column of Table 2 reports the results of an analysis of a sub-sample, which was restricted to current cigarette smokers. In the sample of current smokers, we no longer find that males are more likely to try DTPs, as had been found in the full sample. As in the analysis of the full sample, use of certain other tobacco products is associated with likelihood of trying. As in the analysis of the full sample, current use of snus was strongly associated with likelihood of trying (AOR = 8.2; CI=1.9–35.8); in addition, current use of chewing tobacco was associated with propensity to try (AOR = 9.2; CI=3.1–26.9). Finally, considering quitting smoking was associated with likelihood of trying DTPs (AOR = 2.0; CI=1.1–3.5).

4. DISCUSSION

In our sample of college students from 11 universities in North Carolina and Virginia, a relatively small percentage of students reported interest in trying DTPs (3.7%). However, the likelihood of trying these products was significantly greater among individuals with certain characteristics and behaviors. Consistent with previous research on actual trial and use of snus, both within test markets (Biener and Bogen, 2009; Biener et al., 2011) and after national release, (Loukas et al., 2012; Regan et al., 2012) we found that males reported a greater likelihood of trying DTPs than did females. Similarly, users of other tobacco products, including cigarettes and snus, were more likely to report that they would try a free sample of DTPs.

There is considerable evidence that U.S. companies' introduction and marketing of snus has targeted individuals who already smoke, as well as promoting dual use of snus and cigarettes. For example, Mejia and Ling (2010) found that tobacco company webcasts and conference calls for investors emphasized RJR snus' appeal to smokers (in particular, "the adult smoker under thirty"), including young women. Carpenter and colleagues (2009), in an analysis of tobacco industry internal documents made publically available, found that new SLT products, including snus, were heavily targeted to cigarette smokers, and had been "designed to augment cigarette use when smoking is not possible, thus offsetting regulatory strategies such as clean indoor air laws" (Bahreinifar et al., 2011). Thus, the new DTP products may be marketed in a similar manner, if they are released nationally.

The FDA, as well as other government and advocacy organizations, have strong concerns about the potential threat of these products to public health (Tobacco Products Safety Advisory Committee, 2012). While some individuals have advocated them as a harm reduction strategy (Rodu, 2011), it is unclear whether they will help individuals wean themselves away from smoking, or allow them to continue smoking, alternating back and forth between cigarettes and smokeless products, depending on the setting.

We found that perceptions of lower health risks were associated with higher use of DTPs. This association, which has been found for other tobacco products as well (Sutfin et al., 2011), suggests that interventions aimed at increasing knowledge of risk may have potential for discouraging experimentation and regular use of DTPs, either in the current test markets, or nationwide, if national release takes place. There are a number of ways to convey health risks to current and potential users of tobacco products, including product warning labels, mass media campaigns, and warning signs posted at the point of purchase (Coady et al., 2012; Li et al., 2012). Under the 2009 Family Smoking Prevention and Tobacco Control Act, the FDA has the authority to assert jurisdiction over emerging tobacco products, including DTPs (Deyton et al., 2010). Requiring warning labels and point-of-purchase warnings could ensue when and if the FDA asserts its regulatory authority. Of course, the limited research that has been conducted to date on the individual- and population-level health risks of these products would be a barrier to creating messages that are both accurate and effective.

This study has a number of strengths. To our knowledge, it is the first assessment of college students' propensity to try DTPs, if offered a free sample. The sample is relatively large, and is drawn from multiple (11) colleges and universities. Finally, it examined a wide range of potential correlates of DTP use, which were selected based on past research on similar new, smokeless tobacco products, such as snus.

The study also has a number of limitations. Categorization of tobacco use is based on self-reports; there was no effort to biochemically validate use. And the sample is restricted to college students in two states, North Carolina and Virginia, located in one geographic region in the U.S. Finally, the analysis of the sub-sample, which was restricted to smokers, had a fairly small sample size (N=229); thus, in that analysis, we had limited statistical power to detect significant associations between predictor variables and the outcome variable of interest.

