

7.5.3-1: INITIAL - NONUSERS’ BEHAVIOR – LITERATURE SUMMARY

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List of Abbreviations

CDC	Centers for Disease Control and Prevention
CI	confidence interval
MRTP	modified risk tobacco product
MRTPA	Modified Risk Tobacco Product Application
OR	odds ratio
PR	prevalence ratio
ST	smokeless tobacco
TAPS	Teenage Attitudes and Practices Survey
U.S.	United States

7.5.3-1. LITERATURE SUMMARIZING THE EFFECT ON TOBACCO USE INITIATION AMONG NONUSERS

The Family Smoking Prevention and Tobacco Control Act and the Food and Drug Administration’s Modified Risk Tobacco Product Application (MRTPA) 2012 Draft Guidance Section VI(A)(3) require the following assessments of tobacco use initiation in nonusers:

- the likelihood that consumers who have never used tobacco products, particularly youth and young adults, will initiate use of the tobacco product;
- the likelihood that nonusers who adopt the tobacco product will switch to other tobacco products that present higher levels of individual health risk; and
- the likelihood that former users of tobacco products will reinitiate use with the tobacco product.

To address the effect of the MRTP on tobacco use initiation, the Food and Drug Administration recommends submitting data from human studies that evaluate consumer perception of the product, including its labeling marketing and advertising. Results from these studies are summarized in [Section 6.4](#). In addition to studies on consumer perception, the following section summarizes the published scientific literature on smokeless tobacco (ST) use initiation in nonusers.

Altria Client Services LLC conducted a comprehensive literature search to identify published information relevant to ST product use, initiation in nonusers of tobacco products, or former tobacco product users (i.e., initiation, gateway, and reinitiation). A description of our literature search and review process is presented in [Section 7.5.1](#) of this MRTPA. This review is limited to studies of ST products used in the United States that were published between through December 2014. From this search, a total of 6,742 publications were identified, and, after a comprehensive and in depth critical review, 537 were determined to be in scope. These publications were further reviewed to assess which specific category(ies) in the MRTPA Draft Guidance each article addressed. Reports published shortly after the date of our last search were included in this review when deemed to be significant contributions to this body of research. The initial literature search yielded 55 publications addressing initiation in nonusers and 27 publications addressing ST use as a gateway product. Limited information was available that specifically addresses behaviors related to reinitiation in former users. An updated literature review was conducted to bridge the original review to February 2017, and updated findings informing initiation, gateway, and reinitiation are presented in [Section 7.5.6-2](#).

For all sections, supplementary relevant publications were identified from citations included in the selected publications. The studies in this summary include primarily cross-sectional and longitudinal survey studies, as well as a smaller number of randomized-controlled interventional studies. The number of subjects evaluated in these studies ranged from as few as eight ([Benowitz, Jacob, & Yu, 1989](#)) to nationally representative weighted samples (e.g., [Fix et al., 2014](#); [Saunders & Geletko, 2012](#)). Participants included children, adolescents,

young adults (including college students, college athletes, Native Americans, military personnel), and adult males and females. The ST products evaluated within these studies are most commonly described as ST (nonspecific), snuff, or chewing tobacco. Since moist smokeless tobacco products comprise a significant proportion of the ST products available in the U.S. market, and have done so for many years, the scientific observations based on the general category of ST products are considered generalizable to moist smokeless tobacco.

Although a relatively large body of literature exists that evaluates patterns of ST use, fewer studies focus specifically on patterns of initiation, particularly in nonusers. Furthermore, the available literature is inconsistent with respect to the definition of initiation. For example, some studies define initiation as the first time a user tried a product, while others define initiation as the beginning of regular use of a product. In many instances, the definition of initiation is not provided within an article. Likewise, in review of the gateway literature, we found no single study that focused on the primary issue of *causality*, which is central to the examination of any possible effect of ST use on subsequent cigarette smoking. Lastly, in our review, only one study directly evaluated the likelihood of former users of tobacco products reinitiating use of ST ([Section 7.5.3-1.3](#)). Although there are limitations to this literature review, the large volume and quality of publications conducted with ST products manufactured in the United States indicate that the data sets within the current literature characterizing ST use initiation in nonusers are sufficiently robust to address the issues raised by the Food and Drug Administration in the MRTPA Draft Guidance. Within each tobacco use behavior section, the strengths and limitations of the available literature are presented. An updated literature review was conducted to bridge the information in this section to 2017, and the updated findings for topics in this section are presented in [Section 7.5.3-2](#).

On the basis of the current published literature with U.S. ST products, the following observations can be made about tobacco use initiation in nonusers:

- Although ST use is reported among youths and young adults, the prevalence is lower than cigarette smoking, and the use of ST has been decreasing gradually since the mid-1990s.
- The trial and initiation of regular ST use are most common among younger white males residing in rural communities with initiation of regular ST use typically occurring around 19 years of age.
- Among children and adolescents, familial use of ST is strongly related to trial and initiation, while in young adults, peer use has a greater influence. Trial and initiation of regular ST use are related to other risky or thrill-seeking behaviors and may be promoted by a combination of other behavioral or psychological characteristics.
- Although cigarette smoking has been reported to be more common among ST users than among nonusers, based on the existing literature, a definitive causal link between ST use and subsequent cigarette smoking has not been established.
- Limited data are available on reinitiation of ST use in former users; however, in those individuals who report using smoking as a method of quitting ST, some individuals may reinitiate ST use rather than continuing to smoke cigarettes. Relative to dual-users, exclusive ST users may be less likely to reinitiate use after attempting to quit.

7.5.3-1.1.The Likelihood that Consumers Who Have Never Used Tobacco Products, Particularly Youth and Young Adults, Will Initiate Use of the Product

7.5.3-1.1.1. Overview

The following section addresses ST product’s effect on tobacco use behavior, specific to product use initiation in consumers who have never used tobacco products, particularly youth and young adults. Although there is vast literature on patterns of use for ST, few studies focus specifically on patterns of initiation in nonusers. The studies that describe patterns and correlates of initiation in youths and young adults have some limitations. First, a proportion of the studies were conducted between 15 and 35 years ago (1980-2000), and the relevance of the results to current behaviors should be taken under consideration. Furthermore, within the studies reviewed, there was great variability in the measures used to define initiation as well as the research methods employed, including the use of cross-sectional study designs rather than a longitudinal approach. Although cross-sectional studies generate important data on relationship patterns, they do not provide information on the direction of the relationship between independent variables (i.e., it is difficult to discern whether a trait preceded a behavior or vice versa). Many of the studies focused only on specific age groups or specific regions of the country, which may not be representative of the entire population. As a result, comparisons between studies are difficult to make. For the purposes of this submission, we have considered the operational definition of *initiation* as the progression from product trial to regular usage of the product. There are many existing metrics for defining regular use of a tobacco product, primarily based on national surveys. Some examples of these metrics include past 7-day use, past 30-day use, daily use, etc. Where applicable, we will use this approach to address the *likelihood* of initiation.

Overall, the prevalence of ST use among youths and young adults is lower than cigarette smoking and the use of ST has been decreasing gradually since the mid-1990s. The trial and initiation of regular ST use are most common among younger white males residing in rural communities. Current population-based surveys indicate that the age of initiation of regular ST use typically occurs around 19 years; however, the literature suggests that a younger age of initiation is associated with greater risk of a heavier and longer duration ST use. Familial use of ST has been found to be strongly related to trial and initiation of regular ST use, particularly in children and adolescents; however, in young adults, peer use has been reported to have greater influence. Consistent with the Common Liability Theory (discussed in Section 7.5.3-1.1.4), initiation of regular ST use may also be related to other risky or thrill-seeking behaviors and may be promoted by a combination of other behavioral or psychological characteristics.

7.5.3-1.1.2. Literature Review Results

The literature search yielded 55 publications that assessed the prevalence of ST trial and initiation, ST use patterns, and correlates of ST initiation. Specifically, 2 publications focused on predictive correlates of ST use in children (primarily elementary school age); 38 publications reported on the patterns of trial, initiation, and ST use in adolescents; 9

publications were specific to trial, initiation, and ST use in young adults; and 6 publications were focused on initiation of ST in adults. Relevant publications are those that provided information on the prevalence of ST use among youths and young adults, along with a discussion of the factors that contribute to initiation and the age or conditions present at first use. The number of participants evaluated in these studies ranged from as few as 53 (Nemeth et al., 2012) to as many as 414,509 (Vander Weg, Cunningham, Howren, & Cai, 2011). With the exception of four studies that included a longitudinal element in the design, most of the studies were cross-sectional survey studies.

7.5.3-1.1.3. Prevalence of Use in Adolescents and Young Adults

Several ongoing, nation-wide surveys provide relatively up-to-date information on the prevalence and patterns of tobacco use initiation in the United States. These surveys include large populations involving several thousand respondents across the major geographic regions of the United States, thereby providing some of the most comprehensive information on the population rates and patterns of initiation.

According to data collected as part of the Monitoring the Future study (Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2016), a long-term study of American adolescents, college students, and adult high school graduates through age of 55 years, the use of ST has been decreasing gradually, and 30-day prevalence is now approximately half the peak levels reached in the mid-1990s. Daily usage rates in 2015 were 0.8 percent, 1.6 percent, and 2.9 percent for Grades 8, 10, and 12, respectively (Johnston et al., 2016). Minor reductions in past-month ST use were also reported in results from the Youth Risk Behavior Survey, a biannual, in-school survey conducted by the Centers for Disease Control and Prevention (www.cdc.gov/healthyyouth/data/yrbs/index.htm). According to the Youth Risk Behavior Survey, past-month use of ST declined slightly from 11.4 percent in 1995 to 8.8 percent in 2013 (Kann et al., 2014).

7.5.3-1.1.4. Factors Associated with Initiation of ST Use in Youths and Young Adults

A large body of research has been compiled on the predictive correlates of ST use in youths and young adults with a few lines of research focusing specifically on the factors contributing to licit and illicit drug initiation, and accompanying patterns of high risk behaviors. One theory, The Common Liability Theory, identifies psychological and heritable factors contributing to risky behavior, substance use disorders, and problem behaviors (Hicks, Iacono, & McGue, 2012; Holman, Bricker, & Comstock, 2013; Vanyukov, Kirisci, et al., 2003; 2003). The Common Liability Theory uses sociocultural and heritable cues to explain adolescent and young adult initiation into tobacco, alcohol, and other drugs, thereby constructing a general set of risk factors (Hicks et al., 2012). This line of research defines *substance use* as “a function of a common factor of substance-use vulnerability” and suggests that substance use may be one of a number of behaviors that are associated with a deviant lifestyle (Jackson, Sher, Rose, & Kapiro, 2009). Finally, the theory takes into consideration the contextual basis for and concurrent use of a variety of risky or illicit behaviors.

Within the articles included in this literature review, the factors associated with the initiation of ST use were typically divided into four categories among youths: demographics,

socioenvironmental correlates (e.g., familial use, peer-group use, role-model use), personality traits and personal beliefs (attitudes towards ST, behavioral characteristics), and perceived risk (knowledge of health risks, perceived sanctions from parents, peers, school). The following sections summarize the available literature on these four factors.

7.5.3-1.1.4.1. Demographics Associated with ST Use

In terms of sex, ST use is almost an exclusively male behavior and ST trial is more common in males than females. The daily prevalence rates in the Monitoring the Future study ranged between 1.2% and 5.8% for males versus 0.0% and 0.3% for females in Grades 8 to 12 (Johnston et al., 2016).

This difference in sex was also evident across all the studies reviewed, regardless of the time the data were collected (1987 to 2014), the age group analyzed (i.e., children, adolescents and young adults), or geographic region of the United States. In general, the proportion of males who tried ST was statistically greater than the proportion of females, and the proportion of males who became current or regular users of ST was greater than the proportion of females (Abrams, Skolnik, & Diamond, 1999; Bonaguro, Pugh, & Bonaguro, 1986; Botvin, Baker, Tortu, Dusenbury, & Gessula, 1989; Colborn, Cummings, & Michalek, 1989; Coogan, Geller, & Adams, 2000; Dunn, 2014; Ebbert et al., 2006; Foreyt et al., 1993; Glover, Laflin, & Edwards, 1989; Lisnerski, McClary, Brown, Martin, & Jones, 1991; Marty, McDermott, Young, & Guyton, 1986; Noland et al., 1996; Smith, Colwell, Forte, Pulczynski, & McKyer, 2015; Tercyak & Audrain, 2002; Tomar & Giovino, 1998). In many of the studies reviewed, female data were removed altogether due to low prevalence of use. For example, Marty et al. (1986) reported 31.8% of males using ST as compared with 2.3% of females, while McCarthy et al. (1986) reported that less than 4% of females experimented with ST as compared with 16% of males. In more recent studies, 15% of males versus 2.2% of females reported past 30-day use of ST (Dunn, 2014).

As noted above, the strongest factor in initiation of ST use seems to be sex; however, race is also strongly associated with ST use. In the majority of studies reviewed, white male adolescents were found to be significantly more likely to be current ST users than African-American or Hispanic males (Boyle, 1989; G. L. Burke, Hunter, Croft, Cresanta, & Berenson, 1988; Coogan et al., 2000; Ebbert et al., 2006; Foreyt et al., 1993; Tercyak & Audrain, 2002; Tomar & Giovino, 1998). For example, Foreyt et al. (Foreyt et al., 1993) reported that 21% of white males used ST as compared with only 10.4% of African Americans, 5.4% of Hispanics, and 5.4% of others, primarily Asians. Interestingly, the use of ST and cigarettes (i.e., dual use) was more likely in African Americans (odds ratio [OR] = 2.30; 95% confidence interval [CI], 1.01-5.25) but significantly less likely in Hispanics (OR = 0.25; 95% CI = 0.11-0.58) (Gansky, Ellison, Kavanagh, Isong, & Walsh, 2009) (Section 7.5.3-1.3).

Among the studies included in the current literature review, youth and young adults self-reported an age of initiation between 9 and 15 years (Ary, Lichtenstein, Severson, Weissman, & Seeley, 1989; Bonaguro et al., 1986; Chisick, Lee, Raker, & Williams, 1992; Riley, Barenie, & Myers, 1989; Spangler, Dignan, & Michielutte, 1997). However, one study

suggested that initiation of ST use exhibits a bimodal age curve, with 42 percent of all ST users initiating use at the age of either 12 year or 18 years (Schroeder, Iadecola, Chen, Glover, & Edmundson, 1987).

Interestingly, Schroeder et al. (1987) who reported the bimodal age curve, also reported differences in the characteristics of individuals who began using ST as adolescents versus those who began using ST as young adults. For example, those ST users who initiated ST use at a younger age (<15 years) were more likely to use ST twice as long as those who began using ST at an older age (total duration of use: 28.1 years vs. 14.4 years) (Schroeder et al., 1987). In addition, the prevalence of use tended to increase with increasing age or years in school, which is consistent with other research (Abrams et al., 1999; Gansky et al., 2009). In one cross-sectional study of male high school students, those students who were current heavy users of ST (five to seven times in the last week) first tried ST and began using it regularly at a significantly younger age than those who were classified as moderate or low users (first tried ST: 10.4, 13.0, and 12.8 years of age for heavy, moderate, and low use, respectively, $p < 0.001$; began using ST regularly: 12.4, 14.5, 13.5 years of age for heavy, moderate, and low use, respectively, $p = 0.002$) (Gansky et al., 2009).

In terms of differences in geographic region, those individuals residing in rural communities were more likely to try and initiate regular use of ST (Botvin et al., 1989; Colborn et al., 1989; Schroeder et al., 1987; Tomar & Giovino, 1998; Walsh, Hilton, Ernster, Masoureddis, & Grady, 1994). In a study of elementary school children, those in rural communities were more likely to have tried ST (36.4% of first grade students) than urban children, and 72.5% of those in rural communities had tried ST by seventh grade ($F_{1, 531} = 59.44$, $p < 0.01$) (Lisnerski et al., 1991). In one large, nationally representative sample of adults residing in the United States, rural dwelling participants were more likely to be current and lifetime users of ST than those living in suburban or urban environments (current users: 5.9% [rural], 3.6% [suburban], 2.2% [urban], $p < 0.001$) (Vander Weg et al., 2011).

In summary, trial and initiation of regular ST use are more common in males than in females, in white males than in African-American or Hispanic males, and in individuals residing in rural than in those residing in urban communities. In addition, the initiation of regular ST use typically occurs in youths between the ages of 9 and 15 years, with a younger age of initiation associated with greater risk of a longer duration and heavier ST use.

7.5.3-1.1.4.2. Socioenvironmental Correlates Associated with ST Use

Familial, peer-group, and role-model use of ST has consistently been reported to be associated with trial and initiation of regular ST use in both youth and young adults. In younger children (first, third, fifth, and seventh grade students), members of the household using ST was positively correlated with trial and initiation of regular ST use ($r = 0.31$ and $r = 0.23$; $p < 0.01$ for both) (Lisnerski et al., 1991). In a study of adolescents use patterns, 28 percent of self-reported ST users had parents who also used ST, as compared with 5 percent in nonusers ($p < 0.01$) (Colborn et al., 1989). Consistent with the well-described sex differences in ST use, in most cases, parental use reflected the father’s use of ST (Ary et al., 1989; Boyle, Claxton, & Forster, 1997; Brubaker, Fowler, & Kinder, 1987; Marty et al., 1986; Noland et al., 1996), with one study reporting that 9.3 percent of subjects (adolescent

boys) described first using ST in the presence of their fathers (Ary et al., 1989), and another study reporting higher risk of ST use if the product is used in the home environment (Agaku, Ayo-Yusuf, Vardavas, Alpert, & Connolly, 2013). These findings reflect the importance of parental attitudes about ST use since parents exert significant influence on tobacco use by adolescents (Andrews, Tildesley, Hops, Duncan, & Severson, 2003; Chassin, Presson, Sherman, McLaughlin, & Gioia, 1985).

A number of studies suggest that perceived parental lack of approval of ST use is associated with reduced risk of ST initiation to regular use (Biglan, Duncan, Ary, & Smolkowski, 1995; Bonaguro et al., 1986; Brubaker et al., 1987; Marty et al., 1986). Parental response to ST and parental rules in the home have been shown to be strongly associated with intention to use ST (Brubaker et al., 1987). One study reported increased risk of trial ST use in both male and female adolescents if parents approved of ST use (OR = 2.34, $p = 0.009$; OR = 3.29, $p = 0.052$; respectively) (Lee, Raker, & Chisick, 1994). Brubaker et al. (Brubaker et al., 1987) suggested that the presence of parental rules forbidding ST use results in a decreased intent to use ST; likewise, results from a study of 2,924 adolescent males identified fewer parental sanctions (OR = 1.74; 95 percent CI = 1.30-2.32) and fewer school sanctions (OR = 1.58; 95 percent CI = 1.16-2.39) as strongly related to ST use (Boyle et al., 1997).

Consistent with these findings, ST use by a sibling has been associated with increased risk of ST trial and initiation of regular ST use (Boyle et al., 1997; Colborn et al., 1989; Smith et al., 2015). According to a study of 833 adolescents, ST users are approximately 4 times more likely to have a sibling that uses ST (OR = 4.28, $p = 0.0001$) (Horn, Gao, Dino, & Kamal-Bahl, 2000). In addition to family influence associated with ST use, family status can also affect ST initiation. In a longitudinal study, Ebbert et al. (2006) found that being married or being in a married-like relationship decreased the likelihood of initiation of regular ST use at 12-month follow-up in previously nonusing military recruits.

Peer influences and relationships also have a marked effect on the likelihood of trial and initiation of regular ST use among youths and young adults. Numerous studies refer to peer use, especially among a youth’s closest friends, as having the greatest effect of the socioenvironmental factors on ST initiation (Ary et al., 1989; Bonaguro et al., 1986; Boyle et al., 1997; Boyle, Gerend, Peterson, & Hatsukami, 1998; Chassin et al., 1985; Colborn et al., 1989; Creath et al., 1988; de Moor et al., 1994; Dent, Sussman, Johnson, Hansen, & Flay, 1987; Elder, Molgaard, & Gresham, 1988; Foreyt et al., 1993; Goebel, Crespo, Abraham, Masho, & Glover, 2000; Holman et al., 2013; Horn et al., 2000; Lee et al., 1994; Lisnerski et al., 1991; Lowe et al., 1988; Marty et al., 1986; Riley et al., 1989; Walsh et al., 2003).

Among young adult females, 80 percent reported first use among nonspecified friends (Boyle et al., 1998). The same study also reported that greater than 50 percent of ST users first tried ST after friends gave them ST (Ary et al., 1989). When adolescents were asked about their future intentions to use ST, a significant, positive relationship was found between the intention to use ST and more peers who used ST ($r = 0.25$, $p < 0.01$) (Chassin et al., 1985). The perception of ST use among one’s peer group has also been reported to be associated with ST use in adolescents. Those subjects who believed that half of their friends used ST and those subjects who had an inflated perception of the percentage of students who use ST were three and two times, respectively, more likely to use ST (Boyle et al., 1997).

