

Brief Report

Evidence against a gateway from smokeless tobacco use to smoking

Brad Rodu, D.D.S.,¹ & Philip Cole, M.D., Dr.P.H.²¹ Department of Medicine, School of Medicine, University of Louisville, Louisville, KY² Department of Epidemiology, School of Public Health, University of Alabama at Birmingham, Birmingham, AL

Corresponding Author: Brad Rodu, D.D.S., Department of Medicine, School of Medicine, University of Louisville, 505 South Hancock Street, Louisville, KY 40202, USA. Telephone: 502-852-7793; Fax: 502-852-7979; E-mail: brad.rodu@louisville.edu

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Abstract

Introduction: It has been suggested that smokeless tobacco (ST) use by young people induces them to become smokers, but direct evidence is lacking.

Methods: Information in the 2003, 2005, and 2007 National Survey on Drug Use and Health was used to determine the prevalence of smoking among White men (aged 18+ years) and boys (aged 16–17 years) who had started tobacco use with ST, cigarettes, or with both products.

Results: Among White men, the majority (82.2%, *CI* = 81.3–83.1) of ever-smokers were cigarette initiators, while 10.7% (*CI* = 10.0–11.4) were ST initiators and 7.1% (*CI* = 6.6–7.7) were dual initiators. The prevalence of current smoking among cigarette initiators was 34.7% (*CI* = 33.7–35.7). The prevalence among dual initiators was 10% higher (prevalence ratio [PR] = 1.10, *CI* = 1.04–1.16), while the prevalence among ST initiators was significantly lower (PR = 0.80, *CI* = 0.77–0.84). Among White boys, almost 92% were either cigarette or dual initiators. The prevalence of current smoking among cigarette initiators was 42.8% (*CI* = 40.5–45.2). In comparison, the prevalence among ST initiators was less than half (PR = 0.43, *CI* = 0.36–0.52).

Conclusions: ST use has played virtually no role in smoking initiation among White men and boys, the demographic groups among which ST use is most prevalent. There is evidence that, compared with cigarette initiators, ST initiators are significantly less likely to smoke. This suggests that ST may play a protective role.

Introduction

Tobacco harm reduction involves the use of alternative sources of nicotine by smokers unable or unwilling to achieve complete tobacco and nicotine abstinence. One worthy alternative is smokeless tobacco (ST) use, which is associated with far fewer health risks than smoking. Unlike smoking, ST use does not cause emphysema or lung cancer. A recent meta-analysis concluded that the risk of cancer from ST use is about 100-fold lower than that from smoking (Lee & Hamling, 2009). Other

recent meta-analyses have also documented that ST use is not associated with significantly elevated risks for heart attack and stroke (Boffetta & Straif, 2009; Lee, 2007). Tobacco research experts have concluded that ST use confers only 0.1%–10% of the risks of smoking (Levy et al., 2004; Phillips et al., 2006; Royal College of Physicians of London [RCP], 2002). Two respected medical groups believe that ST can play a role in reducing smoking-attributable deaths. In 2007, Britain's Royal College of Physicians concluded "... that smokers smoke predominantly for nicotine, that nicotine itself is not especially hazardous, and that if nicotine could be provided ... as a cigarette substitute, millions of lives could be saved." (RCP, 2007) In 2008, the American Association of Public Health Physicians became the first medical organization in the United States to formally adopt a policy of "... encouraging and enabling smokers to reduce their risk of tobacco-related illness and death by switching to less hazardous smokeless tobacco products" (Nitzkin & Rodu, 2008).

Opponents of tobacco harm reduction believe that it will lead to increased teenage ST use, which will function as a "gateway" to smoking (Tomar et al., 2009). It has been observed that teenagers who use ST are more likely than nonusers to subsequently smoke, but the evidence suggests only that ST use is one of several behaviors associated with smoking, not that it leads to smoking (Ary, 1989; Ary et al., 1987; Dent et al., 1987; Glover et al., 1989; Tomar, 2003).

The National Survey on Drug Use and Health (NSDUH) contains detailed information on current and former smoking and ST use among teenagers and adults. The survey also gathers information about the age at which cigarettes and SLT were first used. This information can be used to determine the smoking status of subjects who started with cigarettes or with ST.