In this study, which was conducted in areas that were not part of the test markets for DTPs, interest in trying these products was widespread among college students who were current smokeless tobacco users, especially those who also smoked cigarettes. Longitudinal research is needed within the current test markets to assess smokers' and nonsmokers' initiation of use of DTPs, and whether or not they maintain use of these and other tobacco products. Population-level patterns of use in test markets will provide the best indication of the impact on tobacco use and public health when and if DTPs are released and marketed nationwide.

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References

Bahreinifar S, Sheon NM, Ling PM. Is snus the same as dip? Smokers' perceptions of new smokeless tobacco advertising. Tob Control. 2011; 22:84–90. [PubMed: 21972063]

Biener L, Bogen K. Receptivity to Taboka and Camel Snus in a U.S. test market. Nicotine Tob Res. 2009; 11:1154–1159. [PubMed: 19564175]

Biener L, McCausland K, Curry L, Cullen J. Prevalence of trial of snus products among adult smokers. Am J Public Health. 2011; 101:1874–1876. [PubMed: 21330582]

Campaign for Tobacco-Free Kids. Smokeless tobacco and kids. http://www.tobaccofreekids.org/research/factsheets/pdf/0003.pdf

Carpenter MJ, Saladin ME, DeSantis S, Gray KM, LaRowe SD, Upadhyaya HP. Laboratory-based, cue-elicited craving and cue reactivity as predictors of naturally occurring smoking behavior. Addict Behav. 2009; 34:536–541. [PubMed: 19395178]

Chen P, Jacobson KC. Developmental trajectories of substance use from early adolescence to young adulthood: gender and racial/ethnic differences. J Adolesc Health. 2012; 50:154–163. [PubMed: 22265111]

Choi K, Forster J. Awareness, perceptions and use of snus among young adults from the upper Midwest region of the USA. Tob Control. 2012; 22:412–417. [PubMed: 22821750]

CNN Money. Reynolds American to sell dissolvable tobacco. 2008. http://money.cnn.com/news/newsfeeds/articles/apwire/d5357bfbcec9681cd6eefb7b7eadcfe6.htm

Coady MH, Chan CA, Auer K, Farley SM, Kilgore EA, Kansagra SM. Awareness and impact of New York City's graphic point-of-sale tobacco health warning signs. Tob Control. 2012 epub ahead of print.

Connolly GN, Richter P, Aleguas A, Pechacek TF, Stanfill SB, Alpert HR. Unintentional child poisonings through ingestion of conventional and novel tobacco products. Pediatrics. 2010; 125:896–899. [PubMed: 20403932]

Deyton L, Sharfstein J, Hamburg M. Tobacco product regulation--a public health approach. N Engl J Med. 2010; 362:1753–1756. [PubMed: 20410498]

Evans, S. Topography of Dissolvable Tobacco Products. Tobacco Products Scientific Advisory Committee Meeting; Rockville, MD. 2012. http://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/TobaccoProductsScientificAdvisoryCommittee/UCM288290.pdf

Hatsukami DK, Kotlyar M, Hertsgaard LA, Zhang Y, Carmella SG, Jensen JA, Allen SS, Shields PG, Murphy SE, Stepanov I, Hecht SS. Reduced nicotine content cigarettes: effects on toxicant exposure, dependence and cessation. Addiction. 2010; 105:343–355. [PubMed: 20078491]

Hoyle RH, Stephenson MT, Palmgreen P, Lorch EP, Donohew R. Reliability and validity of a brief measure of sensation seeking. Person Individ Diff. 2002; 32:401–414.

Klein, J. Tobacco Targets: Students Concerned about Free Smokeless Tobacco Offered in Bars. 2007. ChicoER.com

Li L, Borland R, Yong HH, Hitchman SC, Wakefield MA, Kasza KA, Fong GT. The association between exposure to point-of-sale anti-smoking warnings and smokers' interest in quitting and quit attempts: findings from the International Tobacco Control Four Country Survey. Addiction. 2012; 107:425–433. [PubMed: 21954921]

Loukas A, Batanova MD, Velazquez CE, Lang WJ, Sneden GG, Pasch KE, Karn SS, Robertson TR. Who uses snus? A study of Texas adolescents. Nicotine Tob Res. 2012; 14:626–630. [PubMed: 21908457]

McMillen R, Maduka J, Winickoff J. Use of emerging tobacco products in the United States. J Environ Public Health. 2012; 2012:1–8.