Consistent with the finding of [Bonaguro et al. \(1986\)](#), who reported that peer usage and father’s approval accounted for approximately 40 percent of the variance associated with ST use, the set of socioenvironmental factors most strongly related to ST trial and initiation may be familial use and approval as well as peer use.

7.5.3-1.1.4.3. Personality Traits and Behaviors Associated with ST Use

While there is substantial evidence that the influence of friends and family has an important effect on the likelihood of ST initiation, there is a large body of evidence, including the Common Liability Theory, suggesting that certain personality traits and related behaviors also substantially influence the risk of trial and initiation of regular ST use.

Several studies have examined the correlation between ST use and risk-taking or thrill-seeking personality characteristics. [Coogan et al. \(2000\)](#) found that students who use ST are more likely to drive drunk or ride with a drunk driver ($p < 0.001$). [Holman et al. \(2013\)](#) observed that peer influence, rebelliousness, and thrill seeking were strongly predictors of ST initiation in young male adolescents. Consistent with these findings, [Tomar et al. \(1998\)](#) reported that in male students, risk seeking behavior and engaging in physical fights was predictive of regular ST use, while [Ebbert et al. \(2006\)](#) suggested a strong association between a preference for taking legal risks and ST use. These findings in youths are similar to those described by [Vander Weg et al. \(2005\)](#), where young adult female military recruits who reported having ever used ST also reported a preference for taking risks such as driving fast, reported arguing and fighting, described themselves as rebellious, engaged in acts of road rage, and agreed that taking legal and illegal risks would be fun.

In addition some studies report that ever users of ST are more likely to report current or past cigarette smoking, alcohol consumption, and use of illicit substances such as marijuana ([Coogan et al., 2000](#); [Dent et al., 1987](#); [Everett, Giovino, Warren, Crossett, & Kann, 1998](#)). [Ary et al. \(1987\)](#) reported that of the students who indicated daily use of ST, 82.7 percent used multiple substances, with the percentage of students reporting smoking cigarettes, consuming alcohol, and smoking marijuana increasing with increased use of ST. In contrast, other studies report less risk of abuse of other substances in ST users. For example, [Sussman et al. \(1990\)](#) reported that males involved in sports (including primarily skate boarding) were more likely to use ST but less likely to use other drug substances. This finding was attributed to the likelihood that ST users did not want their sports performance negatively affected by using other drug substances ([Sussman et al., 1990](#)).

ST use may also be promoted by a combination of other behavioral or psychological characteristics. [Botvin et al. \(1989\)](#) suggested that regular ST users may have fewer adaptive coping skills so that ST use becomes an alternative means of achieving desired goals, coping with stress ([Coogan et al., 2000](#); [Hermes Eric et al., 2012](#)), dealing with dysphoric feelings ([Tercyak & Audrain, 2002](#)) or perceived failure ([McCarthy et al., 1986](#); [Zullig, Valois, Huebner, Oeltmann, & Drane, 2001](#)). Conversely, in certain populations, ST use has been associated with a more positive image in comparison to smoking. In one study of rural high school students, ST users were perceived to be for example, more confident, happier, more popular, healthier, more relaxed, braver, more athletic, and more patriotic, ($p < 0.01$) than smokers ([Chassin et al., 1985](#)).

These studies suggest that ST trial and initiation are more prevalent in individuals who are more likely to engage in high-risk behaviors and are consistent with other reports in youth, suggesting a relationship between increased risk-taking and substance use and abuse (e.g., [Windle, 1994](#)). However, results of these studies must be interpreted with caution. Due to their cross-sectional design, the directionality of the association between trial and initiation of regular ST use and certain behavioral characteristics cannot be determined, nor if ST use facilitates the behavior or vice versa.

7.5.3-1.1.4.4. Perceived Risks Associated with ST Use

The studies in this literature review that included assessments of perceived risks associated with ST use primarily focused on youth, adolescents, and young adults. These studies suggest that, in a younger population, social acceptability or unacceptability and physical effects or health risks associated with use may be among the most important factors in initiation of regular use of ST.

In terms of physical effects, among youths and young adults, the most commonly reported effects of first ST use include general negative effects, such as feeling sick, dizziness and nausea/vomiting, with the reported negative physical effects declining by second use ([Ary et al., 1989](#); [Boyle et al., 1998](#)). In some studies, ST users were more likely to attribute fewer negative risks or health risks to ST use in comparison with smoking ([Chassin et al., 1985](#); [Riley et al., 1989](#); [Smith et al., 2015](#)). One study of rural high school students, nonusers of ST reported a positive relationship between a strong intention to use ST in the future and less perceived health risk associated with ST use ($r = 0.32$, $p < 0.01$) ([Chassin et al., 1985](#)). Consistent with these findings, in a group of 12- to 19-year-old male subjects, ST users were more likely to attribute positive consequences to using ST than nonusers (i.e., helps you relax, tastes good, look more macho) ([Colborn et al., 1989](#)). However, there are a number of studies that suggest that ST users are well aware of health risks but use ST regardless of these risks. For example, in a sample of 995 adolescent male athletes, 93.7% of ST users agreed that ST use is harmful to health ([Creath et al., 1988](#)); while in a small subset of 20 female young adult ST users, 75% of ST users reported risk of cancer, 30% reported risk of oral disease, and 30% reported risk of tooth loss as perceived health risks ([Boyle et al., 1998](#)). These latter findings are consistent with perception of harm data reported as part of the Wave 1 results of the Population Assessment of Tobacco and Health study ([Hyland et al., 2016](#)). The Population Assessment of Tobacco and Health study is a nationally representative longitudinal study of tobacco use, its determinants, and its effects in never, current, and former tobacco users aged 12 years and older. Results from the Population Assessment of Tobacco and Health study suggest that in youths aged 12 to 17 years, ST use is perceived as only slightly less harmful and more addictive than cigarettes. Consistent with reports in youth, only 8.6% of adults surveyed reported that ST products are less harmful than cigarettes while 27.6% reported ST use as more harmful than cigarettes. This discrepancy in the findings from the literature review and the Population Assessment of Tobacco and Health study is likely related to differences between current data (i.e., data collected within the last 5 years versus the older literature, which includes data from the past 15 to 20 years).

Overall, the literature on ST initiation suggests that the origins of decisions to initiate and sustain tobacco use are similar to those influencing youth’s decisions to engage in other risky

behaviors. However, recent data suggest that in both youth and adults, perceived health risks and general negative consequences related to ST use are only marginally lower than cigarettes.

7.5.3-1.1.5. Summary

Although ST use is reported among youths and young adults; the prevalence is lower than cigarette smoking and it has been decreasing gradually since the mid-1990s. Across the literature, the trial and initiation of regular ST use are more common in males than in females, in white males than in African American males or Hispanic males, and in individuals residing in rural than in those residing in urban communities. The initiation of regular ST use was previously reported to occur between 9 and 15 years of age, with a younger age of initiation associated with greater risk of heavier and a longer duration of ST use. In younger children and adolescents, familial use of ST is strongly related to trial and initiation, while in young adults, peer use is more strongly related to trial and initiation of ST use. In both males and females, trial and initiation of regular ST use were related to other risky or thrill-seeking behaviors, lower perceived sanctions, as well as to the current or past alcohol or cigarette use and to the use of illicit substances. In youths and young adults, ST use may be promoted by a combination of other behavioral or psychological characteristic such as greater psychological distress and may be used as a form of coping with stress. In addition, the factors influencing the decision to initiate and sustain tobacco use are similar to those influencing youth’s decisions to engage in other risky behaviors. Recent data suggest that perceived health risks associated with ST use are only marginally lower than those associated with cigarettes. [Table 7.5.3-1-1](#) presents a summary of the 55 publications identified that assessed initiation of ST use.

Table 7.5.3-1-1: Literature Evaluating Initiation of ST

Author Publication Year	Title	Study Type Sample	Measures	Outcomes and Authors’ Findings	Comments
<i>Studies with Children</i>					
(Lisnerski et al., 1991)	Demographic and predictive correlates of smokeless tobacco use in elementary school children	Cross-sectional survey N = 559 School children North Carolina	Use of ST	22.4% tried ST at least once; 5.72% continued use of ST. <i>Tried ST:</i> <ul style="list-style-type: none"> Males > females ($F_{1, 531} = 30.88, p < 0.01$) ST use increased with grade ($F_{3, 531} = 10.73, p < 0.01$) Rural children > urban children ($F_{1, 531} = 59.44, p < 0.01$) <i>Still use:</i> <ul style="list-style-type: none"> Males > females ($F_{1, 531} = 13.10, p < 0.01$) Rural children > urban children ($F_{1, 531} = 8.73, p < 0.01$) 36.4% of rural 1st graders had tried ST increasing to 72.5% by the 7th grade. 20% of rural 7th-grade students reported “still using” ST. 	<i>Strengths:</i> Moderate sample size Unique sample, young age Direct urban vs. rural comparison <i>Limitations:</i> Cross-sectional Self-report Limited geographic representation (North Carolina)
			Measures of Association	<i>Tried ST:</i> Strongest correlations among “have tried” are “tastes good” ($r = 0.67, p < 0.01$), that it makes one feel “grown-up” ($r = 0.46, p < 0.01$), use of members of the household ($r = 0.31, p < 0.01$), want to be like admired athletes ($r = 0.30, p < 0.01$) and friend’s use ($0.27, p < 0.01$). <i>Still use:</i> Strongest correlations among “have tried” are “tastes good” ($r = 0.46, p < 0.01$), that it makes one feel “grown-up” ($r = 0.25, p < 0.01$), want to be like admired athletes ($r = 0.26, p < 0.01$), use of members of the household ($r = 0.23, p < 0.01$), and friends use ($r = 0.20, p < 0.01$).	
				Authors’ finding is that initial trial of ST is associated with: 1) Identity, self-concept, or self-presentation 2) Familial use	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

Author Publication Year	Title	Study Type Sample	Measures	Outcomes and Authors’ Findings	Comments
(Andrews et al., 2003)	Elementary school age children's future intentions and use of substances	Cohort-sequential design (5 grade cohorts assessed at annual intervals over 3 years) N = 1,070 Grades 1 to 5 Western Oregon	Prevalence of trying	<p><i>Tried ST:</i></p> <ul style="list-style-type: none"> Males (2.9%) > females (0.7%) (OR = 2.11; 95% CI = 1.29-3.45, $p < 0.01$) Males > females tried ST without parents' knowledge (OR = 3.24; 95% CI = 1.05-9.95, $p < 0.05$) <p><i>First Assessment (T1):</i></p> <ul style="list-style-type: none"> Boys in the 4th-grade at T1 more likely to report trying ST (5.5%) than boys in the 2nd grade or 3rd grade at T1 (1.0% and 0.5%, respectively) ($\chi^2 = 8.1$, $p < 0.05$). Girls in 3rd grade at T1 were more likely to report trying ST at the 5th-grade assessment (4.9%) vs. girls in 4th or 5th grade at T1 (0.0% for both cohorts) ($\chi^2 = 9.6$, $p < 0.01$). <p>Authors’ finding are that there is a lower prevalence of the use of ST vs. cigarettes, only about one-fourth of 1st graders identified this substance, with the proportion recognizing it increasing to about half by 3rd grade and boys were more likely than girls to report trying ST at an early age and without parents’ knowledge.</p>	<p><i>Strengths:</i> Cohort-sequential design, in contrast to cross-sectional and longitudinal designs, allows an examination of all three sources of variance within one study: the cohort, the age or grade of the child, and the assessment time. Large sample size</p> <p><i>Limitations:</i> Change from interview to questionnaire at older ages Self-report 50% enrollment Low attrition but lost to follow-up associated with greater risk factors</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

Author Publication Year	Title	Study Type Sample	Measures	Outcomes and Authors’ Findings	Comments
<i>Studies with Adolescents</i>					
(G. L. Burke et al., 1988; Ebbert et al., 2006)	The interaction of alcohol and tobacco use in adolescents and young adults: Bogalusa heart study	Cross-sectional survey N = 1,811 12-24 years Louisiana	Use of tobacco products	White males; aged 12-15 years (44%-48%; $p < 0.001$) Moderate smokers (1-2 pack per week) No significant interaction between ST and smoking	<i>Strengths:</i> Sample size Reliability results at retest
			Alcohol consumption	Increased alcohol use in white male ST users (younger age groups). Greater than 60% of ST users vs. >30% of nonusers who used ST at 14-15 years of age also consumed alcohol. Author’s findings were that young people use alcohol and tobacco products concurrently, which may result in a cohort of people at increased risk for cancer and cardiovascular disease.	<i>Limitations:</i> Cross-sectional Self-report Minimal data reported
(Chassin et al., 1985)	Psychosocial correlates of adolescent smokeless tobacco use	Cross-sectional survey N = 297 Rural, midwest public high school students	Prevalence of tobacco use	33% males reported ST use vs. 13% reporting smoking ($p < 0.01$) Positive relationship between ST use and smoking ($\chi^2 = 39.8$, $p < 0.0001$). Regular smokers more likely to be regular ST users (70%), but most ST users not regular smokers (73.6%).	<i>Strengths:</i> Multiple key social measures included
			Health beliefs	ST use vs. smoking associated with gum disease and mouth cancer ($p < 0.001$). ST users believe ST use less dangerous vs. nonusers and smokers ($F_{2, 112} = 5.53$, $p < 0.005$).	<i>Limitations:</i> Sample size
			Tobacco use intentions and behavior	For male nonusers, less perceived danger in ST use was associated with stronger intentions to use ST in the future ($r = 0.32$, $p < 0.01$).	Cross sectional
			Social acceptability of tobacco use	Male nonusers reported that their parents/friends would be negative about all tobacco use but more accepting of ST use (paired t-tests, $p < 0.001$). Male ST users reported that 71.1% of parents knew about ST use (vs. only 41.2% of smokers).	Limited geographic representation
			Tobacco use among significant others	ST use more prevalent among peers (44.6% vs. 26.8% smoking; $p < 0.001$). Use of ST by family members weakly related to use ($p < 0.10$). Nonusers with intention to use had more peers who used ST ($r = 0.25$, $p < 0.01$).	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

			Social image	<p>Compared to the smoker image, the ST user was seen as significantly less phoney, more confident, happier, more popular, more hardworking, healthier, more relaxed, getting along more with families, braver, liked country more, used drugs less, and more athletic ($p < 0.01$); also better at schoolwork and more conservative ($p < 0.05$).</p> <p>Authors’ findings were that ST use is more prevalent in males, other than mouth and gum disease, ST use is perceived as less dangerous, ST use is more socially acceptable, and ST use is associated with a more positive social image for ST vs. smoking</p>	
(Chisick et al., 1992)	A profile of tobacco use among teenage dependents	Cross-sectional Survey N = 2,241 Teenage dependents of active duty soldiers Grades 6-12 Kentucky	Use (ever tried, frequency, age of initiation, number of years of use)	<p><i>ST only:</i></p> <ul style="list-style-type: none"> Grade 6: 3.1% Grade 12: 7.1% Overall use: 3.2% <p><i>Dual-use:</i></p> <ul style="list-style-type: none"> Grade 6: 7.3% Grade 12: 19.4% Overall use: 13.2% <p><i>Age at first use:</i> Highest proportion of subjects reported age of first use between 9-14 years of age (9-10 years [24.8%], 11-12 [23.0%], 13-14 [22.6%]) Most (55% of subjects) reported using ST for ≤ 1 year Of respondents that had only tried ST, males (5.7%) more likely to have tried ST than females (0.6%)</p>	<p><i>Strengths:</i> Sample size</p> <p><i>Limitations:</i> Limited geographic representation (Kentucky) Cross-sectional</p>
			Demographics and attitudes toward tobacco use	<p>Males: 50% of ST use is experimental. Females: 80% of ST use is experimental.</p> <p>Authors’ found that white teenagers are more likely to try or use ST than other ethnic groups, percentage of students ever trying ST increases with grade and majority of youths first tried ST between ages 9 and 14.</p>	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Colborn et al., 1989)	Correlates of adolescents’ use of smokeless tobacco	Cross-sectional survey N = 568 12-19 years N = 261 Sub-analysis in male subjects only New York	Prevalence	Males (69%) tried > females (18%). Males (19%) currently use > females (0.7%). 85% use dipping tobacco (moist snuff). Rural schools highest prevalence of ST use.	<i>Strengths:</i> Sample size Validated questionnaire <i>Limitations:</i> Cross-sectional No analysis of age differences Limited geographic representation (New York State)
			Tobacco use experience	86% of ST users also tried smoking vs. 68% of non- ST-users ($\chi^2 = 5.8$, $p = 0.02$). Among 51 current users, 25% also smoke as compared with 23% of nonusers ($\chi^2 = 0.26$, $p = 0.61$).	
			Parent, sibling, friend tobacco use	Overall 9% had parents currently using ST. <i>Comparison between users vs. nonusers</i> <ul style="list-style-type: none"> • Parent uses ST 28% vs. 5% ($p < 0.01$) • Sibling uses ST 39.2% vs. 13.8% ($p < 0.01$) • Friends use ST 55% vs. 12.9% ($p < 0.01$) • Smoking by siblings and peers not related to ST use 	
			Attitudes about ST	<i>Comparison between users vs. nonusers</i> <ul style="list-style-type: none"> • Users of ST had more favorable attitudes towards social and product attributes than nonusers ($p < 0.05$ for all). • 39% of variance in ST use was accounted for by having the following: friends who use, positive product attributes, negative product attributes, parents use, siblings use, health consequences and positive social attributes. 	
				Authors’ findings were that male adolescents at highest risk of using ST are those who have experimented with cigarettes, have friends and family members who use ST, and ascribe positive consequences to using ST (i.e., helps you relax, tastes good, look more macho). Also, adolescents least likely to use ST have few friends who use and associate use with negative social and health consequences.	
(Coogan et al., 2000)	Prevalence and correlates of smokeless tobacco use in a sample of Connecticut students	Cross-sectional survey N = 12,565 Grades 4-8 N = 19,293 Grades 9-12	ST use	Grades 4-8: <1% used ST and quit, and <1% were currently using ST. Grades 9-12: 3.3% used ST and quit and 4.1% were currently using ST. <i>Current users:</i> <ul style="list-style-type: none"> • 75.3% reported occasional use 	<i>Strengths:</i> Very large sample size <i>Limitations:</i> Cross-sectional Limited geographic