Methods

We obtained NSDUH data files for 2003, 2005, and 2007 from the Inter-University Consortium for Political and Social Research (U.S. Department of Health and Human Services, 2003, 2005, 2007). We combined surveys in order to provide reasonable precision in the smallest initiation group. We chose alternating survey years in order to cover a wider time period while avoiding

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potential cohort overlap inherent in using consecutive years. The surveys employed a complex design involving stratification, clustering, and multistage sampling.

Since 1999, NSDUH surveys have asked: "Have you smoked at least 100 cigarettes in your entire life?" Subjects answering "no" are never-smokers, and those who answer "yes" are ever-smokers. All participants are asked: "During the past 30 days, have you smoked part or all of a cigarette?" Ever-smokers answering "yes" were designated as current smokers. This is consistent with the definition employed by the CDC when using NSDUH (Centers for Disease Control and Prevention [CDC], 2004) and with a recent report comparing results from NSDUH and National Health Interview Surveys (NHIS) (Substance Abuse and Mental Health Services Administration [SAMHSA], 2006). Current smokers reporting that they had smoked on all the past 30 days were designated as daily smokers.

Subjects also were asked at what age they first smoked part or all of a cigarette and at what age they first used chewing tobacco or snuff. The individual responses for chewing tobacco and snuff were combined into a single response for ST. Subjects were then classified into one of three groups: (a) those who had only smoked cigarettes or had first smoked before they first used ST (cigarette initiators); (b) those who had first used ST before they smoked for the first time (ST initiators); and (c) those who both smoked and used ST for the first time in the same year (dual initiators).

SPSS statistical software with Complex Samples (Version 15.0 for Windows) was used to estimate the prevalence of ever and current smoking based on the noninstitutionalized civilian population of the United States, and these estimates were adjusted for invalid and nonresponses. Dual and ST initiators were compared to cigarette initiators (referent group) using prevalence ratios (PRs) with 95% CI (Lowry, 2008). If ST use is a gateway to smoking, then the prevalence of ever and current smoking among ST and dual initiators would be equal to or greater than that among cigarette initiators. In order to evaluate the effect of socioeconomic status on smoking outcomes, we repeated our analyses after dividing the cohort into two family income groups, low (<\$50,000) and high (>\$50,000). The resulting PR estimates were evaluated for statistical significance based on the SEs of their variances.

Results are reported separately for men aged 18+ years and for boys aged 16–17 years, the age at which adolescent smoking patterns are somewhat established. Our analyses were limited to White males because ST use is minimal to nonexistent in females and other racial groups (Rodu & Cole, 2009a).

Results

The three surveys included 33,649 white males aged 18+ years. The prevalence of current smoking was 28.6% (CI = 27.9–29.3), and the prevalence of former smoking was 28.9% (CI = 28.0–29.8). Information on first use of cigarettes and ST was available for all ever-smokers and for 60% of never-smokers, the latter reporting the age at which they had smoked their first cigarette or had used ST but not meeting the 100-cigarette threshold of an ever-smoker. The majority (82.2%, CI = 81.3–83.1) of ever-smokers were cigarette initiators, while 10.7% (CI = 10.0–11.4) were ST initiators and 7.1% (CI = 6.6–7.7) were dual initiators.

Table 1 shows the prevalence of ever and current smoking among men 18+ years who were cigarette ($n = 20,008$), dual ($n = 2,504$), and ST initiators ($n = 4,863$). The prevalence of ever smoking among cigarette initiators was 72.3% (CI = 71.2–73.3). In comparison, the prevalence of ever smoking among dual initiators was 65.9% (PR = 0.91, CI = 0.88–0.94), and the prevalence among ST initiators was 48.8% (PR = 0.97, CI = 0.65–0.70).

The prevalence of current smoking among cigarette initiators was 34.7% (CI = 33.7–35.7). The prevalence among dual initiators was 10% significantly higher (PR = 1.10, CI = 1.04–1.16), while the prevalence among ST initiators was significantly lower (PR = 0.80, CI = 0.77–0.84). The proportion who smoked every day was significantly higher among cigarette initiators (73.4%, CI = 72.0–74.8) than among either ST initiators (65.5%, CI = 61.8–69.0, $p < .0002$) or dual initiators (69.6%, CI = 66.3–72.6, $p = .005$).