Mejia AB, Ling PM. Tobacco industry consumer research on smokeless tobacco users and product development. Am J Public Health. 2010; 100:78–87. [PubMed: 19910355]

Mejia AB, Ling PM, Glantz SA. Quantifying the effects of promoting smokeless tobacco as a harm reduction strategy in the USA. Tob Control. 2010; 19:297–305. [PubMed: 20581427]

Norberg M, Malmberg G, Ng N, Broström G. Who is using snus? - Time trends, socioeconomic and geographic characteristics of snus users in the ageing Swedish population. BMC Public Health. 2011; 11:929. [PubMed: 22169061]

Pfeffermann D, Skinner CJ, Holmes DJ, Goldstein H, Rasbash J. Weighting for unequal selection probabilities in multilevel models. J Royal Stat Soc Series B Stat Method. 1998; 60:23–40.

Piano MR, Benowitz NL, FitzGerald GA, Corbridge S, Heath J, Hahn E, Pechacek TF, Howard G. Impact of smokeless tobacco products on cardiovascular disease: implications for policy,

prevention, and treatment a policy statement from the American Heart Association. Circulation. 2010; 122:1520–1544. [PubMed: 20837898]

Rainey CL, Conder PA, Goodpaster JV. Chemical characterization of dissolvable tobacco products promoted to reduce harm. J Agric Food Chem. 2011; 59:2745–2751. [PubMed: 21332188]

Regan AK, Dube SR, Arrazola R. Smokeless and flavored tobacco products in the U.S.: 2009 Styles survey results. Am J Prev Med. 2012; 42:29–36. [PubMed: 22176843]

Rodu B. The scientific foundation for tobacco harm reduction, 2006–2011. Harm Reduct J. 2011; 8:19. [PubMed: 21801389]

Romito LM, Saxton MK, Coan LL, Christen AG. Retail promotions and perceptions of R.J. Reynolds' novel dissolvable tobacco in a US test market. Harm Reduct J. 2011; 8:10. [PubMed: 21569637]

Seidenberg AB, Rees VW, Connolly GN. RJ Reynolds goes international with new dissolvable tobacco products. Tob Control. 2011 epub ahead of print.

Spangler, J.; Song, E-Y.; Richardson Pockey, J.; Sutfin, EL.; Reboussin, BA.; Wagoner, K.; Wolfson, M. Correlates of Smokeless Tobacco Use among first year college students in North Carolina and Virginia. n.d. Under Review

Stepanov I, Biener L, Knezevich A, Nyman AL, Bliss R, Jensen J, Hecht SS, Hatsukami DK. Monitoring tobacco-specific N-nitrosamines and nicotine in novel Marlboro and Camel smokeless tobacco products: findings from Round 1 of the New Product Watch. Nicotine Tob Res. 2012; 14:274–281. [PubMed: 22039075]

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]

Sutfin EL, McCoy TP, Reboussin BA, Wagoner KG, Spangler J, Wolfson M. Prevalence and correlates of waterpipe tobacco smoking by college students in North Carolina. Drug Alcohol Depend. 2011; 115:131–136. [PubMed: 21353750]

Tobacco Products Safety Advisory Committee. TPSAC Report on Dissolvable Tobacco Products. 2012. http://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/TobaccoProductsScientificAdvisoryCommittee/UCM295842.pdf

Watson, C. Quantitative and Qualitative Analysis of Dissolvable Tobacco Products. Tobacco Products Scientific Advisory Committee Meeting; Rockville, MD. 2012. http://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/TobaccoProductsScientificAdvisoryCommittee/UCM288288.pdf

Wolfson M, Champion H, McCoy TP, Rhodes SD, Ip EH, Blocker JN, Martin BA, Wagoner KG, O'Brien MC, Sutfin EL, Mitra A, Durant RH. Impact of a randomized campus/community trial to prevent high-risk drinking among college students. Alcohol Clin Exp Res. 2012; 36:1767–1778. [PubMed: 22823091]