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

		Connecticut		<ul style="list-style-type: none"> • 11.5% reported using 1-2 times daily • 13.2% reported using more frequently. • Males > females • White > other races • ST use increased with age 	representation Self-report
			Risk-taking & psychological distress	<i>Users vs. nonusers:</i> <ul style="list-style-type: none"> • Smoked cigarettes and smoked heavily ($p < 0.001$) • Current use of marijuana, cocaine, and other drugs ($p < 0.001$) • Drinking alcohol and getting drunk ($p < 0.001$) • Receiving poor grades in school with no plans for postsecondary ($p < 0.001$) • Risky behavior (e.g., no seat belt, fighting, driving drunk, $p < 0.001$) • More psychological distress ($p < 0.001$) 	
				Authors’ finding is that ST use is part of a constellation of "problem behaviors."	
(Boyle et al., 1997)	The role of social influences and tobacco availability on adolescent smokeless tobacco use	Cross-sectional survey N = 2,924 Adolescent males Greater Minnesota area	Demographics (age, single-parent home, socioeconomic status)	<i>Among ST users:</i> <ul style="list-style-type: none"> • 75.9% lived in two-parent homes • 64.3% reported smoking in past 30 days • 64.3% dual-users of cigarettes and ST • 49.1% purchase tobacco in past 30 days. 	<i>Strengths:</i> Sample size Validated questionnaire <i>Limitations:</i> Cross-sectional No information collected on other high-risk behaviors Geographically and racially homogeneous
			Social influence (father's use of tobacco, older siblings, friends, and percentage of students in their grade who use tobacco)	<i>Among ST users:</i> <ul style="list-style-type: none"> • 11.7% father, 15.5% older sibling, 68.7% best friend use ST • 54.6% believe half of friends use ST • 40.5% overestimated use of tobacco products by other students their age 	
			Sanction (perception of punishment)	Lower perceived parental sanctions in ST users (43% vs. 69.9%). Lower perceived school sanctions in ST users (18.6% vs. 34.1%).	
			Actual and perceived tobacco availability	80% of ST users reported that tobacco was not difficult to obtain. <i>Logistic regression:</i> <ul style="list-style-type: none"> • 8th grade (OR = 1.38; 95% CI = 0.95-2.01); 9th grade (OR = 1.64; 95% CI = 1.19, 2.27) more likely to use ST vs. 10th grade 	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				<ul style="list-style-type: none"> • Best friend uses ST (OR = 6.59; 95% CI = 4.73- 9.19) • Believes half of friends use ST (OR = 3.28; 95% CI = 2.38- 4.52) • Inflated perception of percentage of students who use ST (OR = 2.20; 95% CI = 1.63- 3.09) • Smoking in past month (OR = 2.87; 95% CI = 2.05-4.03) • Purchase of tobacco (OR = 4.57; 95% CI = 3.24- 6.45) • Low school sanctions (OR = 1.58; 95% CI = 1.16-2.39) • Low parental sanctions (OR = 1.74; 95% CI = 1.30- 2.32) • Tobacco easy to obtain (OR = 1.49; 95% CI = 0.39- 1.77) <p>Authors’ findings stress the influence of the social environment and importance of both social and commercial access to adolescents use of ST products</p>	
(Biglan et al., 1995)	Peer and parental influences on adolescent tobacco use	<p>Longitudinal survey study with assessments at baseline (T1), 12 months (T2) and 18 months (T3)</p> <p>N = 608 14-17 year olds Pacific Northwest</p>	<p>Adolescent problem behavior Peer deviant behavior Parental monitoring Family involvement Parent/child coerciveness</p>	<p><i>1st model (10% of variance):</i></p> <ul style="list-style-type: none"> • Inadequate parental monitoring at T2 predicted ST use at T3 ($\beta = 0.358$, $t = 1.926$, $p < 0.06$) • Association with deviant peers was not related to ST use <p><i>2nd model (27% of variance):</i></p> <ul style="list-style-type: none"> • Variable positively associated was perceived father's approval ($\beta = 0.624$, $t = 4.096$, $p < 0.01$) • Variable negatively associated was perceived mother's approval ($\beta = -0.294$, $t = -1.984$, $p < 0.05$) <p>Authors’ findings were that ST use is associated with engagement in other problem behaviors. Poor parenting practices are not risk factors for development of ST use among boys when more specific influences are considered.</p>	<p><i>Strengths:</i> Longitudinal study design</p> <p><i>Limitations:</i> Sample had a disproportionately large number of smokers, reduced generalizability.</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Bonaguro et al., 1986)	Multivariate analysis of smokeless tobacco use by adolescents in grades 4 through 12	Cross-sectional survey N = 1,055 Grades 4-12 Ohio	Use	32% males, 1.4% females users of chewing tobacco 37% males, 2.8% females users of snuff	<i>Strengths:</i> Sample size <i>Limitations:</i> Cross-sectional Self-report
			Age of initiation	9.5 years; SD = 3.0 (chewing tobacco) 10 years; SD = 2.9 (snuff)	
			Best friends use Close friends usage Parental approval	<i>Use related to:</i> <ul style="list-style-type: none"> • peer usage • parental approval • sex • age <i>Multiple regression (removed sex and age from model):</i> <ul style="list-style-type: none"> • Peer usage and father's approval = 41% of variance (chewing tobacco). • Peer usage and father's approval = 43.6% of variance (snuff). 	
				Authors' finding is that the set of variables that define tobacco use is peer usage, father and mother's approval, and sex. Author suggests that social acceptability or unacceptability may be one of the most important constructs in initiation of ST.	
(Botvin et al., 1989)	Smokeless tobacco use among adolescents: Correlates and concurrent predictors	Cross-sectional Survey N = 1,539 7th grade New York	Demographics	<i>Prevalence of ST use:</i> <ul style="list-style-type: none"> • 15% of students overall use • Males 26% > females 3% ($\chi^2 = 159.40$, $p < 0.0001$) • Rural 24% > nonrural 12% ($\chi^2 = 33.49$, $p < 0.0001$) • 43% rural males, 10% used >20 times <i>Logistic regression ($\chi^2 = 140.93$, $p < 0.0001$):</i> <ul style="list-style-type: none"> • Rural ($p < 0.0001$) • Male ($p < 0.0001$) • Low grades in school ($p < 0.0001$) 	<i>Strengths:</i> Sample size Number of variables included Statistical analysis <i>Limitations:</i> Limited geographic representation Single age group and race Cross-sectional Self-report
			Self-reported use of tobacco, alcohol, and marijuana	<i>Significant correlations between background variables and ST use:</i> <ul style="list-style-type: none"> • Smoking ($r = 0.23-0.36$, $p < 0.0001$) • Alcohol use ($r = 0.34-0.41$, $p < 0.0001$) • Marijuana use ($r = 0.31-0.32$, $p < 0.0001$). <i>Logistic regression ($\chi^2 = 96.97$, $p < 0.0001$):</i> <ul style="list-style-type: none"> • Smoked cigarettes more than 4 times ($p < 0.0001$) • Amount of alcohol consumed ($p < 0.0001$) 	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

			Cognitive, attitudinal, psychosocial	<p><i>Logistic regression ($\chi^2 = 84.70, p < 0.0001$):</i></p> <ul style="list-style-type: none"> • Social anxiety ($p < 0.0001$) • Tendency to eat as a coping response ($p < 0.0002$) • Smoking attitudes ($p < 0.005$) • Assertiveness ($p < 0.006$) • Risk taking ($p < 0.008$) • Self-efficacy ($p < 0.02$) <p>Authors’ findings were that ST users are predominantly males from rural areas, ST use may be promoted by a combination of social and psychological factors: susceptibility to social influences may be moderated by factors like assertiveness, sense of personal control, and anxiety in social situations. In addition, ST use may be used as a coping mechanism for stress, dysphoric feelings, perceived failure, alternative means of achieving desired goals and ST users may have fewer adaptive coping skills.</p>	
(Ary et al., 1989)	An in-depth analysis of male adolescent smokeless tobacco users: Interviews with users and their fathers	Interview-based, 6-month, follow-up study N = 191 Male adolescent ST users Grades 6-11 Oregon Fathers included in analysis = 137	Initial experiences with ST	<p><i>First use experiences:</i></p> <ul style="list-style-type: none"> • 74.2% general negative effects • 32.1% feeling sick • 30.3% dizziness • 6.8% felt a buzz • 11% no effects <p><i>Second use experiences:</i></p> <ul style="list-style-type: none"> • 53.2% negative physical effects 	<p><i>Strengths:</i> Open-ended interviews Detailed questions on first experiences</p> <p><i>Limitations:</i> Small sample size Self-selected nature of sample</p>
			Situational determinants for first tobacco use	<p><i>Why they tried ST:</i></p> <ul style="list-style-type: none"> • 47.5% curious • 22.7% peer pressure • 18.5% response to direct offer 	
			Situation of ST use	<p><i>Environment at first ST use:</i></p> <ul style="list-style-type: none"> • 3.9% were alone • 56.6% with friends • 35.6% with family • 15.1% with brother • 9.3% with father • 11.2% with other relative • 44.6% while hanging out • 36.4% sports • 1% during school breaks 	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				<ul style="list-style-type: none"> 0.5% during parties <p><i>Access to first use:</i></p> <ul style="list-style-type: none"> 87.9% given their first ST (57.9% from friends, 30% from relatives) 7.4% bought or took their first ST 	
			Age of initiation	<p><i>Current users:</i> 10.3 years <i>Experimenters:</i> 11.5 years Significantly younger age of initiation in current users ($F_{1,188} = 11.5, p < 0.001$). Current users tried ST significantly more times than experimental users on each of the first 3 days of use (All p-values < 0.01). Time intervals to second and third usage of ST were significantly shorter among current users than among experimenters [$F_{1,161} = 7.69, p = 0.006$] and [$F_{1,139} = 7.65, p = 0.006$].</p>	
				<p>Author’s findings were that the initial experience nearly always occurs in a social context, usually with ST being offered to the initiate. Greater than a third of initial experiences with ST occur with relatives, most involving offers by the relatives. Curiosity and peer pressure are the most common attributions for accepting the offer. The majority of initial users experience negative physical effects. The age of initiation appears younger for regular users than for experimental users.</p>	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Zullig et al., 2001)	Relationship between perceived life satisfaction and adolescents’ substance abuse	Cross-sectional Survey Study N = 5,032 1997 South Carolina Youth Risk Behavior Survey	Life Satisfaction Scale (6 domains): 1) Family 2) Friends 3) School 4) Self 5) Living environment 6) Overall life	White females reporting dissatisfaction with life and ST use (past 30 days) (OR = 3.33; 95% CI = 1.58-7.03; p < 0.005). Black females reporting dissatisfaction with life and ST use (past 30 days) (OR = 3.78; 95% CI = 1.00-14.29; p < 0.05). White males reporting dissatisfaction with life and ST use (past 30 days) (OR = 1.54; 95% CI = 1.10-2.14; p < 0.05). Black males reporting dissatisfaction with life and ST use (past 30 days) (OR = 2.73; 95% CI = 1.09-6.82; p < 0.05). Authors’ finding was that ST use was significantly associated with life dissatisfaction in adolescents.	<i>Strengths:</i> Large sample size Random sampling Stratification of schools by size High response rates Reliability and construct validity of Life Satisfaction Scale analysis by race and sex <i>Limitations:</i> Cross-sectional study Limited geographic representation Elimination of subjects with missing data
(Schroeder et al., 1987)	Bimodal initiation of smokeless tobacco usage: Implications for cancer education	Cross-sectional survey N = 150 Divided into 50 nonsmokers and ST users, 50 smokers, and 50 nonusers Ages 18-80 (mean age 37)	Age of initiation Primary influence in initiation Family members using tobacco Level of education Number of years of use Demographics	Study found a bimodal curve for initiation of ST with 21/50 (42%) aged 12 or 18 years old <i>Younger cohort (aged 12 years initiation):</i> <ul style="list-style-type: none"> less education rural area use ST longer chew tobacco rather than use snuff only primarily influenced by family members (including female family members who use ST) 68% agreed that ST was harmful 82% that smoking was harmful 82% agreed it was habit forming <i>Older cohort (aged 18 years initiation):</i> <ul style="list-style-type: none"> more education nonrural use ST half the number of years of younger cohort mostly use snuff primarily influenced by friends >50% none of the family use ST 80% agreed that ST was harmful. 97% that smoking was harmful. 92% agreed it was habit forming 68% of all ST users started their ST habit as an alternative to smoking.	<i>Strengths:</i> Data analysis Complexity of questionnaire <i>Limitations:</i> Small sample size Cross-sectional Self-report

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				Authors’ finding was that the highest risk ages for ST initiation in males are 12 and 18 years old; however, the two age groups differ in use patterns, demographics, and psychosocial factors.	
(Noland et al., 1996)	Relationship of personal tobacco-raising, parental smoking, and other factors to tobacco use among adolescents living in a tobacco-producing region	Cross-sectional survey study N = 3,851 7th-grade students Males Kentucky	Demographic information Tobacco use Use by family or friends	<p><i>Father uses tobacco:</i> Ever used and 30-day use for those who personally raised tobacco > non-tobacco raising homes (ever use = 85.7 vs. 70.8 and 30-day use = 39.7% vs. 22.6%; $p < 0.05$).</p> <p><i>Father does not use ST:</i> Use across all categories in those who personally raised tobacco > do not personally raise tobacco and non-tobacco raising homes (ever use = 66.5% vs. 49.4% and 36.2%; $p < 0.001$).</p>	<p><i>Strengths:</i> Large sample size Unique relationship between tobacco growing and use</p> <p><i>Limitations:</i> Cross-sectional Self-report</p>
				Authors’ findings were that students were at higher risk for tobacco use if one or more parents smoked. Students were at higher risk for tobacco use if they personally raised tobacco. There was a relationship between tobacco-raising and risk for tobacco use regardless of parental smoking patterns. Students who were at highest risk were those who personally raised tobacco and had one or more parents that smoked.	
(Nemeth et al., 2012)	Factors influencing smokeless tobacco use in rural Ohio Appalachia	Cross-sectional focus-group study Adult (N = 63) and adolescent (N = 53) ST users and nonusers Rural Ohio Appalachia	Cultural beliefs Factors influencing ST initiation	Boys emulated or were actively encouraged to use ST through male family and peer networks. Perceived acceptance to peer networks predicated on ST use. Community factors (advertising, marketing and access) reflected, reinforced, and normalized behavior. Adolescents age at tobacco initiation (mean [SD]): 11.7 (2.9) years Adults age at tobacco initiation (mean [SD]): 15.0 (4.0) years.	<p><i>Strengths:</i> Identification of unique subpopulation and cultural norms in that population</p> <p><i>Limitations:</i> Limited geographic representation Sample size Limited data included in paper</p>
(Lee et al., 1994)	Psychosocial factors influencing smokeless tobacco use by teen-age military dependents	Cross-sectional Survey N = 2,257 On-post middle school	Demographics Knowledge of adverse health effects Smoking status Parental and peer approval	Users and triers have more positive attitudes about ST. <i>Trial use: (results shared by males/females [OR; 95% CI = p-value]):</i> <ul style="list-style-type: none"> Parental approval: OR = 2.34; 95% CI = 1.23-4.43, $p = 0.009$/OR = 3.29; 95% CI = 0.99-10.9, $p = 0.052$ 	<p><i>Strengths:</i> Comprehensive scope, included measures of dental health, and difficulty purchasing STs as variables for use</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