The surveys also included 5,564 White boys aged 16–17 years. The prevalence of current smoking was 18.9% (CI = 17.7–20.1), and the prevalence of former smoking was 2.4% (CI = 2.0–3.0). Information on first use of cigarettes and ST was available for all current and former smokers and for 36.9% of

Table 1. Prevalence and PR of ever and current smoking among White males aged 18+ years and aged 16–17 years, according to Tobacco Product Initiation, NSDUH 2003–2005–2007

Product (survey n)	Ever-smoking prevalence ^a (CI)	PR (CI)	Current-smoking prevalence ^a (CI)	PR (CI)
Age 18+ years				
Cigarettes (20,008)	72.3 (71.2–73.3)	1.00	34.7 (33.7–35.7)	1.00
Cigarettes + ST (2,504)	65.9 (62.9–68.9)	0.91 (0.88–0.94)	38.2 (35.3–41.3)	1.10 (1.04–1.16)
ST (4,863)	48.8 (46.7–50.8)	0.67 (0.65–0.70)	27.9 (25.9–30.0)	0.80 (0.77–0.84)
Age 16–17 years				
Cigarettes (2,050)	48.6 (46.3–50.9)	1.00	42.8 (40.5–45.2)	1.00
Cigarettes + ST (221)	43.7 (36.6–51.1)	0.90 (0.77–1.06)	38.8 (31.6–46.6)	0.91 (0.77–1.08)
ST (527)	19.7 (15.7–24.4)	0.41 (0.34–0.49)	18.4 (14.4–23.0)	0.43 (0.36–0.52)

Note. PR = prevalence ratio; ST = smokeless tobacco.

^aExpressed as percent.

never-smokers. The majority (83.5%, $CI = 80.6\text{--}86.1$) of ever-smokers were cigarette initiators, while 8.4% ($CI = 6.6\text{--}10.7$) were ST initiators and 8.0% ($CI = 6.4\text{--}10.0$) were dual initiators.

Table 1 also shows the prevalence of ever and current smoking among 16- to 17-year-old boys who were cigarette ($n = 2,050$), dual ($n = 221$), and ST initiators ($n = 527$). The prevalence of ever smoking among cigarette initiators was 48.6% ($CI = 46.3\text{--}50.9$). In comparison, the prevalence among dual initiators was 10% lower, but the difference was not statistically significant. The prevalence among ST initiators was less than half that among cigarette initiators ($PR = 0.41$, $CI = 0.34\text{--}0.49$), which was statistically significant. Very similar results were seen for the prevalence of current smoking among these groups. The proportion who smoked every day was significantly higher among cigarette initiators (55.6%, $CI = 52.0\text{--}59.1$) than among ST initiators (38.4%, $CI = 26.5\text{--}51.8$, $p = .002$) but not among dual initiators (49.7%, $CI = 40.4\text{--}58.9$, $p = 0.3$).

The effect of family income on ever or current smoking PRs for ST or dual initiators is seen in Table 2. The PR among high-income subgroups was almost always lower than that among low-income subgroups, with the differences achieving statistical significance for ever smoking among both ST and dual initiators 18+ years.

Discussion

ST use appears to have played virtually no role in smoking initiation among White males, the demographic group for which ST use is most prevalent. About 90% of ever-smokers either started with cigarettes or were dual initiators. Therefore, ST could have been a “gateway” to smoking for, at most, only 10% of ever-smokers.

Using the 1987 National Health Interview Survey, Kozlowski et al. (2003) found that 77% of male ST users aged 18–34 years

Table 2. The PR of ever or current smoking among White men who were ST or dual initiators compared with cigarette initiators, according to family income, NSDUH 2003–2005–2007

Income	PR ever smoking (CI)	PR current smoking (CI)
ST initiators, 18+ years		
Low	0.73 (0.69–0.77)	0.80 (0.73–0.87)
High	0.62 (0.58–0.67)	0.81 (0.70–0.92)
ST initiators, 16–17 years		
Low	0.49 (0.37–0.64)	0.51 (0.39–0.68)
High	0.34 (0.24–0.49)	0.37 (0.25–0.53)
Dual initiators, 18+ years		
Low	0.96 (0.91–1.01)	1.05 (0.94–1.18)
High	0.86 (0.79–0.93)	1.15 (1.02–1.30)
Dual initiators, 16–17 years		
Low	0.95 (0.76–1.20)	0.92 (0.69–1.22)
High	0.88 (0.68–1.14)	0.92 (0.70–1.21)

Note. PR = prevalence ratio; ST = smokeless tobacco. PRs in bold are significantly different ($p \leq .05$).

had never smoked or had smoked prior to ST use. They concluded that ST use was not a gateway to smoking and, more importantly, that ST use more likely prevented smoking than led to it. The same research group found similar results in data from the 2000 National Household Survey on Drug Abuse, the former name of the NSDUH series (O'Connor et al., 2005).