Table 1

Demographic and behavioral characteristics of fall 2010 cohort of college students from 11 universities (N=2472)

	Characteristic (%)	Like to Try Dissolvables (%)[1]	p-value
Gender			
Male	50.6	7.0	<0.001
Female	49.3	1.8	
Age			
18 years old	85.6	3.3	0.003
> 18 years old	14.4	6.4	
Race			
White	85.6	3.7	0.882
Non-white	14.4	3.5	
Ethnicity			
Hispanic	5.7	5.2	0.198
Non-Hispanic	94.3	3.6	
Spending Money			
> $100	57.2	4.3	0.007
<= $100	42.8	2.9	
Mother's education			
College degree or higher	63.1	3.8	0.766
Less than college degree	36.9	3.5	
Father's education			
College degree or higher	65.4	3.6	0.690
Less than college degree	34.6	3.9	
College location			
NC	65.8	3.7	0.784
VA	34.2	3.6	
Binge Drinking (past 30 days)[1]			
Yes	37.1	6.7	<0.001
No	62.9	1.9	
Marijuana Use (past 30 days)[1]			
Yes	15.6	11.2	<0.001
No	84.3	2.2	
Illicit Drug Use (lifetime)[1]			
Yes	5.6	18.9	<0.001

	Characteristic (%)	Like to Try Dissolvables (%)[1]	p-value
No	94.4	2.8	
Cigarette Smoker (past 30 days)[1]			
Yes	12.9	17.7	<0.001
No	87.1	1.6	
Chew Use (past 30 days)[1]			
Yes	0.4	36.3	<0.001
No	99.6	3.6	
Dip Use (past 30 days)[1]			
Yes	2.3	31.4	<0.001
No	97.7	3.0	
Snus Use (past 30 days)[1]			
Yes	1.4	56.2	<0.001
No	98.6	2.9	
Aware of Dissolvables[1]			
Yes	20.7	3.8	0.849
No	79.3	3.6	
Brief Sensation Seeking Score[1]	Mean=3.08 (range 1–5) SE=0.02		<0.001
Perceived Health Risks of Dissolvables[1]	Mean=29.25 (4–40) SE=0.28		<0.001

[1]Weighted prevalence to account for oversampling

Table 2

Weighted Multivariable Logistic Regression Model Predicting Likelihood of Trying Dissolvable Tobacco Products.

	Full Sample AOR (95% CI) p-value (N=2472)	**Current Smokers AOR (95% CI) p-value (N=229)**
Cigarette Smoker (past 30 days)	6.0 (3.7, 9.6) <0.001	-------
Chew User (past 30 days)	1.3 (0.5, 3.2) 0.571	6.8 (2.1, 22.2) <0.001
Dip User (past 30 days)	1.9 (0.9, 4.0) 0.075	1.1 (0.4, 3.0) 0.825
Snus User (past 30 days)	6.5 (2.3, 18.2) <0.001	8.1 (2.0, 32.7) 0.003
Gender (reference = female)	2.1 (1.5, 3.0) <0.001	1.0 (0.4, 2.9) 0.939
Age 18 (reference = > 18)	0.6 (0.3, 1.0) 0.052	0.7 (0.3, 1.3) 0.227
Brief Sensation Seeking Score	1.5 (1.1, 2.2) 0.025	1.5 (0.8, 2.7) 0.148
> $100 Spending Money	1.3 (0.8, 1.9) 0.287	1.4 (0.6, 2.9) 0.399
Binge Drinking (past 30 days)	1.1 (0.6, 1.8) 0.765	0.8 (0.4, 1.9) 0.691
Marijuana Use (past 30 days)	1.0 (0.6, 1.7) 0.948	0.9 (0.5, 1.6) 0.709
Illicit Drug Use (lifetime)	1.9 (1.3,2.8) 0.001	1.2 (0.7, 2.2) 0.545
Perceived Health Risks of Dissolvables	0.9 (0.9, 1.0) 0.001	0.9 (0.9, 1.0) 0.077
Thinking of Quitting Smoking	------	2.0 (1.1, 3.7) 0.023