		<p>and high school students (Grades 6-12) Kentucky</p> <p>Divided into triers (368) and non-triers (1,879) and Users (57) and Nonusers (2,189) U.S.</p>	<p>Use of ST by relatives</p> <p>Membership on school team</p>	<ul style="list-style-type: none"> • Peer approval: OR = 1.95; 95% CI = 1.39-2.74, $p < 0.0001$/OR = 2.12; 95% CI = 1.07-4.21, $p = 0.030$ • Trying smoking: OR = 7.39; 95% CI = 5.11-10.6, $p < 0.0001$/OR = 8.58; 95% CI = 3.52-20.8, $p < 0.0001$ • Relatives using ST: OR = 2.29; 95% CI = 1.64-3.21, $p < 0.0001$/OR = 2.56; 95% CI = 1.33-4.99, $p = 0.005$ • Athletic team membership: OR = 1.39; 95% CI = 0.98-1.99, $p = 0.063$/ OR = 3.56; 95% CI = 1.82-6.98, $p < 0.0001$ <p>Male trial of ST was also associated with being white, difficulty in purchasing ST, having relatives who smoke, current smoking, and a belief that ST can cause mouth cancer.</p> <p><i>Reasons for initiation (triers/users):</i></p> <ul style="list-style-type: none"> • Friends were using (26.2%/20.8%) • Sports or music stars (3.6%/5.7%) • Experience taste or effects (37.1%/20.8%) • Relatives using (10.6%/9.4%) • Boredom (5.3%/9.4%) • Advertising (1.3%/1.9%) • Other (15.9%/32.1%) 	<p><i>Limitations:</i></p> <p>Cross-sectional</p> <p>Self-report</p>
				<p>Authors’ findings were that parental and peer influences contribute to ST experimentation but not to use, and they also found an association between smoking status and ST trial and use. They reported a relationship between ST trial and use and participation in team sports and that access to ST by adolescents is very easy and a significant variable in male trial use.</p>	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Horn et al., 2000)	Determinants of youth tobacco use in West Virginia: A comparison of smoking and smokeless tobacco use	Cross-sectional survey N = 833 Adolescents Rural West Virginia	Tobacco use Knowledge about tobacco Attitudes Self-perception, school and family problems	<p>6% current ST-only users 10% dual-users <i>Multiple logistic regression in ST users:</i></p> <ul style="list-style-type: none"> ST use among siblings (OR = 4.28; 95% CI = 2.07-8.84, p = 0.0001) Close friends (OR = 1.71; 95% CI = 1.23-2.38, p = 0.0016) Favorable attitudes toward tobacco use (OR = 1.12; 95% CI = 1.05, 1.19, p = 0.0003) <p>Authors’ findings were that sex was the most powerful determinant (but it was removed from the model since most ST users were male), significant determinants of ST use included the two variables related to peer use of the specific tobacco product (i.e., having friends and siblings who use ST) and having favorable attitudes toward tobacco use. Results were similar to the patterns reported for smokers, with the exception of smoking also being related to having family problems.</p>	<p><i>Strengths:</i> Moderate sample size, Relevant at-risk population <i>Limitations:</i> Rural population Low generalizability Simple classification of tobacco use (users vs. nonusers)</p>
(Holman et al., 2013)	Psychological predictors of male smokeless tobacco use initiation and cessation: A 16-year longitudinal study	16-year longitudinal survey study N = 2,468 Males only Baseline data was collected at age 12 years. Follow-up data was collected at age 18 years. Washington State	Theory of Triadic Influence: Parent noncompliance Friend compliance Rebelliousness Thrill-seeking	<p>Of 2468 adolescent males who never tried ST at age 12, 233 (9.4%) reported daily ST use at age 18 <i>Measures at age 12 that were predictive of daily ST use at age 18:</i></p> <ul style="list-style-type: none"> Friend compliance (OR = 2.56; 95% CI = 1.78-3.68, p < 0.001) Rebelliousness (OR = 2.16; 95% CI = 1.46-3.19, p < 0.001) Thrill seeking (OR = 2.33; 95% CI = 1.45-3.75, p < 0.001) <p>Authors’ findings were that scoring highly on friend compliance, rebelliousness, and thrill-seeking at least doubles the odds that an adolescent male will become a daily ST user. Interpretation of the nonsignificant parent noncompliance prediction is that ST use is rarely targeted by parents.</p>	<p><i>Strengths:</i> Longitudinal study Sample size High levels of retention <i>Limitations:</i> Psychological factors included only a few items per factor Self-report Limited generalizability to females and older adults</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Abrams et al., 1999)	Patterns and correlates of tobacco use among suburban Philadelphia 6th-through 12th-grade students	Cross-sectional survey N = 1,549 6th-, 8th-, 10th-, and 12th-grade Philadelphia	Demographics	<p><i>ST Use:</i> 13% of students across grades reported having “ever tried ST”. < 1% of female students in all grades reported currently using ST</p> <p>Ever tried (males/females): Grade 6 = 3.9%/0.9%, Grade 8 = 24.4%/7.8%, Grade 10 = 26.8%/3.6%, Grade 12 = 36.7%/11.5%</p> <p>Current use (males/females): Grade 6 = 3.2%/0.9%, Grade 8 = 5.1%/0%, Grade 10 = 5.1%/0%, Grade 12 = 9.2%/0.7%</p> <p><i>School-related factors (e.g., after school sports, self-report of class standing):</i></p> <ul style="list-style-type: none"> • Students who participation in >3 sports activities were twice as likely to use ST. • 2% of top students and average students vs. 25% of students at the bottom of their class currently use ST. <p>By 12th grade roughly 33% of males vs. 10% of females reported ever trying ST.</p>	<p><i>Strengths:</i> Sample size Use of validated survey</p> <p><i>Limitations:</i> Self-report Cross-sectional Focus of study is on smoking</p>
				<p>Authors’ found that fewer than 1% of females currently use ST compared with 5% of males.</p>	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Creath et al., 1988)	The prevalence of smokeless tobacco use among adolescent male athletes	Cross-sectional survey N = 995 Male football players Alabama	First use	<p><i>Age at initiation:</i></p> <ul style="list-style-type: none"> • <11 years = 12.8% • 11–13 years = 44% • >13 years = 43.2% <p><i>Reason for initiation:</i></p> <ul style="list-style-type: none"> • 59.9% friends use • 9.7% family members use • 4.5% advertisements • 1.4% to quit smoking • 1.4% coaches • 24.6% other <p><i>Household use:</i> 31.4% of users have family members who dipped</p> <p><i>Risk Perception (harmful to health):</i> 93.7% agree; 6.3% disagreed</p> <p>Authors’ findings were that the age at which athletes first tried ST was usually before starting high school, with 56.8% trying it by age 13 years. Author comments on the importance of peer influence in initiating ST use with 59.9% initiating because of friends. Usage of ST by family members has limited value in predicting people at risk for initiating ST use.</p>	<p><i>Strengths:</i> Sample size Cross-section of backgrounds (racial and economical)</p> <p><i>Limitations:</i> Cross-sectional Self-report</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Goebel et al., 2000)	Correlates of youth smokeless tobacco use	Cross-sectional survey N = 808 5th-, 8th-, 11th-grade males West Virginia	ST Use Knowledge of health risks Attitude	<p><i>ST use:</i> Snuff = 43% ever used, 15.5% current use Chew = 34% ever used, 10% current use 7th grade most frequent grade for initiation (57 students snuff, 41 chew; 19% of ever users)</p> <p>10% initiated snuff/chew before 3rd grade.</p> <p><i>Snuff:</i> 31% who initiated before 5th grade are daily users. 6% who initiated in 6th grade or higher are current users.</p> <p><i>Chew:</i> 14% who initiated before 5th grade are daily users. 2% who initiated in 6th grade or higher are current users.</p> <p><i>Correlates of use:</i> <i>Positive Correlations</i></p> <ul style="list-style-type: none"> Family member not living at home uses (3.50; 1.75-7.02) Friend uses (OR = 6.91; 95% CI = 3.12-15.28) Plays football (OR = 2.19; 95% CI = 1.28-3.72) Tried cigarettes (OR = 5.09; 95% CI = 2.85- 9.11) Parents permit use in the home (OR = 4.28; 95% CI = 2.56-7.17) <p><i>Negative Correlations</i></p> <ul style="list-style-type: none"> Higher attitude score (OR = 0.93; 95% CI = 0.90-0.97) Higher knowledge score (OR = 0.94; 95% CI = 0.91-0.98) Plays basketball (OR = 0.38; 95% CI = 0.22-0.66) <p>Authors’ finding were that important differences exist in knowledge and attitudes about ST between users and nonusers. Younger age of initial use is associated with increased likelihood of becoming a regular user.</p>	<p><i>Strengths:</i> Results consistent with larger surveys</p> <p><i>Limitations:</i> Appalachian population, not generalizable. No effort to account for absentees No high school drop-outs included Cross-sectional survey was read aloud to 5th-grade students, possible bias. No biochemical corroboration of ST use</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Dent et al., 1987)	Adolescent smokeless tobacco incidence: Relations with other drugs and psychosocial variables	Longitudinal (one-year follow-up) school-based survey of smoking behavior N = 3,393 8th grade California	Prevalence Predictors of ST onset Psychosocial predictors	<p><i>Prevalence of trying ST:</i> 19% of 8th grade students tried ST 27% of 9th grade students tried ST 8th grade boys 32% > 8th grade girls 7% 9th grade boys 45% > 9th grade girls 12%</p> <p><i>Predictors of ST onset:</i></p> <ul style="list-style-type: none"> Onset probability between Grades 8 and 9 $\chi^2 = 0.11$. Onset greater in regular smokers at 8th grade $\chi^2 = 0.29$, $p < 0.05$. Tried other drugs average $\Phi = 0.139$. Peer norms $\Phi = 0.13$-0.30. <p><i>Psychosocial predictors:</i></p> <ul style="list-style-type: none"> Need for peer acceptance $\Phi = 0.128$ Self-image if smoked $\Phi = 0.114$ Risk taking $\Phi = 0.148$ <p><i>Logistic regression (Model $\chi^2 = 205.32$, $P < 0.001$):</i> Sex, prior experience with cigarettes (regular use), prior use of beer/wine, risk taking</p> <p>Authors’ findings were that adolescents who try ST are those who are willing or enticed to engage in a variety of other drug-related activities.</p>	<p><i>Strengths:</i> Large sample Longitudinal approach</p> <p><i>Limitations:</i> Data obtained primarily from urban youths Items were focused on cigarette smoking not ST use Only one ST item as an outcome variable</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Dignan, Block, Steckler, Howard, & Cosby, 1986)	Locus of control and smokeless tobacco use among adolescents	Cross-sectional survey N = 322 7th grade North Carolina	Use Health behaviors and attitudes	<p><i>ST use:</i> 11.4% users 1.3% daily users 26/37 users (~8%) recent habit (beginning ages: 9-11 years).</p> <p><i>Measures of smoking knowledge, attitudes toward smoking, self-concept and locus of control:</i></p> <ul style="list-style-type: none"> Occasional users were more ‘internally oriented’ than regular users (regular users score= 11.72 vs. occasional users score=13.43; t-test (t statistic not provided), $p < 0.05$) <p>Authors’ findings were that use of ST fits into a paradigm where the behavior is believed to lead to valued reinforcement.</p> <p>Regular users more highly motivated to seek such reinforcement than occasional users. Reinforcement comes from adolescent peer groups.</p>	<p><i>Strengths:</i> Validated scale</p> <p><i>Limitations:</i> Small sample size; minimal methodology and data reported</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Lowe et al., 1988)	Predictors of smokeless tobacco use among students: A preliminary multivariate analysis	Cross-sectional survey N = 1,481 7th and 10th grade Males only Alabama	First use	<p><i>7th grade:</i> <i>Regular users</i></p> <ul style="list-style-type: none"> 71% of 7th grade students tried ST before age of 10 years and were using regularly by ages 10 to 12. <p><i>Nonusers</i></p> <ul style="list-style-type: none"> 31% tried before age 10 years <p><i>10th grade:</i> <i>Regular users</i></p> <ul style="list-style-type: none"> 49% of regular users tried ST before age of 10 years <p><i>Nonusers</i></p> <ul style="list-style-type: none"> 44% of nonusers tried ST before age 10 years <p><i>Multivariate logistic regression to predict use vs.non-use:</i> <i>User vs. non-user (7th and 10th grade combined)</i></p> <ul style="list-style-type: none"> Number of close friends who use (r = 0.257, p = 0.001) Best friends use (r = 0.160, p = 0.001) Brother uses ST (r = 0.098, p = 0.001) Father’s use (r = 0.081, p = 0.001) Mother’s smoking (r = 0.074, p = 0.003) Membership in band/choir (r = - 0.061, p = 0.011) <p>Similar findings were observed when 7th and 10th grades analyzed independently</p> <p>Authors’ findings were that peer influence is the most frequent reason for initiating ST use. Parental role models also play an important role.</p>	<p><i>Strengths:</i> Sample size</p> <p><i>Limitations:</i> No biochemical confirmation of self-report Validity of self-report Limited questionnaire</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Elder et al., 1988)	Predictors of chewing tobacco and cigarette use in a multiethnic public school population	Cross-sectional survey N = 433 6th- and 7th-grade San Diego	Frequency of use Potential predictors: parental smoking peers extracurricular activities Sex	<p><i>Multiple stepwise regression -Predictors of ST experimentation (10% of variance):</i></p> <ul style="list-style-type: none"> • Perception of peers using ST ($r^2 = 0.06$, $p < 0.01$) • Best friend chews ($r^2 = 0.09$, $p < 0.01$) • Sex ($r^2 = 0.10$, $p < 0.01$) <p><i>Multiple stepwise regression -Predictors of ST prevalence of use:</i></p> <p>Some use in the past-year predictor (12% of variance):</p> <ul style="list-style-type: none"> • Perception of peers using ST ($r^2 = 0.05$, $p < 0.01$) • Best friend chews ($r^2 = 0.08$, $p < 0.01$) • Perception of peers smoking ($r^2 = 0.10$, $p < 0.01$) • Sex ($r^2 = 0.12$, $p < 0.01$) <p><i>Past-week use predictors (58% of variance):</i></p> <ul style="list-style-type: none"> • Perception of peers using ST ($r^2 = 0.51$, $p < 0.01$) • Perception of peers smoking ($r^2 = 0.56$, $p < 0.01$) • Father employed ($r^2 = 0.58$, $p < 0.01$) <p><i>Past-day use predictors (39% of variance):</i></p> <ul style="list-style-type: none"> • Perception of peers using ST ($r^2 = 0.33$, $p < 0.01$) • Father employed ($r^2 = 0.37$, $p < 0.01$) • Perception of peers smoking ($r^2 = 0.39$, $p < 0.01$) <p><i>Ethnicity and sex:</i></p> <p>Males > females (experimentation $\chi^2 = 18.0$, $p < 0.01$ and prevalence $\chi^2 = 4.3$, $p < 0.01$)</p> <p>ST experimentation were strongest for white and black students ($\chi^2 = 4.49$ and 6.11, $p < 0.05$, respectively).</p> <p><i>Norm perceptions:</i></p> <p>Perception of classmates smoking and chewing significantly associated with both smoking and chewing experimentation and prevalence.</p> <p>Authors found that psychosocial predictors of norm perception and best friend's tobacco use proved to be more frequently and powerfully associated with both ST and smoking, while socioeconomic variables such as parental marital status and ethnicity also contributed to the prediction.</p>	<p><i>Strengths:</i></p> <p>Number of variables included</p> <p><i>Limitations:</i></p> <p>Small age range</p> <p>Chewing tobacco only, not dipping.</p> <p>Cross-sectional</p> <p>Sample size</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Brubaker et al., 1987)	Parental influence on adolescents’ intention to use smokeless tobacco	Cross-sectional survey N = 106 6th to 9th-grade males non-ST users in a small rural community	Demographics Personal and parental use of ST Intention to use ST in future Parental response to ST use Parental rules prohibiting ST use	<p>Subjects were classified into those who intended to use ST in the next month (26%) and those did not intend to use ST in the next month (75%). Intention to use ST was not related to grade level $\chi^2 = 4.53$, $p > 0.20$. <i>Intention to use ST and anticipated parental response:</i></p> <ul style="list-style-type: none"> Anticipated parental response accounts for 18.5% of variance in intention to use ($r = 0.43$, $p < 0.001$) Compared to non-intenders: <ul style="list-style-type: none"> Intenders < punishment from father or mother (verbal reprimand [$p < 0.02$ for both] or loss of privileges [$p < 0.001$ for both]). Intenders > father or mother would ignore ($p < 0.02$ for both). Intenders > father or mother would be less angry or disappointed ($p < 0.0001$; father less disappointed is $p < 0.001$) Nonintenders > mother more likely to discuss risks ($p < 0.02$). Nonintender > parents more likely to have rules prohibiting use of ST ($p < 0.02$). <p><i>Intention to use ST and parental use:</i></p> <ul style="list-style-type: none"> Father’s use and intention to use ST ($\chi^2 = 11.98$, $p < 0.001$) <p><i>Multiple Regression (26.2% of variance in intention to use):</i></p> <ul style="list-style-type: none"> Anticipated parental punishment ($p < 0.05$) and use of ST by father ($p < 0.01$) were significant predictors of intention to use. <p>Authors’ findings were that parents exert significant influence on adolescent tobacco use. Perceived parental acceptance may create a climate in which experimentation with (and possibly continued use of) ST is likely.</p>	<p><i>Strengths:</i> Focused on intention to use in nonusers; validated questionnaire</p> <p><i>Limitations:</i> Sample not representative Self-report Limited geographic representation</p>
(Agaku et al., 2013)	Use of conventional and novel smokeless tobacco products among US adolescents	Cross-sectional survey N = 18,866 National Youth Tobacco Survey 2011 U.S.	Use Access to ST Perception of harm Exposure to health warning labels Advertising Peer/household pro-tobacco influences	<p><i>Prevalence of use:</i> Overall ST use = 5.6% Use increased with age, lowest among respondents aged 9 to 11 years (2.2%; 95% CI = 0.9%–3.6%) and highest among those aged ≥ 18 years (10.8%; 95% CI = 8.1%–13.5%). Use higher among boys (9.0%; 95% CI = 7.2%–10.7%) compared with girls (2.0%; 95% CI = 1.7%–2.4%) Use higher among high school students (7.7%; 95% CI = 6.2%–9.3%) compared with middle school students</p>	<p><i>Strengths:</i> Nationally representative sample</p> <p><i>Limitations:</i> Recall bias may have resulted in an underreporting of tobacco use. Cross-sectional study design</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				<p>(2.6%; 95% CI = 2.1%–3.1%). current smokeless tobacco Use lowest among non-Hispanic blacks (2.2%; 95% CI = 1.1%–3.4%), highest among non-Hispanic whites (6.7%; 95% CI = 5.3%–8.1%) and non-Hispanic American Indian/Alaska Natives (7.4%; 95% CI = 3.3%–11.6%).</p> <p><i>Factors associated with ST use:</i> Protective factor</p> <ul style="list-style-type: none"> Perceived harm (OR = 0.55; 95% CI = 0.38, 0.79) Exposure to warning labels on ST products was not protective against smokeless tobacco use (aOR 5 2.68; 95% CI: 1.93–3.74) <p><i>Higher risk of use:</i></p> <ul style="list-style-type: none"> Pro-ST peer (OR = 9.56; 95% CI = 7.14,12.80) Household environment (OR = 3.32; 95% CI = 2.23, 4.95) <p>Authors’ found that household member’s continued ST use might be associated with greater odds that the adolescent child may use ST. Protective effects of risk perception of all tobacco products.</p>	
(Walsh et al., 2003)	Spit (smokeless) tobacco intervention for high school athletes: Results after 1 year	Cluster-randomized controlled trial N = 1,084 Varsity baseball players Of 777 baseline ST users, 48% in intervention group; 52% in control group California	Initiation of ST: 1-month and 1-year follow-up	<p>Baseline prevalence of current ST use = 28% ST initiation rate: 11% (95% CI = 9%-13%) No significant effect of intervention .</p> <p><i>Predictors of initiation:</i></p> <ul style="list-style-type: none"> History of and plans for future ST use (OR = 5.98; 95% CI = 2.59-13.8). Belief that “almost all” their teammates used (OR = 4.73; 95% CI = 1.54-14.5). Current smokers (OR = 7.25; 95% CI = 3.07-17.1) <p>Authors’ findings were that the strongest predictor of ST initiation in the control and intervention groups combined was being a current smoker. Moreover, former ST use or perceiving high ST use among teammates also were predictors of ST use initiation.</p>	<p><i>Strengths:</i> Intervention study Sample size Follow-up study <i>Limitations:</i> Self-report</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Tomar & Giovino, 1998)	Incidence and predictors of smokeless tobacco use among US youth	Longitudinal survey N = 7,830 12-18 year olds (baseline and 4-year follow-up) U.S.	Cumulative incidence of experimental use Cumulative incidence of regular use Predictor variables: Sociodemographic Environmental Behavioral Personal	<p>Between baseline to follow-up, 12.7% became experimenters and 4% became regular users. Of those who reported never using ST, 1.7% became regular user at follow-up. Of those who had tried ST at baseline, 17.9% became regular users at follow- up.</p> <p><i>Males Adolescents:</i> Never users to experimenters = 20.9% Never users to regular users = 8% Significantly higher for whites (26.4%) vs. blacks (7.1%) and Hispanics (15.8%)</p> <p><i>Female Adolescents:</i> 6.7% became experimenters</p> <p><i>Predictors of experimentation:</i></p> <ul style="list-style-type: none"> • Rural dwelling (OR = 1.3; 95% CI = 1.0-1.7) • White male with unmarried parents (OR = 1.3; 95% CI = 1.1-1.7) • Perceived use by peers OR = 1.8 95% CI = 0.9-3.6) • Self-reported intention to use OR = 2.7; 95% CI = 1.0-7.4) • Perceived approval or indifference from friends (OR = 1.4; 95% CI = 1.1-1.7) • Discussed serious problems with friends (OR = 1.4; 95% CI = 1.0-1.8) • Engage in risky behavior (OR = 1.5; 95% CI = 1.2-1.9) • Current smoker (OR = 1.7; 95% CI = 1.1-2.8) • Steady girlfriend (OR = 1.3; 95% CI = 1.0-1.6) • Reported truancy from school (OR = 2.0; 95% CI = 1.0-4.1) <p><i>Predictors of regular use:</i></p> <ul style="list-style-type: none"> • 15 to 17 year olds at baseline (OR = 1.7; 95% CI = 1.3-2.2) • South region (OR = 2.2; 95% CI = 1.4- 3.3) • Midwest region (OR = 1.6; 95% CI = 1.0- 2.5) • Use of ST by household (OR = 2.2; 95% CI = 1.5- 3.0) • Perceived use by peers (OR = 2.8; 95% CI = 1.5-5.1) • Smokers at baseline (OR = 1.9; 95% CI = 1.2- 2.9) • Participation in organized sports (OR = 1.4; 95% 	<p>Sample size Longitudinal study</p> <p>Self-reports over telephone Sampling Bias - youths who were followed up were less likely to have reported ST use than those who could not be reinterviewed</p> <p>Did not investigate advertising influences</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				<p>CI = 1.0- 1.9)</p> <ul style="list-style-type: none"> Engage in risky behavior (OR = 1.5; 95% CI = 1.1- 2.0) Reported having ever had a steady girlfriend (OR = 1.8; 95% CI = 1.2- 2.7) Perceived their friends would approve or not care if they used (OR = 1.7; 95% CI = 1.2- 2.2) 	
				<p>Authors’ findings were that experimentation may be a function of personal factors, coupled with a weak family structure or support. In contrast, progression to regular use appears to be partially a function of adult role modeling, peer influences, and sports team membership.</p>	
(Tercyak & Audrain, 2002)	Psychosocial correlates of alternate tobacco product use during early adolescence	Cross-sectional survey N = 1,123 9th-grade students Virginia	Demographics Cigarette smoking Environmental smoking exposure Depression Alternate tobacco use	<p>1.3% reported using chew or snuff (14/1,084) <i>Alternate tobacco users more likely to have the following characteristics:</i></p> <ul style="list-style-type: none"> Male $\chi^2 = 32.04$, $p < 0.05$ White $\chi^2 = 3.90$, $p < 0.05$ Current cigarette smokers $\chi^2 = 254.44$, $p < 0.05$ Exposed to high level of environmental smoking $\chi^2 = 47.46$, $p < 0.05$ High depressive symptoms $\chi^2 = 12.43$, $p < 0.05$ Likely presence of clinically significant depressive symptoms $\chi^2 = 10.57$, $p < 0.05$ <p><i>Logistic regression (controlling for sex, race, and current smoking):</i></p> <ul style="list-style-type: none"> Tobacco exposure (OR = 3.3; 95% CI = 1.6-7.0, 	<p><i>Strengths:</i> Examines both social and psychological correlates <i>Limitations:</i> Cross-sectional Collapsed all alternate tobacco use- not just ST Low parental consent rates</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				<p>p < 0.001)</p> <ul style="list-style-type: none"> Depressive symptoms (OR = 2.0; 95% CI = 1.1-3.6, p = 0.02) 	
				<p>Authors’ found that higher level of exposure to cigarette smoking and elevated depressive symptoms is independently related to using alternate forms of tobacco.</p>	
(Sussman et al., 1990)	Peer-group association and adolescent tobacco use	<p>Cross-sectional survey</p> <p>N = 340 7th grade Southern California</p> <p>N = 615 10th grade Southern California</p>	<p>Identified social group (hot-shot, jock, dirt, skater, regular)</p> <p>Tobacco use (ever tried, current use, future use)</p>	<p><i>Most likely group(s) to use ST:</i> Trial-use: jock (27%); dirt (27%); skater (29%) Current use: skater (16%), dirt (11%) Intend to use in future: skater (13%)</p> <p><i>Activities and values:</i> Skaters more likely to be involved in individual sports (62%) compared to hot-shots, jocks, regulars, or dirts (47%, 44%, 34%, and 19%, respectively)</p> <p>Dirts were more likely to report that members of their group used other drug substances and alcohol, scored higher in risk taking, and were lowest in self-esteem. Dirts and skaters self-reported grade point average was lower than hot-shots and jocks,</p> <p>Authors found that skaters, a distinctive group that are centered-on risky, individual-oriented, outdoor activity were most likely to use ST. Skaters were also less likely to use alcohol, marijuana, or hard drugs.</p>	<p><i>Strengths:</i> Moderate sample size</p> <p><i>Limitations:</i> Group descriptors may result in over-generalization Cross-sectional data.</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Smith et al., 2015)	Psychosocial correlates of smokeless tobacco use among Indiana adolescents	Cross-sectional survey N = 938 Middle and high school students Indiana	Lifetime use of ST (dependent variable) Impulse control Peer approval Mastery of the external world Risk vs. benefit Perceived peer behavior Personal characteristics	<p><i>Participants who reported using ST (9%):</i></p> <ul style="list-style-type: none"> • 1-5 times = 66.7% • 6-19 times = 11.9% • 20+ times = 21.5% • More males ($\chi^2 = 34.12$, $p < 0.001$) • More enrolled in public schools ($\chi^2 = 19.77$, $p < 0.001$) • More with sibling smoker ($\chi^2 = 4.06$, $p = 0.044$) • More compare themselves with others ($\chi^2 = 8.80$, $p = 0.003$) • Enrolled in higher grades: ($t = -4.78$, $p < 0.001$) • Lower scores on Risk Versus Benefit Scale ($t = 4.69$, $p < 0.001$) • Higher Peer Approval Scale scores ($t = -7.55$, $p < 0.001$) • Perceived Peer Behavior Scale scores ($t = -6.27$, $p < 0.001$) <p><i>Logistic regression:</i> <i>Block 1 (personal characteristics)</i> Female participants less likely to have used ST in their lifetime (OR = 0.21, CI = 0.12-0.36, $p < 0.001$). ST users more likely:</p> <ul style="list-style-type: none"> • Public schools (OR = 4.20, CI = 1.46-12.08, $p = 0.008$) • Higher-grade levels (OR = 1.27, CI = 1.08-1.49, $p = 0.004$) • Compared themselves with others (OR = 2.07, CI = 1.27-3.38, $p = 0.003$) <p><i>Block 2 (Personal and interpersonal variables)</i> Female participants less likely (OR = 0.23, CI = 0.13-0.40, $p < 0.001$) ST users more likely:</p> <ul style="list-style-type: none"> • Public schools (OR = 4.35, 1.50-12.61, $p = 0.007$) • Higher-grade levels (OR = 1.28, CI = 1.09-1.51, $p = 0.003$) • Compared themselves with others (OR = 1.82, CI = 1.10-3.01, $p = 0.02$) • Risk Versus Benefit Scale (OR = 0.92, CI = 0.88-0.96, $p < 0.001$) <p><i>Block 3 (Block 1 and Block 2)</i> Female participants (OR = 0.26, CI = 0.14-0.47, $p < 0.001$);</p>	<p><i>Strengths:</i> ST use investigated exclusive of use of cigarettes</p> <p><i>Limitations:</i> Cross-sectional</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				<p>ST users more likely:</p> <ul style="list-style-type: none"> Public schools (OR = 3.83, CI = 1.31-11.15, p = 0.014) Compared themselves with others (OR = 1.74, CI = 1.03-2.95, p = 0.039) Peer Approval Scale, higher (OR = 1.14, CI = 1.08-1.20, p < 0.001) <p>Authors’ findings were that the origins of decisions to initiate and sustain tobacco use are similar to those influencing youth’s decisions to engage in other risky behaviors.</p>	
(Simon, Sussman, Dent, Burton, & Flay, 1993)	Correlates of exclusive or combined use of cigarettes and smokeless tobacco among male adolescents	<p>Cross-sectional survey</p> <p>N = 4,036</p> <p>Junior high school males</p> <p>N = 1,038</p> <p>Senior high school males</p> <p>Southern California</p>	<p>Tobacco use</p> <p>Other drug use</p> <p>Sports participation</p> <p>Trial of alcohol</p> <p>Current use of alcohol</p> <p>Trial of marijuana</p> <p>Risk taking</p> <p>Self-esteem</p> <p>Perceived stress</p> <p>Susceptibility to peer influence</p>	<p>ST users = 3% (Jr. High trial users)</p> <p>Dual users = 14% (Jr. High trial users)</p> <p>Junior high: Trial use = 17%; Monthly use = 4%</p> <p>Senior high: Trial use = 45%; Monthly use = 13%</p> <p>18% of junior high tried ST exclusive of smoking</p> <p>7% of senior high tried exclusive of smoking</p> <p>25% of monthly users were ST users only</p> <p>Most smokers did not use ST</p> <p><i>Predictors of trial use of ST:</i></p> <ul style="list-style-type: none"> Junior high model was significant for all 8 variables (listed in measures column) except sports participation (p < 0.05) Senior high school model was significant for all variables except self-esteem and sports participation (p < 0.05) The scores of triers of cigarettes only or ST only were between the scores of non-triers or triers of both products in most cases. <p><i>Predictors of monthly use of ST:</i></p> <ul style="list-style-type: none"> Junior high model was significant for all 8 variables Senior high school model was significant for all variables except risk-taking, self-esteem and sports participation (p < 0.05). <p>Tobacco use associated with perceived stress and self-esteem only at junior high level, younger users may be more deviant than those who use in high school.</p>	<p><i>Strengths:</i></p> <p>ST use investigated exclusive of use of cigarettes</p> <p>Sample size.</p> <p><i>Limitations:</i></p> <p>Cross-sectional</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Riley et al., 1989)	Typology and correlates of ST use	Cross-sectional survey N = 3,725 Grades 9-12 Richmond, Virginia	Frequency of cigarette use Beliefs concerning harmful effects of tobacco Age at first ST use Frequency and duration of use Source of encouragement to use ST	<p><i>Incidence and correlates of initial use:</i></p> <ul style="list-style-type: none"> • 19.9% report having tried ST (35.5% of males vs. 5.8% of females) • 96.8% of total sample agreed that ST can be harmful to teeth and gums, but, significantly fewer agreed that ST causes mouth cancer (90.2%, $\chi^2 = 13.36$, $p < 0.0001$) • Compared to nonusers, those who tried ST more likely to disagree that smoking causes lung cancer (95.4% vs. 97.4%; $\chi^2 = 7.97$, $p < 0.005$) and ST can be harmful to teeth and gums (93.0% vs. 97.8%; $\chi^2 = 43.60$, $p < 0.0001$) • Strong relationship between more frequent smoking and trying ST ($\chi^2 = 136.2$, $p < 0.0001$). <p><i>Discriminant function analysis for trying ST (sex, age, cigarette use, and agreement with ST health risks as predictor variables of initial use in males, standardized coefficients shown):</i></p> <ul style="list-style-type: none"> • Frequency of cigarette use (0.858) • Disbelief that ST causes teeth and gum problems (0.398) <p><i>First use:</i></p> <ul style="list-style-type: none"> • 44.1% before 13 years • 18.9% before 10 years • 36.4% between 13 and 14 years • 19.6% >15 years • Analysis revealed greater use in those reporting younger age of initiation ($\chi^2 = 61.78$, $p < 0.0001$; $\chi^2 = 72.85$, $p < 0.0001$) • Males more likely to first use ST at a later age than females ($\chi^2 = 25.39$, $p < 0.0001$) <p><i>Encouragement of use:</i></p> <ul style="list-style-type: none"> • 73.1% encouraged by friends • 16% family • 4.8% advertisements • 6.1% substitute for cigarettes • Analysis of frequency of use by type of encouragement found that those using ST >3 times per day more likely to report being influenced by trying quit cigarettes ($\chi^2 = 30.66$, $p < 0.005$). Same relationship observed 	<p><i>Strengths:</i></p> <p>Large sample size Detailed survey Statistical analysis</p> <p><i>Limitations:</i></p> <p>Incidence of initial use lower than previously reported, possibly due to predominant medical influence in the area. Cross-sectional study</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				<p>between type of encouragement and hours of ST use per day ($\chi^2 = 46.22$, $p < 0.0001$).</p> <ul style="list-style-type: none"> Source of encouragement related to age of first ST use ($\chi^2 = 63.92$, $p < 0.0001$), encouragement from friends major factor in those who begin using at older than age 10. 	
				<p>Authors’ found that early initial use associated with greater levels of use. Most adolescents reported being influenced by friends, but those who tried at a very young age were more likely to be influenced by advertising or family. Strong relationship between smoking and ST use, smoking related to probability of initial use and frequency and hours per day. 6% reported using ST to quit smoking.</p>	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Marty et al., 1986)	Prevalence and psychosocial correlates of dipping and chewing behavior in a group of rural high school students	Cross-sectional survey N = 179 High school students Northwest Arkansas	Prevalence/frequency Initiation and reinforcement	<p>31.8% of males reported using ST vs. 2.3% of females 27% of ST users reported occasionally smoking cigarettes 8 of the ST users reported periodically using alcohol <i>Initiation of use: (N = 29 responded):</i> Who/what was the single most significant influence in your decision to begin using ST?</p> <ul style="list-style-type: none"> • Friend: n = 15 (51.7%) • Brother: n = 6 (20.7%) • Parent: n = 4 (13.8%) • Other relative: n = 3 (10.3%) • Coach: n = 1 (3.4%) <p>Reinforcement of use:</p> <ul style="list-style-type: none"> • Father approves or doesn’t care significantly higher in ST users ($\chi^2 = 12.88$, $p < 0.0003$) Nonusers more likely than users to believe that ST has at least a moderate effect on one’s health ($\chi^2 = 9.17$, $p < 0.0025$) <p>Authors’ findings were that a sizeable percentage of young people in the rural setting have exposure to ST. Peer influence is the most prevalent factor in lending to begin using ST.</p>	<p><i>Strengths:</i> Use of a validated survey in a relevant population <i>Limitations:</i> Small sample size; limited generalizability of sample</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(McCarthy et al., 1986)	Smokeless tobacco use among adolescents: Demographic differences, other substance use and psychological correlates	Cross-sectional survey N = 2,926 7th-, 9th-, and 11th-grade students California	Substance use Perceived harmfulness of marijuana Perceived parental attitudes toward drug use Mood state Quality of life	<p><1% of females vs. 5% of males were regular users of ST. <4% females experimented with ST. 16% males experimented with ST.</p> <p><i>Relationship of ST use to attitudes toward other substance use:</i></p> <ul style="list-style-type: none"> • Use of ST less related ($r=0.17$) to perceived danger of marijuana use than was smoking ($r=0.43$). • Smokers who never used ST: showed a negative correlation between smoking and perceived health risks of marijuana • ST users who never smoked: showed a curvilinear relationship between ST and perceived harm of marijuana, ST use most likely if marijuana is seen as only moderately harmful. <p><i>Perceived parental attitudes toward drug use:</i></p> <ul style="list-style-type: none"> • Parents’ level of approval of child’s use of marijuana positively related to ST use ($r = 0.14$) and smoking ($r = 0.25$) <p>Authors’ found that respondent’s satisfaction with his or her relationships with friends, family, and school and satisfaction with his or her social emotional skills were negatively related to ST use.</p>	<p><i>Strengths:</i> Sample size Three age groups</p> <p><i>Limitations:</i> Cross-sectional Self-report</p>
(LeMaster, Connell, Mitchell, & Manson, 2002)	Tobacco use among American Indian adolescents: Protective and risk factors	Cross-sectional Survey N = 2390 Grades 9-12 American Indian Voices of Indian Teens Project U.S.	Demographics Protective factors Ethnic identity Risk factors Problem Health Behavior	<p>Prevalence: 21% reported ST use</p> <p>Predictors of ST use (logistic regression models):</p> <ul style="list-style-type: none"> • Sex (OR = 0.45, CI = 0.34-0.61, $p = 0.01$) • Death/Loss stressful life events (OR = 1.31, CI = 1.14-1.49, $p = 0.01$) • Substance abuse by important adults (Past use OR = 1.60, CI = 1.00-2.56, $p = 0.05$ and present use OR = 1.75, CI = 1.25-2.45, $p = 0.01$) <p>None of the protective factors were related to ST use.</p> <p>Authors’ found that adolescents who had experienced more death/loss and other stressful life events were more likely to engage in use of both cigarettes and ST than were those who had experienced fewer stressful life events.</p>	<p><i>Strengths:</i> Large sample Replication design</p> <p><i>Limitations:</i> Cross-sectional Self-report Did not include all possible constructs Sample may not be generalizable to all American Indian adolescents</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Gansky et al., 2009)	Patterns and correlates of spit tobacco use among high school males in rural California	Cross-sectional survey study N = 4,731 Male high school students Rural California	Demographics Tobacco use Frequency of use Duration of use Age of initiation	<p><i>Prevalence:</i></p> <ul style="list-style-type: none"> Overall prevalence of ST use was 9.8% 5.1% for freshman increasing to 15.2% of seniors (OR = 3.35, CI = 2.26-4.96) 32% of smokers also used ST compared to 4.8% non-smokers (OR= 8.55, CI = 6.44-11.4) 26% of ST users thought no or slight risk of harm with ST use (OR= 4.09, CI = 2.88-5.80) <p><i>Age of Initiation:</i></p> <ul style="list-style-type: none"> Significant difference in mean age first tried by level of use ($p < 0.001$): Low use (Used ST in past 30 days but not in prior week): 12.8 years Moderate use (Used ST on 1 to 4 days of the past week): 13.0 years Heavy use (Used ST on 5 to 7 days of the past week): 10.4 years <p><i>Age began using regularly:</i></p> <ul style="list-style-type: none"> Significant difference in mean age began using regularly by level of use ($p = 0.002$): Low use: 13.5 years Moderate use: 14.5 years Heavy use: 12.7 years <p>Authors found that ST use increased with year in school and recommended early intervention. Also focused on dental health practitioners addressing high school male subgroups in rural areas that are at risk for ST-associated adverse health effects.</p>	<p><i>Strengths:</i></p> <p>Sample size Statistical analysis 4 year study</p> <p><i>Limitations:</i></p> <p>Potential bias because student participation rate was low (50.4%) and total school participation rate low (28%)</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(de Moor et al., 1994)	Patterns and correlates of smoking and smokeless tobacco use among continuation high school students	Cross-sectional questionnaire N = 619 Students attending continuation high schools San Diego County	Current Use	22.3% of respondents reported ever having tried ST Males > females ($\chi^2 = 14.92$, $p < 0.001$)	<i>Strengths:</i> Population unique (continuing education) <i>Limitations:</i> Independent study students were not survey- sample of students may be at highest risk. Single administration of questionnaire resulted in a high degree of missing data due to absenteeism. No biochemical validation of self-reported use was obtained. Low number of respondents who admitted using ST
			Age at first use	<i>Mean age of first use:</i> Ever users: 12.2 years (SD = 2.7, range = 4 to 18) Monthly users: 12.3 years (SD = 2.5 range = 8 to 17)	
			Household use	<i>Household use:</i> 5.2% of all respondents indicated that adult (s) in the home used ST.	
			Friend’s use	<i>Friends use:</i> 25.7% indicated that their friends used ST.	
				<i>Predictors of monthly ST use (Stepwise logistic regression):</i> <ul style="list-style-type: none"> • Friends use (OR= 13.2, CI = 5.1-34.1, $p < 0.001$) • Sex (OR = 0.1, CI = 0.0-0.3, $p < 0.001$) • Weekly alcohol use (OR = 3.9, CI = 1.6-9.4, $p < 0.01$) • School plans (OR = 2.9, CI = 1.3-6.8, $p < 0.01$) • Adult’s in-home use(OR = 4.2, CI = 1.4-12.9, $p < 0.05$) 	
				Author’s found that the covert nature of ST use is not associated with the same negative social meaning as other substances, this may explain why it has not become a preferred substance among the highest-risk deviancy-prone students.	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