Most smokers do not start with ST use, and most ST use is not a gateway to smoking. This study also shows that White men in the United States who were ST initiators were significantly less likely than cigarette initiators to become smokers. This inverse association between ST initiation and subsequent smoking was also seen among 16- to 17-year olds. The inverse association was stronger among those of high-income status, but the effect was modest.

Although NSDUH surveys collect valuable information relevant to the gateway issue, they have features that warrant some discussion. First, the age of initiation reported by survey participants, which were used to form the initiation groups in this study, were from recall and therefore subject to imprecision and inaccuracy. However, there is no evidence that the ages of initiation of cigarettes and ST are systematically biased in a manner that would affect our results. In addition, NSDUH has a somewhat more inclusive definition of current smoking than NHIS (Rodu & Cole, 2009b). But the definition of current smoker that we used is consistent with the definition employed by the CDC when using NSDUH (CDC, 2004) and with a 2006 report by the U.S. Substance Abuse and Mental Health Services Administration that compared results from NSDUH and NHIS (SAMHSA, 2006).

The view that ST is a gateway to smoking is based mainly on two longitudinal studies comparing subsequent smoking among adolescent ST users and nonusers (Severson et al., 2007; Tomar, 2003). The first study, which used the 1989 Teenage Attitudes and Practices Survey (TAPS) and its 1993 follow-up, found that young males who used ST were significantly more likely to have become smokers at follow-up than nonusers of tobacco (odds ratio [OR] = 3.5, $CI = 1.8\text{--}6.5$) (Tomar). However, a subsequent analysis revealed that the earlier study did not take into account well-known psychosocial predictors of smoking initiation that were in the TAPS, including experimenting with smoking, below-average school performance, household member smoking, depressive symptoms, fighting, and motorcycle riding (O'Connor et al., 2003). Inclusion of these variables into a multivariate model reduced the odds ratio of smoking among regular ST users to 1.7, which was not statistically significant. The investigators concluded that the earlier “analysis should not be used as reliable evidence that smokeless tobacco may be a starter product for cigarettes.”

The second study found that seventh- and ninth-grade students who had used ST (in the past 30 days) were more likely than nonusers to be smoking 2 years later ($OR = 2.6$, 95% $CI = 1.5\text{--}4.5$), after controlling for smoking by family and friends, low grades, alcohol use, and deviant behavior (Severson et al., 2007). However, Timberlake et al. (2009) have commented that regression analysis may not adequately control for imbalances in covariate distributions between ST users and nonusers (Rubin, 1997). They analyzed data from the National Longitudinal Study of Adolescent Health after propensity score matching and found that adolescent ST use was not associated with an increased risk of smoking in later adolescence or young adulthood.

In Sweden, a country with a very high prevalence of ST use (in the form of moist snuff called snus), there is no evidence that ST is a gateway to smoking, especially among youth. In fact, two reviews concluded that snus use was not a gateway to smoking but provided a path to smoking cessation for Swedish men (Bates et al., 2003; Foulds et al., 2003). Also, a study of tobacco use among 15- to 16-year-old schoolchildren in Sweden over a 15-year period (1989–2003) found that the prevalence of snus use among boys was inversely associated with the prevalence of smoking (Rodu et al., 2005). A study based on the Swedish Twin Registry concluded that “snus use was associated with smoking cessation but not initiation” (Furberg et al., 2005). Finally, a study based on a national Swedish survey found that “Use of snus in Sweden is associated with a reduced risk of becoming a daily smoker . . .” (Ramström & Foulds, 2006). In 2008, the European Commission’s Scientific Committee on Emerging and Newly Identified Health Risks concluded that “The Swedish data . . . do not support the hypothesis that . . . snus is a gateway to future smoking” (Scientific Committee on Emerging and Newly Identified Health Risks [SCENIHR], 2008).

NSDUH data from the years 2003, 2005, and 2007 do not support the hypothesis that ST use is a gateway to smoking among American White males of any age, including teenagers. In fact, there is evidence that, compared with cigarette initiators, ST initiators are significantly less likely to smoke, which suggests that ST may play a protective role.

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Declaration of Interests

Neither author has any financial or other personal relationship with regard to the sponsors or any other stakeholder in the issue of tobacco use and health.

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