<i>Young Adults</i>					
(Vander Weg et al., 2005)	Prevalence and correlates of lifetime smokeless tobacco use in female military recruits	Cross-sectional survey N = 9,087 Female military recruits U.S.	Demographics Tobacco use history Risk factors Health risk behaviors	<p><i>Demographics:</i> Mean age = 20.2 years (SD = 2.6) 45% ethnic/racial minorities 30% annual household income ≤ US\$25,000 30.4% smokers</p> <p><i>Prevalence of ST use:</i></p> <ul style="list-style-type: none"> • Current ST use, n = 34 (0.4%) • Former users, n = 21 (0.2%) • Experimental use, n = 599 (6.6%) <p><i>ST use by geographic region:</i> Lifetime ST use varied according to geographic region ($\chi^2 = 35.44$, $p < 0.001$)</p> <ul style="list-style-type: none"> • Midwest 42/327 (12.8%) • West 33/358 (9.2%) • Northeast 16/216 (7.4%) • South 27/788 (3.4%) <p><i>Multivariate correlates of lifetime ST use:</i> Relative to whites less likely:</p> <ul style="list-style-type: none"> • African Americans (OR = 0.09; 95% CI = 0.05-0.16, $p < 0.001$), • Hispanics (OR = 0.51; 95%CI = 0.35-0.73, $p < 0.001$) • Asians or Pacific Islanders (OR = 0.27; 95% CI = 0.13-0.56 $p < 0.001$) • Other ethnic group (OR = 0.60; 95% CI = 0.36-1.00 $p = 0.048$) • Native American <i>more</i> likely (OR = 2.02; 95% CI = 1.12-3.63, $p = 0.019$) <p>High school or GED vs. some college more likely (OR = 1.26; 95% CI = 1.03-1.55) $p = 0.025$ Frequency of bad verbal arguments (at least once a week: OR = 1.71; 95% CI = 1.18-2.48, $p = 0.005$ and Once a month: OR = 1.39; 95% CI = 1.05-1.85, $p = 0.024$) Frequency of road rage (at least once a week: OR = 1.48; 95% CI = 1.06-2.06, $p = 0.021$ and Less than once a month: OR = 1.28; 95% CI = 1.04-1.58, $p = 0.022$) Frequency of alcohol consumption (daily drinkers:</p>	<p><i>Strengths:</i> One of few studies to investigate ST use in females Large sample of young adult females</p> <p><i>Limitations:</i> Only military recruits (generalizability) Self-report Did not include factors previously associated with ST use (e.g., sports), correlates based on lifetime history not current use No differentiation between different types of ST</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				<p>OR = 1.71; 95% CI = 1.03-2.82, p = 0.037 and Once a week: OR = 1.35; 95% CI = 1.00-1.81, p = 0.047 and 2-4 times a month: OR = 1.59; 95% CI = 1.25-2.02, p < 0.001 and once a month: OR = 1.31; 95% CI = 1.00-1.72, p = 0.05) Cigarette smoking status (regular smoker: OR = 3.80; 95% CI = 2.42-5.94, p < 0.001 and former smoker: OR = 3.06; 95% CI = 1.84-5.08, p < 0.001 and experimental smoker: OR = 3.10; 95% CI = 1.98-4.87, p < 0.001)</p>	
				<p>Authors’ found that current ST use was uncommon in female military recruits; less than 1% report daily or occasional use. Female recruits who have ever used ST also engaged in a variety of other risk-taking and harmful behaviors, following a pattern similar to that observed among male ST users.</p>	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Hannam, 1997)	Smokeless tobacco use among big ten wrestlers and selected associated factors	Cross-sectional survey N = 234 Big Ten Athletic Conference Wrestlers	Age of initiation	<p>27.8% of sample were current ST users Mean age of initiation of ST use: 13.6 years Coaches use ST: 32.8% Attempted to quit in the past year: 53% Intend to try to quit: 42.9% No intention to quit: 34.9% <i>Variables that discriminate ST users and non-users (structured coefficient loadings):</i></p> <ul style="list-style-type: none"> • Having smoked cigarettes (0.59) • Free ST sample (0.49) • Alcohol consumption (0.37) <p>Author found that three variables (prior cigarette smoking, receiving a free ST sample, and alcohol consumption) were strong discriminators of ST use. Similar to prior ST studies, ST use by peers was a moderately good indicator of ST use.</p>	<p><i>Strengths:</i> Unique population Validated survey <i>Limitations:</i> Generalizability of sample Limited biochemical validation of use</p>
(Boyle et al., 1998)	Use of smokeless tobacco by young adult females	Cross-sectional survey (with interview) N = 20 Females aged 19-39 years Minneapolis/St. Paul	Demographics Initiation and pattern of ST use First use of ST Physical reactions Perception of health risks Advantages of using ST	<p><i>First use of ST:</i> Mean age of first use was 17.6 years of age (SD = 5.9) 80% were with friends at first use; 10% with relatives; 10% with team mates <i>Reasons for trying:</i></p> <ul style="list-style-type: none"> • 40% curiosity • 40% expectations from friends • 25% switching to ST to help quit smoking <p><i>Physical reactions:</i></p> <ul style="list-style-type: none"> • 45% nausea/vomiting • 35% buzz/high • 30% light-headed/dizzy <p><i>Perceptions of health risks:</i></p> <ul style="list-style-type: none"> • 75% cancer • 30% gum disease • 30% tooth loss <p>Authors’ found that reported reactions, such as nausea, dizziness, and getting a high correspond to the range of responses reported to first cigarette experience.</p>	<p><i>Strengths:</i> Female ST users <i>Limitations:</i> Descriptive study Relatively small sample size and recruited from small urban area in the Midwest</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Glover, Laflin, & Edwards, 1989)	Age of initiation and switching patterns between smokeless tobacco and cigarettes among college students in the United States	National collegiate cross-sectional survey N = 2,888 males N = 3,006 females U.S.	Demographics Age of initiation	<p>Overall prevalence of ST use = 12% Male ST users (22%) > female ST users (2%) Age of initiation did not vary by tobacco type. Age of initiation of tobacco use and currently using ST:</p> <ul style="list-style-type: none"> • 10 years old or younger: 61% • 10-12 years old: 71% • 13-15 years old: 91% • 15 years old or older: 90% <p>Authors’ found that those who initiated cigarette smoking at an early age were less likely to be current users than early age initiators of ST.</p> <p>Those using ST before the age of 13 years were proportionately more likely to be current smokers than those who did so at a later age.</p>	<p><i>Strengths:</i> Representativeness of sample</p> <p><i>Limitations:</i> Self-report Cross-sectional</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Foreyt et al., 1993)	Psychological profile of college students who use smokeless tobacco	Self-report questionnaire N = 1,991 Undergraduate students Texas	Prevalence of ST use	<i>Prevalence of ST use:</i> <i>Sex</i> <ul style="list-style-type: none"> ST use related to sex ($\chi^2 = 133.49$, $p < 0.001$) female <1%; males 17% 6.1% males dual users <i>Ethnicity</i> <ul style="list-style-type: none"> Tobacco use related to ethnicity ($\chi^2 = 32.96$, $p < 0.01$) 21% white 10.4% black 5.4% Hispanic 5.4% other 	<i>Strengths:</i> Large sample size <i>Limitations:</i> Concern about generalizability to other populations Limited female ST users
			Reasons for beginning use of ST	<i>Top 3 Reasons for initiation:</i> <ul style="list-style-type: none"> See if I would enjoy it, 59.7% Most friends use it, 46.6% Try something new, 45% 	
			Personality factors	<i>Personality Factors:</i> <i>Extraversion scores (Mean [SD])</i> <ul style="list-style-type: none"> Nonsmokers 13.0 (3.9) Smokers 12.8 (3.2) ST users = 14.4 (3.1) Significant difference between tobacco use group ($F = 6.75$, $p < 0.01$) <i>Neuroticism</i> <ul style="list-style-type: none"> Nonsmokers = 10.3 (4.8) Smokers = 11.8 (4.8) ST users = 11.3 (6.4) Significant difference between tobacco use group ($F = 5.34$, $p < 0.01$) <i>State anxiety</i> <ul style="list-style-type: none"> Nonsmokers = 39.9 (10.0) Smokers = 40.8 (10.4) ST users = 37.3 (9.6) Significant difference between tobacco use group ($F = 3.82$, $p < 0.05$) 	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				<i>Trait Anxiety</i> <ul style="list-style-type: none"> • Nonsmokers = 41.3 (8.8) • Smokers = 42.3 (8.9) • ST users= 39.1 (8.5) • Significant difference between tobacco use group (F = 3.90, p < 0.05) 	
				Authors’ found that the college student most likely to be an ST user was a white male who scored higher on extraversion and neuroticism but lower on state anxiety than nonusers.	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Ebbert et al., 2006)	Predictors of smokeless tobacco initiation in a young adult military cohort	Prospective survey study (12-month follow-up) N = 28,229 Recruits reporting that they had never used ST regularly prior to entering the military. U.S.	<p><i>Baseline:</i> Demographics Tobacco use history Potential risk factors for tobacco use Health risk behaviors <i>12 month follow-up:</i> Tobacco abstinence, initiation</p>	<p><i>Baseline results:</i> 81.5% of subjects never used ST 18.5% of subjects experimental users Compared to never users, experimental users were significantly more likely to be:</p> <ul style="list-style-type: none"> • 91.3% vs. 68.2% male • 85.7% vs. 54.9% white • 54.6% vs. 24.3% current cigarette smoker • 10.2% vs. 6.4% past cigarette smokers <p><i>Rates of initiation at 12-month follow-up:</i> <i>Baseline never users</i></p> <ul style="list-style-type: none"> • 3.9% reported any use of ST • 1.5% reported current use of ST • 1.2% reported daily use • Males > females for all rates of use <p><i>Baseline experimental users</i></p> <ul style="list-style-type: none"> • 19.3% reported any use of ST • 8.3% reported current use • 6.5% reported daily use • Males > females for all rates of use <p><i>Predictors of any ST use at 12 month follow-up:</i></p> <ul style="list-style-type: none"> • Younger age (p < 0.01) • White (p < 0.001) • Marital status - Single (p = 0.029) • Past ST use (p < 0.001) • Smoking status (p < 0.001) • Risk-taking (p = 0.004) <p>Smokers at baseline were four times more likely to initiate ST at one year follow-up.</p>	<p><i>Strengths:</i> Prospective design Large sample size Ability to report on daily use Study population of adult ST users.</p> <p><i>Limitations:</i> Retrospective tobacco use questions (recall validity) No assessment of illicit drug use Did not separate out Native Americans Self-report Small number of females</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				Authors’ found that the strongest predictor of any or daily ST use at a 1-year follow-up among males is baseline current cigarette smoking. Among females, prior ST experimentation was the only predictor for any ST use at follow-up.	
(Walsh et al., 1994)	Prevalence, patterns, and correlates of spit tobacco use in a college athlete population	Cross-sectional survey N = 1,328 Varsity athletes including football and baseball players California	Patterns of ST use Age of initiation (age of regular ST use more than once a month and not first experimentation)	<p><i>Prevalence of ST use:</i></p> <ul style="list-style-type: none"> • 53% never used ST • 11% formerly used ST • 36% currently use ST: <ul style="list-style-type: none"> ○ 71% daily users ○ 29% more than once/week < once/day <p><i>Ethnicity</i></p> <ul style="list-style-type: none"> • Whites (43.8%) • Native Americans (48.3%) • Asians (33.3%) • Hispanics (33.0%) • African Americans (10.9%) <p><i>Sport</i> 52.6% baseball vs. 26.6% football (OR = 2.44; 95% CI = 1.90-3.12)</p> <p><i>Smoking status</i></p> <ul style="list-style-type: none"> • Prevalence of ST use higher in current and former smokers higher (54%) vs. in non-smokers (34%), $p < 0.001$. <p><i>Use of alcohol (Wilcoxon, $p < 0.001$)</i></p> <ul style="list-style-type: none"> • <8 drinks per week (OR = 5.4; 95% CI = 3.2-9.3) • 8-14 drinks per week (OR = 10.4; 95% CI = 5.9-18.2) • >14 drinks per week (OR = 12.8; 95% CI = 7.1-22.7) <p><i>Age at first use:</i> <i>Baseball players began by 17 years of age:</i></p> <ul style="list-style-type: none"> • White: 34.6% (95% CI = 29.5-40.3) • African Americans: 16.8% (95% CI = 6.7-39.0) <p><i>Football players began by 17 years of age:</i></p> <ul style="list-style-type: none"> • White: 36.8% (95% CI = 32.4-41.5) • African Americans: 6.4% (3.8-10.6) 	<p><i>Strengths:</i> Large sample size</p> <p><i>Limitations:</i> Cross-sectional Self-report</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

				<p><i>Reason for initiation:</i></p> <ul style="list-style-type: none"> • 50% friends offered • 16% through sports • 28% when started playing baseball • 4% when started playing football <p><i>Duration of ST use:</i></p> <ul style="list-style-type: none"> • >50% used for 3 years or less • 23% for >5 years <p><i>Top 3 reasons for ST use:</i></p> <ul style="list-style-type: none"> • Taste • Stress relief • Strong cravings 	
				<p>Authors’ found that more than a fourth of the baseball players reported initiation when they started playing baseball, and more than half reported their use was greater during the baseball season and while on the field (i.e., while playing).</p>	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Dunn, 2014)	Association between physical activity and substance use behaviors among high school students participating in the 2009 Youth Risk Behavior Survey	Cross-sectional survey Data derived from the Youth Risk Behavior Survey 2009 (CDC) N = 16,343 U.S.	Past 30-day ST use	<p><i>Prevalence</i> 15% of males and 2.2% of females reported past 30 day use.</p> <p><i>Level of recreational physical activity to ST use:</i></p> <ul style="list-style-type: none"> No relationship to ST use <p><i>Enrolled in Physical Education class:</i></p> <ul style="list-style-type: none"> Males enrolled more likely to have ever used ST compared to males who are not enrolled <ul style="list-style-type: none"> 1-3 days of class (OR=0.80; 95% CI 0.68-0.93, $p < 0.05$) <p><i>Participate in teams:</i></p> <ul style="list-style-type: none"> Males who participate in 2 or more teams are more likely to have used ST compared to males who do not participate in any teams (OR=0.80; 95% CI 0.69-0.92, $p < 0.05$) <p>Authors’ found that use of ST increased with greater activity, possibly as a result of the athletes wanting to preserve their cardiovascular health, i.e., chose to use ST vs. smoking.</p>	<p><i>Strengths:</i> Large sample size Well-controlled, measures show good test-retest reliability</p> <p><i>Limitations:</i> Cross-sectional study Temporality of associations cannot be determined Self-report</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Everett et al., 1998)	Other substance use among high school students who use tobacco	<p>Cross-sectional survey</p> <p>Data derived from the National Youth Risk Behavior Survey</p> <p>N = 10,904 U.S.</p>	<p>Current ST use</p> <p>Frequency of current use</p> <p>Dual Use</p> <p>Substance use behaviors</p>	<p><i>Prevalence of current tobacco use:</i></p> <p>No current tobacco use = 62.2%</p> <p>Current ST user = 3.1%</p> <p>Dual user (cigarettes and ST) = 7.7%</p> <p><i>ST users (not dual users) vs. nonusers (lifetime)</i></p> <ul style="list-style-type: none"> Cocaine = 4.7% vs. 2.2% (not significantly different) Inhalants = 26.8% vs. 11.7% Illegal substances = 14.2% vs. 5.2% (not significantly different) Multiple substances = 22.2% vs. 8.4% <p><i>ST users(not dual users) vs. nonusers (current)</i></p> <ul style="list-style-type: none"> Alcohol use = 71.1% vs. 32.9% Episodic heavy drinking = 50.5% vs. 15.3% Marijuana = 20.6% vs. 9.3% Cocaine = 2.7% vs. 0.5% (not significantly different) <p>Authors’ found that current cigarette smokers were significantly more likely than current smokeless tobacco users and non-tobacco users to report lifetime use of cocaine, other illegal substances, and multiple substances, and current marijuana use.</p>	<p><i>Strengths:</i></p> <p>Differentiation between types of tobacco use</p> <p><i>Limitations:</i></p> <p>No temporal relationship identified</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

Adults					
(Vander Weg et al., 2011)	Tobacco use and exposure in rural areas: Findings from the Behavioral Risk Factor Surveillance System	Cross-sectional survey N = 355,710 (2006) N = 414,509 (2008) Nationally representative sample of U.S adults	Place of residence Tobacco use Exposure to cigarette smoke	<i>Rural dwelling participants more likely to be:</i> <ul style="list-style-type: none">Lifetime users: 21.7% vs. 17.9% (suburban) and 13.8% (urban)Current users: 5.9% (rural); 3.6% (suburban); 2.2% (urban), p<0.001) <i>Multivariate regression:</i> <ul style="list-style-type: none">The odds of lifetime ST use among those from suburban (OR = 0.716; 95% CI = 0.642–0.799) and urban areas (OR = 0.588; 95% CI = 0.523–0.660) were significantly lower than for those from rural locations.The odds of current ST use were 41% lower for those living in suburban vs. rural locations (OR = 0.591; 95% CI = 0.480–0.727), and 58% lower for those residing in urban areas (OR = 0.419; 95% CI = 0.323–0.543).	<i>Strengths:</i> Large, nationally representative sample Multiple types of tobacco use <i>Limitations:</i> Self-report Items used to assess current tobacco use did not include a reference period response rates (sampling bias) Certain items only administered in a subset of states and U.S. territories Classification of place of residence was crude
				Authors’ found that in rural communities, there was a greater prevalence of sociodemographic characteristics traditionally associated with tobacco use: lower income, lower education.	

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Spangler et al., 1997)	Correlates of tobacco use among Native American women in Western North Carolina	Cross-sectional Survey N = 614 Cherokee women Western North Carolina	Ever used Current Former Never used Age of initiation Health Status Smoking Status	<p><i>Prevalence of ST use:</i></p> <ul style="list-style-type: none"> • Current use = 50/614 (8%) • Former use = 154/614 (25%) • Never used = 410/614 (67%) • Age at onset of ST use = 11 years (interquartile range 8 to 15 years) • Median duration of use = 31 years <p><i>Highest prevalence of current ST use:</i></p> <ul style="list-style-type: none"> • >65 years (18.5%) • <12 years of education (13%) • <\$10,999 USD household earning (12%) • Never married (15%) • Not participated in social groups (11.9%) • Consulted Indian healer (12.6%) <p><i>Logistic Regression predictors of current ST use:</i></p> <ul style="list-style-type: none"> • <12 years of education (13%); OR = 4.99; 95% CI = 2.00, 12.4 • Consulted Indian healer (OR = 2.73; 95% CI = 1.48, 5.04) <p>Authors’ found that the prevalence of ST use in Eastern Band Cherokee women is 6 times higher than general population. 1/3 of sample were dual-users. ST use highest among oldest groups and those with lowest level of education.</p>	<p><i>Strengths:</i> Sample size</p> <p><i>Limitations</i> Cross-sectional Adults asked to remember ST use in childhood Age at smoking initiation not recorded so difficult to determine whether ST use preceded smoking</p>
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Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

(Severson, Eakin, Lichtenstein, & Stevens, 1990)	The inside scoop on the stuff called snuff: An interview study of 94 adult male ST users	Descriptive study N = 94 18-79 years Oregon	Current use of ST and cigarettes Perceptions of health risks Current health problems related to ST Interaction with health care providers Use of other drugs	<p><i>Prevalence:</i> 89% used snuff 11% used chew 28% current smokers 8% smoked cigars 4% smoked pipes</p> <p><i>Snuff users:</i></p> <ul style="list-style-type: none"> • 30% smokers • 33% ex-smokers • 37% never smokers • 55% reported smoking and using snuff concurrently (average number of years of dual use 6.6 years [SD = 8.8]). <p><i>Initiation of snuff use:</i></p> <ul style="list-style-type: none"> • Range: 4-48 years (mean = 16.7 years; SD = 6.8) • Onset of regular (daily) use = 20 years (SD = 7.5) • Significant difference in onset age in <25 years old vs. >25 year olds, <25 years olds started ST at a younger age (15 years vs. 24 years, $p < 0.001$) <p>Authors’ found that almost 60% of snuff users in this sample were under age 30, consistent with reports of an emerging population of young snuff users</p>	<p><i>Strengths:</i> At the time first descriptive report of ST users</p> <p><i>Limitations:</i> Convenience sample Small sample size</p>
(Schmitt, Prescott, Gardner, Neale, & Kendler, 2005)	The differential heritability of regular tobacco use based on method of administration	<p>Survey study</p> <p>Data derived from the Virginia Adult Twin Study of Psychiatric and Substance Use Disorders</p> <p>N = 763 monozygotic male N = 554 dizygotic male Virginia</p>	<p>Ever used</p> <p>Regular use</p> <p>Amount used per day</p>	<p><i>Regular use of ST:</i></p> <ul style="list-style-type: none"> • 11.3% monozygotic • 10.4% dizygotic <p>ST use showed a strong heritable component ($\chi^2 = 4.38$, $p = 0.0363$)</p> <p>Authors’ found evidence that liability to use all tobacco forms measured was modestly influenced by that environment shared by twins.</p>	<p><i>Strengths:</i> Twin study</p> <p><i>Limitations:</i> Low prevalence of certain types of tobacco use Sample size</p>
(Gillum, Obisesan, & Jarrett, 2009)	Smokeless tobacco use and religiousness	Third National Health and Nutrition Examination Survey, 1988-1994	<p><i>Self-reported ST use:</i> Have you ever used chewing tobacco or snuff? At what age did you first start</p>	<p><i>Age of initiation:</i></p> <ul style="list-style-type: none"> • Median age started using: 17 years (Interquartile range= 14-24 years) <ul style="list-style-type: none"> ○ 90% started by age 38 	<p><i>Strengths:</i> Representativeness of the sample Use of sample weights provides generalizability</p>

Table 7.5.3–1-1. Literature Evaluating Initiation of ST (continued)

		N = 9,374 males only U.S.	using chewing tobacco or snuff fairly regularly? Do you use chewing tobacco or snuff now?	<ul style="list-style-type: none"> ○ 5% started by age 10 <p><i>Current ST users:</i></p> <ul style="list-style-type: none"> • Chewing tobacco (53%) • Snuff (40%) • Both (7%) • Current smokers = 28% • Former smokers = 41% <p><i>Current use of ST in infrequent attenders vs. frequent attenders of religious services by age in men:</i></p> <ul style="list-style-type: none"> • 17-29 years (n = 2,385): OR = 2.14; 95% CI = 1.18-3.87 • 30-59 years (n = 3885): OR = 1.41 95% CI = 0.78- 2.54 • ≥60 years (n = 3104): OR = 1.07 95% CI = 0.74-1.54 <p>In this national sample of American men aged 17 years and over, Authors’ found that ST use was much less prevalent among frequent attenders of religious services than among infrequent or never attenders independent of age, ethnicity, sex, and other confounders.</p>	<i>Limitations:</i> Possible bias from survey nonresponse and missing values for some variables Possible confounding by variables
(Hermes Eric et al., 2012)	Smokeless tobacco use related to military deployment, cigarettes and mental health symptoms in a large, prospective cohort study among US service members	<p>Prospective cohort, self-reported survey data</p> <p>Data derived from Millennium Cohort Study</p> <p>N = 45,272 Participants completing both baseline and follow-up U.S.</p>	<p><i>Self-reported ST initiation and persistence:</i></p> <p>Newly reported ST use among participants who reported no use at baseline</p> <p>Persistent ST use among participants who reported using ST at baseline</p>	<p><i>Self-reported ST initiation greatest for:</i></p> <ul style="list-style-type: none"> • Deployers with combat exposure (OR = 1.76; 95% CI = 1.49–2.09) • Deployers without combat exposure (OR = 1.31; 95% CI = 1.07–1.60) • Deployed multiple times (OR = 1.67; 95% CI = 1.31–2.14) • Smoking recidivists/initiators (OR = 4.65; 95% CI = 3.82–5.66) • Posttraumatic stress disorder symptoms (OR = 1.54; 95% CI = 1.15–2.07) <p>Authors’ found that deployment and combat exposure in the U.S. military are associated with increased risk of ST initiation and persistence while smoking and symptoms of posttraumatic stress disorder increase the odds for initiation.</p>	<p><i>Strengths:</i></p> <p>Large sample size</p> <p>First study to investigate these relationships</p> <p><i>Limitations:</i></p> <p>Stratified sampling design (sampling bias)</p> <p>Subjects with missing data were removed form analysis</p>

7.5.3-1.2.The Likelihood that Nonusers Who Adopt the Tobacco Product Will Switch to Other Tobacco Products That Present Higher Levels of Individual Health Risk

7.5.3-1.2.1. Overview

This section addresses ST product’s effect on tobacco use behavior, specific to the likelihood that nonusers who adopt the product will switch to other tobacco products that present higher levels of individual health risk. In the literature, this topic is often referred to as “gateway” to higher-risk tobacco products, specifically to smoking cigarettes. To examine the issue of ST products being a gateway to subsequent cigarette smoking, studies conducted among U.S. tobacco consumer cohorts that illustrate the breadth of issues and ongoing debate about use of ST as a possible gateway to eventual cigarette smoking were reviewed. Studies that measured tobacco use and assessed multiple risk factors across a variety of age groups were included because they are thought to provide the most useful information about the risk of ST as a gateway product. Although an extensive literature search was conducted, to the best of our knowledge, no single study in the literature reviewed focused on *causality*, which is central to the examination of any possible effect of ST use on subsequent cigarette smoking.

The studies reviewed included a variety of survey tools and techniques to collect tobacco use data from a distribution of age groups, including adolescents, young adults, and adults. A variety of research methods was employed, from small focus groups with personalized discussions to online surveys with specific questions to gather information on tobacco use. Some investigations focused on specific, at-risk groups such as military personnel or students in middle school, high school, or college, while others used nationally representative samples gleaned from large national health and behavior surveys.

The available literature related to a possible gateway effect for ST use leading to cigarette smoking is associated with several common limitations. First, most of the studies reviewed used data collected from retrospective surveys of tobacco use. Since these retrospective surveys rely on the participants self-reports of tobacco, sometimes requiring recall of past behavior over several years, there is a greater possibility of recall bias. Second, most studies did not include biological confirmation of tobacco use (e.g., blood nicotine), quantitative measurements of ST product or cigarette use, or list specific products either by brand name or type. Lastly, very few studies reported a large sampling of females since ST use in the United States is primarily an activity among males. We also noted variation between the studies in the designation of a participant as a tobacco user (e.g., 100 cigarettes smoked in a lifetime, use during past 30 days, or ever). Sometimes, those definitions changed, even within a longitudinal study time frame, because surveys modified their participant criteria. Notwithstanding the limitations noted above, the volume and quality of survey information available are sufficiently robust to address the question raised by the Food and Drug Administration in the MRTPA Draft Guidance about the possibility of switching to a more risky tobacco product i.e. cigarette smoking.

Overall, the prevalence of smoking has been found to be greater among ST users; however, based on the existing literature (primarily cross-sectional studies), the evidence is inadequate

to infer the presence or absence of a causal relationship between ST use and subsequent smoking.

7.5.3-1.2.2. Literature Review Results

The literature search yielded 23 publications. Participants in these studies included adolescents, young adults, and adult males and females. The number of participants evaluated in these studies ranged from as few as 191 (Ary et al., 1989) to as many as 33,649 (Rodu & Cole, 2010).

7.5.3-1.2.3. Longitudinal Studies

There is ongoing debate within the literature among those who report that ST use may serve as a gateway for nonusers of tobacco to transition from ST to higher-risk tobacco products, specifically cigarette smoking, and those who do not feel that sufficient evidence exists for such an association. This section summarizes the existing longitudinal data evaluating the potential of ST as a gateway to cigarette smoking.

In a 9-month survey of adolescents, Ary et al. (1987) found that males who had used ST in the previous 6 months but were not currently using other drug substances were at an increased risk to begin use of those substances. The proportion of ST users initiating cigarette smoking at follow-up was 22.4% for ST users and 7.3% for nonusers ($\chi^2 = 38.1$, $p < 0.0001$). Researchers also found that ST use was associated with increased use of cigarettes for subjects who were dual users at baseline; 18.4% of ST users reported increased use of cigarettes at follow-up, while only 7.5% of nonusers of ST did. The same group also studied a different population of adolescent male subjects over a 6-month period (Ary et al., 1989) and found that the majority of daily ST users tried smoking cigarettes after they had already been using ST (54.5%) and half of those were daily ST users at the time. Most current users of ST had also smoked at least one cigarette (83%); 25% of current ST users reported that they sometimes smoked when they could not or did not want to use ST, and also that the most common situation when they smoked was when they were out of ST (55%).

Hu et al. (1996) found that ST use was a risk factor for drug use (including cigarettes) and vice versa among adolescents attending urban public schools. Relative odds of the two-way interaction between ST and cigarette smoking were 1.72 (95% CI = 1.54–1.88). Murray et al. (1988) also studied adolescents and found a strong association between ST and cigarettes (OR = 4.24; 95% CI = 2.80–6.42). The authors concluded that the two are associated rather than a replacement or substitute for one or the other. In contrast, Burke et al. (1989) found little overlap in use of cigarettes and ST in their analysis of seventh graders; 39.5% had never smoked cigarettes nor tried ST, and only 3.9% had tried ST at least once and smoked an average of one cigarette per week. Boys who were weekly smokers were found to be significantly more likely than nonsmokers to have tried ST (OR = 3.31, $p < 0.0001$), as were experimenters (less than 1 cigarette per week) (OR = 0.62, $p < 0.0001$). Using ST also increased likelihood of smoking for girls (OR = 3.61, $p < 0.0001$ for weekly smokers and OR = 0.73, $p < 0.0001$ for experimenters); however, consistent with other studies, boys were found to be more likely than girls to use ST (40.6% of boys never used ST versus 82.1% of

girls). They concluded that both boys and girls who had tried one form of tobacco were more likely to try another.

[Griffin et al. \(1999\)](#) studied determinants of heavy cigarette smoking among middle-class high school students for a 6-year period beginning in the seventh grade. They found that boys who experimented with ST (tried 1-5 times) were more likely to be heavy smokers than high school seniors (OR = 2.21; 95 percent CI = 1.11–4.42), while there was no significant association with later heavy smoking in those who had used ST 6 or more times (OR = 1.37 95 percent CI = 0.38–4.90). Results were not significant for girls. Researchers concluded that “early experimentation with virtually any substance may increase the likelihood of becoming a heavy smoker later in adolescence.”

[Haddock et al. \(2001\)](#) found after 1-year of follow-up that U.S. Air Force recruits who had never smoked but currently used ST were more likely to begin smoking than never users (OR = 2.33; 95% CI = 1.84–2.94). Recruits who reported past ST use were also more likely to begin smoking than participants who had never used ST (OR = 2.27; 95% CI = 1.64–3.15). Nearly 27% of current ST users and 26.3% of former ST users initiated smoking over the 1-year period, whereas 12.9% of never users began to smoke after basic military training. Multivariate analysis found that ST use, either past or current, was the most robust predictive factor, nearly doubling the likelihood of smoking initiation ($p < 0.05$ for former or current ST users). The authors concluded that results were consistent with findings for adolescents ([Ary et al., 1989](#)), suggesting that ST serves as a gateway drug for cigarette smoking. However, given the nature of the analysis, such cause and effect cannot be concluded. While [Forrester et al. \(2007\)](#) reported similar findings, with ST use in boys (monthly) among the strongest predictors for smoking; other researchers ([Kozlowski, O'Connor, Edwards, & Flaherty, 2003](#)) have highlighted the limitations of the [Haddock et al. \(2011\)](#) paper. Regarding the finding that past and current ST users were each 2.3 times more likely to have begun smoking at follow-up, [Kozlowski et al. \(2003\)](#) suggested that male military recruits who have not started smoking by 18 years of age are not representative of males in the U.S. population, and also highlighted that the definition of smoking in the [Haddock et al. \(2001\)](#) study changed from baseline to follow-up (from one cigarette per day at baseline to a single puff on a cigarette in the preceding 7 days at follow-up).

In a 4-year longitudinal study of teenage males based on the Centers for Disease Control and Prevention Teenage Attitudes and Practices Survey data, [Tomar \(2003\)](#) found that young males who had been exclusive users of ST were more likely than those who had never used ST to become smokers (OR = 3.45; 95 percent CI = 1.84–6.47). In contrast, initiation rates for current regular ST use did not differ significantly between those who were current smokers and those who had never smoked (OR = 1.65; 95 percent CI = 0.32–8.52). [Tomar \(2003\)](#) determined that there was substantial initiation of cigarette smoking over this 4-year period for young men and that males who were ST users were significantly more likely than those who had never used these products to become cigarette smokers. However, when [O'Connor et al. \(2003\)](#) attempted to replicate these results using the same Teenage Attitudes and Practices Survey data, they found that the effect of ST use on smoking diminished when psychosocial predictors were added to the model. Specifically, ST use was not a statistically significant predictor of subsequent cigarette smoking when experimentation with cigarettes and other psychosocial predictors of smoking (e.g., school performance, household member

smoking, depressive symptoms, being in a physical fight and riding on a motorcycle) were included in the model.

Severson et al. (2007) reported results consistent with those of Tomar (2003). They found that initial use of ST was a significant risk factor for subsequent smoking, even when other factors related to smoking onset (e.g., parental, sibling, or friend smoking; deviant behavior; low academic performance; use of alcohol) were included in the model; however, it is important to note that the factors included in this study were slightly different factors than those used in the O’Connor analysis.

Due to concerns over accuracy of regression models used in previous studies, Timberlake et al. (2009) used the propensity score, which controls for differences between groups by matching individuals on the basis of similar propensity scores and found that before matching on propensity score, there were significant differences between ST users and nonusers for every covariate, including smoking (50.4 percent vs. 26.5 percent, respectively; $p < 0.0001$). However, in the paired sample, not a single covariate exceeded the threshold for statistical significance, indicating that baseline differences between ST users and nonusers (e.g., prevalence of smoking cigarettes, smoking cannabis, drinking heavily, engaging in fighting, receiving failing grades, and rarely or never using seatbelts) accounted for differences in the smoking outcomes. Before matching, the unadjusted risk of an ST user becoming a daily smoker was significant (range of relative risk: 1.3–2.0; $p < 0.001$); however, after matching on propensity score, there was no added risk of smoking among adolescent ST users. The authors therefore suggested that ST use in adolescence is not likely to increase an individual’s likelihood of becoming a smoker.

7.5.3-1.2.4. Cross-Sectional Studies

As with the longitudinal studies described in Section 7.5.3-1.2.3, cross-sectional study results are inconsistent.

In a study investigating ST use among adolescents, McCarthy et al. (1986) found that ST use leveled off with age and postulated that the decline may be due to increased cigarette use, school dropouts of ST users, or spontaneous quitting of ST, but no direct linkages were made.

Glover et al. (1989) investigated the effect that age of onset of ST use had on the potential for subsequent cigarette smoking among college students (males and females) and found that, while most current ST users did not smoke, those who began ST use before the age of 13 years were proportionally more likely to be current smokers than those who did so at later ages. In addition, 18 percent of subjects who started smoking at any age had also used ST, while 28 percent of those who had ever used ST also smoked cigarettes regularly.

Hatsukami et al. (1999) found that 51.4% of those who had ever smoked tried ST first and 31.3% reported having used cigarettes when ST was unavailable, while among those who had ever smoked, 25.9% used ST as an aid to quitting cigarettes. Walsh et al. (2010) found that ST use appeared to have facilitated initiation of smoking in the adolescent population. Likewise, in a 2002 cross-sectional review (Tomar, 2002), U.S. men ($N = 13,865$) were about

2.5 times more likely to be former snuff users who currently smoked than to be former smokers who used snuff.

In contrast, [Riley et al. \(1996\)](#) found that their population of adult current ST users had more often transitioned from cigarette smoking to ST. For 21.27% users of snuff and 26.51% users of chew, cigarettes preceded ST use, whereas for only 13.77% users of snuff and 12.97% users of chew, ST preceded cigarette use (however, those who may have previously used ST and progressed to cigarettes were not included in the sample). Also, having separated data about chew and snuff, [Riley et al. \(1996\)](#) found that snuff users tended to use snuff only, whereas chew tobacco users were more likely to transition to snuff.

In addition, [Kozłowski et al. \(2003\)](#) evaluated data from the Cancer Control Supplement to the 1987 National Health Interview Survey in an attempt to evaluate causal and noncausal patterns of ST and cigarette use by categorizing participants based on age of first use and excluded user groups that could not result in causation. This analysis found that a large majority of ST-using males between 18 and 24 years of age in the United States (77.2%) appeared to be “nongateway users” in that their ST use did not lead to smoking or their smoking preceded ST use, whereas 22.9% used ST before initiating smoking. In addition, ST use was found to be a predictor of current smoking in a logistic regression model similar to the findings of other studies (OR = 1.35; 95% CI = 1.05–1.74); however, if those who used cigarettes before ST were removed, ever use of ST was no longer a predictor of current smoking (OR = 0.79; 95% CI = 0.56–1.11). Also, multiple logistic regression showed that those who used cigarettes before snuff were 2.1 times more likely to have quit smoking (95% CI = 1.21–3.45); however, when snuff and chewing tobacco were combined, no significant effect on quitting was found. Finally, younger cohorts showed an increase in ST use, but this increase was associated with a decrease in smoking, not an increase, which lends support to the idea that ST may be preventing some potential smokers from initiating use. Concerned that changes may have occurred since 1987 when this study’s data were collected, [O’Connor et al. \(2005\)](#) attempted to replicate these findings using data from the 2000 National Household Survey on Drug Abuse and found that causal uses of ST remained relatively stable (Snuff use in 1987, 1.9% vs. 2.0% in 2000; Chewing tobacco use in 1987, 2.0% vs. 1.9% in 2000) and that no causal link to cigarette smoking could be concluded for the majority of ST users.

Using combined data from the 2003, 2005, and 2007 National Survey on Drug Use and Health for white men and boys, [Rodu and Cole \(2010\)](#) found that approximately 90% of white men began tobacco use with either cigarettes (n = 20,008) or dual use of ST and cigarettes (n = 2,504), so that a gateway to cigarettes would have been possible for approximately 10% of users who were ST initiators (n = 4,863). ST initiators in this population were less likely to become ever smokers than were cigarette initiators (48.8%; prevalence ratio = 0.67; CI = 0.65–0.70 vs. 72.3%; CI = 71.2–73.3) and were significantly less likely than cigarette initiators to become current smokers (27.9%; prevalence ratio = 0.80; CI = 0.77–0.84 vs. 34.7%, CI = 33.7–35.7). This relationship also applied to 16- and 17-year-old males (n = 5,564). The proportion who smoked every day was significantly higher among cigarette initiators (55.6%, CI = 52.0–59.1) than among ST initiators (38.4%, CI = 26.5–51.8, p = 0.002).

7.5.3-1.2.5. Clinical Studies

Two clinical studies addressed the potential for transition from initial ST use to riskier forms of tobacco use.

[Gansky et al. \(2005\)](#) found in an ST-intervention study that of the exclusive ST users at baseline in their sample (n = 431), 18 (4%) reported at follow-up that they had stopped using ST but had started smoking cigarettes in the previous 30 days. Of the 206 baseline dual users, 29 (14%) reported at follow-up that they had quit ST use but continued to smoke. Overall, ST cessation was 36% in the intervention group and 37% in the control group (generalized estimating equation OR = 0.94; 95% CI = 0.70–1.27). In another ST cessation trial, [Walsh et al. \(2010\)](#) reported that exclusive baseline ST users reported a significantly higher percentage of smoking at follow-up (19.4%) than exclusive baseline smokers reported using ST at follow-up (7.8%). Between intervention and no-intervention groups, there were no significant differences in initiation or quitting

7.5.3-1.2.6. Summary

Although the incidence of smoking has been found to be greater among ST users, the evidence is inadequate to infer the presence or absence of a causal relationship between ST use and subsequent smoking. The existing literature on the potential of ST as a gateway to cigarette smoking is extensive; however, currently the data are conflicting, with some data supporting ST use as a strong predictor of future cigarette smoking ([Severson et al., 2007](#); [Tomar, 2003](#)), and other data suggesting that the relationship only exists when other important variables (e.g., psychosocial factors and prior cigarette experimentation) are not taken into account ([Haddock et al., 2001](#); [Kozlowski et al., 2003](#)). The most recently completed study, which used a novel and robust statistical analysis and took into account baseline differences between ST users and nonusers, suggests that it is these inherent differences between users and nonusers that account for most of the variation in smoking outcomes. Given the complexity of psychosocial factors associated with initiation of tobacco use (see [Section 7.5.3-1.1.4](#)), it is less likely that the risk of initiating smoking is related simply to an orderly progression from one substance to another as proposed in the Gateway Theory. Rather, as stated in the Common Liability Theory, adolescent and young adult initiation into tobacco, alcohol, and other drugs may be more strongly related to a range of sociocultural and environmental factors, which each contribute to the overall risk of initiating substance use ([Hicks et al., 2012](#)).

[Table 7.5.3-1-2](#) presents a summary of the 27 publications identified that assessed initiation of ST use.

Table 7.5.3-1-2: Literature Evaluating ST as a Gateway to Smoking

Author Publication Year	Title	Study Type Sample	Measures	Outcomes and Authors’ Findings	Comments
<i>Adolescents</i>					
(Ary et al., 1987)	Smokeless Tobacco Use among Male Adolescents: Patterns, Correlates, Predictors, and the Use of Other Drugs	Longitudinal Study Baseline questionnaire and reassessment 9 months later N = 1,498	Use of cigarettes Use of ST Breath and saliva samples to determine smoking status	Male adolescents who had used ST in the previous 6 months were more likely to be smoking at follow-up. Proportion of subjects initiating cigarette smoking was 22.4% (N = 49) for ST users and 7.3% (N = 54) for nonusers (p < 0.0001).	<i>Limitations:</i> Sampling bias Self-report Limited generalizability
(Ary et al., 1989)	An In-Depth Analysis of Male Adolescent Smokeless Tobacco Users: Interviews with Users and Their Fathers	Longitudinal telephone interviews over a 6-month period. N = 191 Male adolescent ST users where 90 were current (>10 lifetime use and past-month use) ST users Oregon	Tobacco use rates Other drug use Sequential order of use between tobacco and other drugs Cessation experiences	Majority of ST users (54.5%) tried smoking cigarettes after they had already been using ST, and half were daily ST users at the time. Most current ST users had smoked at least 1 cigarette (83%), and 25% of current ST users sometimes smoked when they could not or did not want to use ST. Most commonly smoked when out of ST (55%).	<i>Strengths:</i> In-depth interviews Longitudinal <i>Limitations:</i> Small sample size Low response rate Limited geographical generalizability

(J. A. Burke et al., 1989)	Prevalence and Predictors of Smokeless Tobacco Use: Iowa's Program Against Smoking	Longitudinal survey study from 2 research projects Annual questionnaire (1980-1984) in middle and high school students N = 443 students with 5 year data N = 427 7th grade students with first year data only N = 1,064 Separate cohort of 7th-grade students surveyed twice during 1984/85 school year Iowa	Frequency of ST use Smoking use, including frequency	<p>Data from the 1984/85 project revealed little overlap between smoking and ST (39.5% had tried neither, and 3.9% had tried ST at least once and smoked an average of one cigarette a week).</p> <p>Boys who were weekly smokers (n = 15) were distinguished from the experimenters (n = 153) by having used ST (0.76).</p> <p>Weekly smokers more likely than non-smokers to have tried ST (OR = 3.31; p < 0.0001) as were experimenters (OR = 0.62; p < 0.0001).</p> <p>For girls, greatest discrimination between the 144 never smokers and 12 weekly smokers occurred if substance use was common in their environment: using ST (0.14) or having a brother who smokes (0.33). ST increased likelihood of smoking for girls (OR = 3.61; p < 0.0001 weekly, OR = 0.73; p < 0.0001 experimenters).</p> <p>Boys who had tried one form of tobacco or alcohol were more likely to have tried the other form of tobacco.</p>	<p><i>Strengths:</i> Longitudinal assessment</p> <p><i>Limitations:</i> Self-report</p>
(Dent et al., 1987)	Adolescent smokeless tobacco incidence: Relations with other drug and psychosocial variables	Longitudinal school-based survey (1-year follow-up) N = 2,714 Adolescents California	Ever use of cigarettes and ST Lifetime number of cigarettes Current number of cigarettes Predictors of ST use onset	<p>Transition to regular use of cigarettes significantly predicted ST use onset at follow-up (p < 0.05).</p> <p>ST onset related to higher levels of cigarette smoking and lower quit rates.</p>	<p><i>Strengths: Longitudinal Multivariate regression</i></p> <p><i>Limitations: Limited geographical/demographic generalizability ST use variables not captured</i></p>

(Forrester et al., 2007)	Predictors of smoking onset over two years	Longitudinal community adolescent tobacco use intervention study N = 4,130 Adolescents Oregon	Smoking level ST use	11.8% of non-smokers became weekly smokers 2 years later (n = 489). ST use was a significant predictor of smoking (OR = 2.54; 95% CI = 1.43-4.50). ST use was not a significant predictor of susceptibility to smoking (OR = 1.80; 95% CI = 0.98–3.30, p = 0.0562). Present analysis showed monthly ST use to strongly predict later smoking for boys. The sample did not have enough ST-using girls to test this effect for both sexes.	<i>Strengths: Longitudinal</i> <i>Limitations: Small sample</i> <i>Limited geographic generalizability</i>
(Griffin et al., 1999)	A Six-Year Follow-Up Study of Determinants of Heavy Cigarette Smoking Among High-School Seniors	Longitudinal. 6-year follow-up study. Data part of a larger, long-term, follow-up study of a randomized drug abuse prevention trial. N = 744, adolescents New York	Current smoking frequency (12th grade) Substance use including cigarette smoking, chewing tobacco, alcohol use, marijuana use	Boys who experimented with chewing tobacco were more likely to be heavy smokers than high-school seniors: <ul style="list-style-type: none"> • Tried ST 1 to 5 times: OR = 2.21; 95% CI = 1.11, 4.42 • Tried ST 6+ times, not significant, OR = 1.37 95% CI = 0.38, 4.90 Early experimentation with substances in the 7th grade predicted later heavy smoking among seniors is consistent with this interpretation	<i>Strengths: Longitudinal</i> <i>Limitations: Small sample size</i> <i>Did not look at relative contributions of different types of risk factors within a multivariate framework, nor were interactions between predictors examined.</i>
(Hu et al., 1996)	The Patterns and Predictors of Smokeless Tobacco Onset Among Urban Public School Teenagers	Longitudinal study (1986-1987) N = 6,695 Adolescents (baseline). N = 4,896 Adolescents (follow-up) California	Tobacco use ST use concerning lifetime and last-week use Initiation of ST measured by contrasting self-reported lifetime use at baseline (7th grade) and follow-up (8th grade)	At baseline, 9.8% of ST users smoked cigarettes in past week. At follow-up, 47.4% of subjects who used ST in the last week also used cigarettes, alcohol, and marijuana. Smokers were 1.72 times more likely to use ST than nonsmokers. Those who used cigarettes, alcohol, or marijuana at 7th grade were more likely to initiate ST at 8th grade. Cross-sectional data indicate that ST use increases probability of using other substances and vice versa.	<i>Strengths: Longitudinal</i> <i>Limitations: Limited geographic generalizability</i> <i>Sampling bias</i>

(Murray et al., 1988)	Smokeless tobacco use among ninth graders in a north-central metropolitan population: cross-sectional and prospective associations with age, gender, race, family structure, and other drug use	Longitudinal classroom survey (2 years) N = 4,249 Adolescents Sub-sample of 1,228 white males Minnesota	Cigarette and ST use (lifetime and past month)	<p>Use of cigarettes, alcohol, or marijuana in the past month was associated with ever ST use even after adjusting for family structure ($p < 0.01$). Association strongest for smoking, followed by alcohol and marijuana use.</p> <p>Significant ORs for lifetime ST use (ever) by white males: smokers vs. nonsmokers, OR = 4.24; 95% CI = 2.80, 6.42.</p> <p>Smoking increased the probability of past week ST use, for all subjects.</p> <p>Prospective analysis of past-week data: smoking in 7th grade only marginally predicted ST in the 9th grade ($p < 0.10$). General trend toward an increased probability of 9th-grade ST use given either smoking, drinking, or marijuana use in the 7th-grade. ST use found to be more common among those who smoke.</p>	<p><i>Strengths: Longitudinal and cross-sectional analyses</i></p> <p><i>Limitations: Small sample</i></p>
(McCarthy et al., 1986)	Smokeless Tobacco Use Among Adolescents: Demographic Differences, Other Substance Use, and Psychological Correlates	Cross-sectional survey N = 2,926 Adolescents California	Frequency of ST use and cigarette smoking in past month	<p>Use leveled off with age: 3.9% 7th grade, 6.1% 9th grade, 4.2% 11th grade.</p> <p>To assess ST as "gateway," major drug behaviors submitted to Guttman scaling. ST use may not precede or occur after cigarette smoking, but may be used as an alternative to smoking. In this case, scalability would improve if cigarette smoking or ST use was removed from the analysis; when this was done, scalability improved to 0.66, with only ST use and to 0.69 when cigarette smoking was included.</p> <p>Coefficient of reproducibility was 0.96. Order of use is alcohol, cannabis, cigarettes or ST, cocaine, amphetamines, hallucinogens.</p>	<p><i>Strengths: Sample size Three age groups</i></p> <p><i>Limitations: Cross-sectional Self-report</i></p>

(O'Connor et al., 2003)	Regular smokeless tobacco use is not a reliable predictor of smoking onset when psychosocial predictors are included in the model	Reanalysis of CDC's TAPS data, collected using telephone interview N = 2,683 subset of 2,211 nonexperimenters 12-18 years U.S.	Tobacco use	Experimentation with cigarettes strong predictor of smoking at follow-up (OR = 2.37; 95% CI = 1.75-3.22). Reanalysis showed that ST use was not a statistically significant predictor of subsequent smoking when other variables were included in the model. Model better able to differentiate smokers from nonsmokers through a greater range of predicted probabilities.	<i>Limitations: Cross-sectional Self-report</i>
(Timberlake et al., 2009)	Use of propensity score matching in evaluating smokeless tobacco as a gateway to smoking	Longitudinal. In-school questionnaire (1994-95) N = 18,924 in Wave I N = 13,570 in Wave II N = 14,322 in Wave III ST users = 498 in Wave I (10,322 nonusers) and 496 pairs in the paired sample Middle and high school students U.S.	ST and cigarette use (past month)	Past-month ST users had approximately a twofold greater risk of having smoked daily for at least 1 month by the Wave II survey than nonusers. Users and nonusers of ST significantly differed in their unadjusted risk of becoming smokers by the subsequent surveys. Findings indicate that ST qualifies as a risk factor for daily cigarette use, not accounting for other predictors for smoking.	<i>Strengths: Longitudinal Large sample Nationally representative Limitations: Lifetime use of ST could not be determined among those who were not current users of the product. Potential matched sampling/classification bias</i>

(Tomar, 2003)	Is use of smokeless tobacco a risk factor for cigarette smoking? The US experience	Longitudinal. TAPS survey data and follow-up 4 years later N = 3,996 Males 12-18 years U.S.	Cigarette and ST use (baseline and follow-up)	<p>Current smokers were not significantly different from never smokers in the rate of initiating current regular ST use, OR = 1.65 (95% CI = 0.32-8.52). There was a similar pattern when current use of ST was defined at follow-up as any use within the preceding 30 days, OR = 1.45 (95% CI = 0.50-4.22).</p> <p>Males who had been regular users of ST were more than three times as likely as those who had never used ST to become smokers, OR = 3.45 (95% CI = 1.84-6.47). Similar pattern found when "current smoking" was defined as smoking in past 30 days.</p> <p>Baseline regular ST users but not smokers: 44.8% still exclusively using ST, 25.5% switched to smoking, 14.3% became dual users, and 15.2% were no longer using tobacco.</p> <p>Smokers at baseline but no ST use: 78.7% still smoked exclusively, 0.8% switched to ST, 3.6% became dual users, and 16.9% quit using tobacco.</p> <p>ST initiation not significantly different for smokers and nonusers (OR = 1.65; 95% CI = 0.32-8.52).</p>	<p><i>Strengths:</i> <i>Longitudinal</i> <i>Nationally representative</i></p> <p><i>Limitations:</i> <i>Did not consider certain predictor variables</i> <i>Self-report</i></p>
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<p>(Severson et al., 2007)</p>	<p>Use of smokeless tobacco is a risk factor for cigarette smoking</p>	<p>Longitudinal. Computer survey N = 2,263 Nonsmoking adolescent males 7th and 9th grade (repeated in 9th and 11th grade) U.S.</p>	<p>Use of ST and cigarettes Outcome variable: index of weekly smoking</p>	<p>Baseline nonusers of cigarettes (77.1%): 1.5% used ST infrequently and 3.0% (n = 67) used ST monthly or more. At follow-up, 21% reported infrequent cigarette use and 8.6% reported weekly smoking or more.</p> <p>Baseline ST nonusers (89.6%): 82.2% nonsmokers, 15.2% infrequent smokers, 2.6% smoked weekly or more. At follow-up, 61.5% were still nonsmokers, 26.0% infrequent users, 12.5% weekly or more, 4.1% used ST infrequently, 10.2% used ST at least once in past month.</p> <p><i>Baseline nonsmokers, non-ST users (n = 2,364):</i> At follow-up, 72% nonsmoking no ST, 5% nonsmoking but ST using, 16% smoking but no ST, 8% dual.</p> <p><i>Nonsmoking, ST use baseline (n = 145):</i> 17% no smoking no ST, 26% no smoking but ST use, 17% smoking but no ST (switchers), 41% smoking and ST use.</p> <p>Over half (57.3%) of nonsmokers who used ST at baseline subsequently reported smoking cigarettes at follow-up vs. 24.0% of nonsmokers/non-ST who took up cigarettes (15.7% cigarettes only, 8.3% dual).</p> <p>The ST use variable was a strong predictor of subsequent smoking (OR = 2.62; 95% CI = 1.31-5.22, p < 0.01). The OR for adolescents who used ST at least monthly at baseline, OR for being weekly smokers at follow-up was more than 2.5 times that of those who were not ST users at Time 1. In contrast, smoking cigarettes weekly was not a significant predictor of ST use (OR = 1.52; 95% CI = 0.76-3.04).</p>	<p><i>Strengths:</i> Longitudinal <i>Limitations:</i> Small sample of ST only users at baseline</p>
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(Cooper et al., 2010)	Differences between intermittent and light daily smokers in a population of U.S. military recruits	Population-based group randomized prevention and cessation trial (1-year follow-up) N = 5,603 Air force nondaily or light daily smoking recruits U.S.	Baseline: Tobacco use history Smoking status and tobacco use during the past year	Relative to never use, the use of ST products either intermittently (OR = 1.98, $p < 0.001$) or daily (OR = 5.39, $p < 0.001$), increased the odds of being an intermittent smoker. ST may be associated with less smoking.	<i>Strengths:</i> Longitudinal 1 <i>Limitations:</i> Self-report Limited generalizability Frequency or intensity of use not captured.
(Enofe, Berg, & Nehl, 2014)	Alternative Tobacco Use among College Students: Who is at Highest Risk?	Cross-sectional online survey N = 4,348 College students Southeastern U.S.	Cigarette and alternative tobacco product use (past 30-days)	Current smokers more likely than nonsmokers to be alternative tobacco product users ($p < 0.001$). 67% of chew or snus users were also cigarette smokers (past 30 days). Odds of using alternative tobacco products was higher among nondaily smokers and daily smokers than among nonsmokers (Nondaily smokers: OR = 6.43; CI: 4.92-8.40; $p < 0.001$ and daily smokers: OR = 2.79; CI: 1.92-4.05; $p < 0.001$)	<i>Limitations:</i> Cross-sectional Low response rate Primarily female respondents
(Gingiss & Gottlieb, 1991)	A comparison of smokeless tobacco and smoking practices of university varsity and intramural baseball players	Cross-sectional survey of N=284 male undergraduate athletes from two major Southwestern universities.	Cigarette and ST (chewing tobacco and snuff) use.	About one-fourth of all athletes were current ST users and 4% smokers. Over half of varsity players (53.2%) compared to 25.9% of intramural players used one or both forms of ST. Varsity players were about 20 times more likely to use ST as to smoke, while intramural players were about five times as likely to use ST than to smoke. On both teams, use of chewing tobacco was associated with use of snuff. Smoking was not associated with ST use in either group. Mean ages for initiation for all products was 15, and for quitting, 18. There was no evidence that one form of tobacco served as a gateway for the other among these young adult athletes. Despite the exceptionally high prevalence of ST users among varsity baseball players, fewer varsity athletes smoked than do other college students.	<i>Limitations:</i> Cross-sectional survey. The authors state that “It is not known to what extent future career and social factors are likely to influence lifetime patterns of tobacco use.”

(Glover, Laflin, Flannery, & Albritton, 1989)	Age of Initiation and Switching Patterns between Smokeless Tobacco and Cigarettes among College Students in the United States	Cross-sectional questionnaire N = 5,894 College students U.S.	Demographics Questions on cigarette smoking and ST use	<p>Most current ST users did not smoke (56-79%), but those who began using ST before the age of 13 years were proportionally more likely to be current smokers than those who did so at later ages.</p> <p>Age at smoking initiation:</p> <ul style="list-style-type: none"> • <10 y: 37% started ST at < 13 y, while 6% started later. • 10-12 y: 29% started ST at less than 13 y, and 7% started later. • 13-15 y: 10% started ST before 13 y and 11% started later. • >15 y: 10% started ST at <13 y vs. 23% later <p>Likelihood of smokers starting to use ST decreased substantially for those students who began smoking at ages 13 y and older vs. those who began smoking before 12 y.</p> <p>18% who started smoking at any age had used ST, and 28% who had ever used ST had also smoked.</p>	<p><i>Strengths:</i> <i>Representativeness of sample</i> <i>Limitations: Self-report</i> <i>Cross-sectional</i></p>
	Evidence That Smokeless Tobacco Use Is a Gateway for Smoking Initiation in Young Adult Males	<p>Longitudinal smoking cessation study including baseline survey with 1- year follow-up</p> <p>N = 7,865 Male air force recruits U.S.</p>	Demographics Tobacco use	<p>At 1-year follow-up current ST users more likely to have initiated smoking than nonusers (OR = 2.33; 95% CI = 1.84-2.94).</p> <p>Recruits who reported past ST use were more likely to begin smoking than participants who had never used ST (OR = 2.27; 95% CI = 1.64- 3.15).</p> <p>Nearly 27% (107/403) of current ST users initiated smoking, whereas 26.3% (52/198) of former users and 12.9% (940/7,264) of never users began to smoke after basic military training.</p> <p>Greatest predictor of smoking initiation in a multivariate analysis was past or current ST use at baseline.</p>	<p><i>Strengths:</i> <i>Nationally representative military sample</i> <i>Longitudinal</i> <i>Limitations:</i> <i>Limited demographic generalizability</i> <i>Self- report</i> <i>Change in smoker definition over time</i></p>

(Walsh et al., 2003)	Spit (Smokeless) Tobacco Intervention for High School Athletes: Results after 1 year	Randomized controlled intervention trial (1-year follow-up) N = 1,084 (516 intervention and 568 control) Male high school athletes Rural California	Baseline prevalence of ST and cigarette use	Strongest predictor of ST initiation was being a current smoker. Authors suggest that initiation may be related to tobacco-free policies.	<i>Strengths: Intervention study Sample size Follow-up study Biochemical verification</i> <i>Limitations: Self-report</i>
	Smokeless tobacco cessation cluster randomized trial with rural high school males: Intervention interaction with baseline smoking	Longitudinal randomized controlled intervention trial (1 year follow-up) N = 4,731 High school students with 65% retention (3,072) Rural California	Baseline questionnaire: Demographics and tobacco use and correlates of use. Follow-up questionnaire 1 year after baseline to assess tobacco use and related variables.	Exclusive baseline ST users (i.e., baseline nonsmokers) reported a significantly higher percentage smoking at follow-up (19.4%) than exclusive baseline smokers (i.e., baseline ST nonusers) reported using ST at follow-up [7.8%]. Exact binomial 95% CIs do not overlap, demonstrating statistical significance: 95% CI for baseline smokers, 5.2-11.2; for baseline ST users, 12.5-28.2. Thus, ST use appears to have facilitated initiation of smoking in this adolescent population.	<i>Strengths: Longitudinal</i> <i>Limitations: Self-report Limited geographical generalizability</i>

<i>Adults</i>					
(Hatsukami et al., 1999)	Characteristics of smokeless tobacco users seeking treatment	Cross-sectional questionnaire for those enrolled in ST cessation treatment study N = 402 Adult (mostly male – 99.8%) ST users Minnesota	Tobacco use history, including amount, duration, and pattern of ST use, use of other tobacco products	51.4% of ever smokers tried ST first. 31.3% used cigarettes when ST was unavailable among ever smokers. 25.9% used ST as an aid to quit for ever smokers. 45.1% of ST users had history of being regular (daily) smoker. 33.1% were not using any ST at time of regular smoking, 52.9% used occasionally, and 14.1% had used regularly.	<i>Limitations:</i> Results biased because ST users who were regular smokers (more than 20 cigarettes per month) were excluded
(Kozlowski et al., 2003)	Most smokeless tobacco use is not a causal gateway to cigarettes: using order of product use to evaluate causation in a national US sample	Cross-sectional analysis (Cancer Control Supplement to the 1987 National Health Interview Survey) N = 3,454 Adult males 18-34 years Subsample of 2,614 23-34 year olds U.S.	Lifetime cigarette/snuff/chewing tobacco use Age at first use	Ages 18-34 years 77.2% = nongateway users (snuff did not lead to smoking or smoking preceded snuff use) 22.9% = possible gateway users (used ST before smoking). Ages 23-34 years Use of ST before cigarettes was 1.7% higher in the youngest group than the oldest group, while use of cigarettes before ST was 2.4% lower (youngest : 23-26 years, oldest: 31-34 years). ST significant predictor of current smoking, but if those who used cigarettes before they used ST removed from analysis, ever-use of ST is no longer a significant predictor of current smoking (OR = 0.79; 95% CI: 0.56, 1.11). Of those 23 to 34-year-old males who had ever used ST with or without cigarettes, 77.2% (95% CI: 71.3, 83.3) classifiable as nongateway users in that 35.0% (95% CI: 29.9, 40.1) had only used ST and 42.2% (95% CI: 36.8, 47.7) had used cigarettes first.	<i>Strengths:</i> <i>Addresses overestimated "snuff first" and underestimated "cigarettes first" groups because age at regular use rather than first use is employed</i> <i>Limitations:</i> <i>Self-report Complex early use patterns could not be assessed.</i>

(O'Connor et al., 2005)	Most smokeless tobacco use does not cause cigarette smoking: Results from the 2000 National Household Survey on Drug Abuse	Cross-sectional 2000 National Household Survey on Drug Abuse N = 7,956 Males 22-34 years U.S.	Smoking and ST status	Smoking status and combined ST status: Nonsmokers (65.8%; 95% CI = 63.9, 67.7) more likely than former (34.1%; 95% CI = 29.8, 38.4) or current (42.9%; 95% CI = 40.2, 45.6) smokers to have never used ST ($\chi^2 = 300.2$, $p < 0.0001$). Snuff users: 44.6% used snuff exclusively, 23.8% used cigarettes first, and 31.5% used snuff first. Chewing tobacco users: 45.3% used chew only, 22.9% used cigarettes first, and 31.9% used chew first. Combined ST: 46.2% used ST only, 21.7% cigarettes first, 32.1% ST first. In all cases, the noncausal uses of ST predominate.	<i>Limited quantification of levels of ST use experienced by these participants (some would have used ST a few times, while others may have used it daily for several weeks or longer)</i>
(Peterson, Marek, & Mann, 1989)	Initiation and use of smokeless tobacco in relation to smoking	Longitudinal retrospective assessment of lifetime use of tobacco from 1975-1985. Evaluable data from n=1,631 tenth grade students in 14 school districts in the State of Washington.	Smoking and ST status	Prevalence of Smoking and Smokeless Tobacco Use: More males dipped more than five pieces of SLT than have smoked more than five cigarettes (40.6% vs. 32.5%) and only 6% of females used more than five pieces of SLT. Almost 70% of the females ever smoked and about 31% ever used SLT. Only about 1 of 3 males who have never tried SLT have tried cigarettes, whereas 6 of 7 males who have tried SLT have also tried cigarettes. The weekly smoking onset rate is 1.65 ($p=0.002$) and 2.13 ($p<0.001$) times as large for males and females resp. after initial SLT use has occurred compared with before initial SLT use. The weekly onset rate of SLT use is 2.03 ($p<0.001$) and 6.72 ($p<0.001$) after initial smoking has occurred than before. “Further research is indicated in several directions: how the effect of SLT use on subsequent smoking onset depends on age and inclusion of other aspects of the tobacco use onset processes including social, environmental, and motivation variables.”	<i>Limitations: Recall bias - Recall data collected retrospectively from a cross-sectional study.</i>

(Riley et al., 1996)	Adult Smokeless Tobacco Use and Age of Onset	Interview (cross-sectional) N = 345 Adult, white, male, current ST users U.S.	Assessment of snuff, chewing tobacco, and cigarette use. Age at first use for each substance and typical frequency of use over past year	Snuff only or cigarettes before ST were more frequent with ST use ($p < 0.0001$). Although current level of snuff use did not differ among these groups, chew tobacco use was significantly higher in those who used chew tobacco only or those who used cigarettes before ST use. For both chewing tobacco and snuff, the youngest age of onset was among those using ST before cigarettes and the oldest for those using cigarettes before ST.	<i>Limitations: Retrospective Self-report</i>
(Rodu & Cole, 2010)	Evidence against a gateway from smokeless tobacco use to smoking	Cross-sectional. National Survey on Drug Use and Health data for 2003, 2005, and 2007. Combined surveys to provide reasonable precision in smallest initiation group (cross-sectional) N = 33,649 White adult males aged 18 and older and 5,564 white males aged 16- 17 years Total = 39,213 U.S.	Smoking status Smoking initiation Combined ST and snuff initiation and use = ST initiation and use	The majority of ever smokers were cigarette initiators (82.2%; 95% CI = 81.3-83.1) while 10.7% (95% CI = 10.0-11.4) were ST initiators and 7.1% (95% CI = 6.6-7.7) were dual initiators. Prevalence of current smoking among 18+ cigarette initiators was 34.7% (95% CI = 33.7- 35.7). Prevalence among dual initiators was 10% significantly higher (PR = 1.10; 95% CI = 1.04- 1.16) while prevalence among ST initiators was significantly lower (PR = 0.80; 95% CI = 0.77- 0.84). Proportion who smoked every day was significantly higher among cigarette initiators (73.4%; 95% CI = 72.0-74.8) than among either ST initiators (65.5%; 95% CI = 61.8-69.0, $p < 0.0002$) or dual initiators (69.6%; 95% CI = 66.3-72.6, $p = 0.005$). Majority (83.5%; 95% CI = 80.6-86.1) of ever-smokers were cigarette initiators, while 8.4% (95% CI = 6.6-10.7) were ST initiators and 8.0% (95% CI = 6.4-10.0) were dual initiators. Prevalence of ever smoking (at least 100 cigarettes in life) among ST initiators for 16-17 year old boys was less than half that among cigarette initiators (PR = 0.41; 95% CI = 0.34- 0.49). Proportion who smoked every day was significantly higher among cigarette initiators (55.6%; 95% CI = 52.0-59.1) than among ST initiators (38.4%; 95% CI = 26.5-51.8, $p = 0.002$) but not among dual initiators (49.7%; 95% CI = 40.4-58.9, $p = 0.3$).	<i>Strengths: Large sample size Nationally representative Limitations: Cross-sectional Self-report</i>

7.5.3-1.3. The Likelihood That Former Users of Tobacco Products Will Reinitiate Use with the Tobacco Product

7.5.3-1.3.1. Overview and Literature Review Results

This section focuses on the likelihood that former users of tobacco products will reinitiate use of ST. There are currently limited data on the rate of former tobacco product users who reinitiate use with ST. Although the literature search yielded 55 publications that assessed the prevalence of ST trial and initiation, only one study reported results on individuals reinitiating ST use after discontinuing. Therefore, this section also refers to data on patterns of cessation in ST users, particularly failed attempts at quitting, as a proxy measure of reinitiation of ST use in former users. Overall, the limited data suggest that relative to dual-users, ST users may be less likely to reinitiate use after attempting to quit. However, in those individuals who report using smoking as a method of quitting ST, some individuals may reinitiate ST use rather than continuing to smoke cigarettes.

7.5.3-1.3.2. Summary

In a descriptive study in which 94 males adults were interviewed and 57 reported attempting to quit, 36% of subjects reported smoking cigarettes during their attempt to quit using ST. Of the 57 subjects who reported attempting to quit, 21% reported reinitiating ST use because they perceived that the health risks associated with regular use of ST were less than those associated with regular smoking (Severson et al., 1990).

Another potential source of information on risk of reinitiation of ST use is longitudinal studies that evaluate cessation in ST users. These studies may provide information on former users who quit using the products but have reinitiated use at follow-up (i.e., failed quit attempts). As summarized in Section 7.5.2-1.4, in a longitudinal study that evaluated the prevalence, correlates, and predictors of tobacco cessation in 1,244 male smokers, ST users and dual users, in comparison to exclusive smokers (16 percent) and dual users (11 percent), ST users were more likely to have remained abstinent (20 percent) at the 4-year follow-up. In addition, in this study using less ST (fewer ST uses per day) was associated with a greater likelihood of cessation in ST users (OR = 0.94, p = 0.01) (Wetter et al., 2002).

Based on the data collected in one study, reinitiation of regular ST use in former users suggests that in some cases, former ST users who switched to smoking cigarettes may return to exclusive ST use, as it is associated with fewer perceived health risks. Data on patterns of cessation in ST users suggest that former exclusive ST users may be less likely to reinitiate ST use after quitting, particularly in comparison to dual-users (Section 7.5.2-1.4 for a summary of studies of ST cessation).

7.5.3-1.4.Literature Cited

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