

## Review

# The Effect of Tobacco Control Policies on US Smokeless Tobacco Use: A Structured Review

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## Abstract

**Introduction:** Tobacco use has shifted increasingly from cigarettes to other products. While the focus has been mostly on cigarette-oriented policies, it is important to gauge the effects of policies targeting other products. We review and critique the literature on how policies affect smokeless tobacco (ST).

**Methods:** We conducted a search of the literature on tobacco control policies as they relate to ST use, focusing on tobacco taxes, smoke-free air laws, media campaigns, advertising restrictions, health warnings, cessation treatment policies, and youth access policies. Findings from 78 total studies are summarized.

**Results:** ST taxes, media campaigns, health warnings, and cessation treatment policies were found to be effective tools in reducing ST use. Evidence on the effects of current youth access policies is less strong. Studies have not yet been conducted on marketing or product content restrictions, but the literature indicates that product marketing, through advertising, packaging, flavorings, and extension of cigarette brands, plays an important role in ST use.

**Conclusions:** Although the evidence base is less established for ST policies than for cigarette policies, the existing literature indicates ST use responds to tobacco control policies. Policies should be structured in a way that aims to reduce all tobacco use while at the same time increasing the likelihood that continuing tobacco users use the least risky products.

**Implications:** Studies find that policies targeting smoking and policies targeting smokeless products affect smokeless use, but studies are needed to examine the effect of policies on the transitions between cigarette and smokeless use.

## Introduction

Since 2000, smokeless tobacco (ST) use has been increasing in the United States.<sup>1–4</sup> Data from the Department of Treasury<sup>5</sup> indicate that snuff sales increased by 62% between 2001 and 2014, which was partially offset by reduced chewing tobacco sales. The increase in snuff use occurred mostly since 2005 (42%), during which time cigarette sales declined by 41% in the United States. Since 2005,

Reynolds American and Altria (formerly Phillip Morris) acquired major US ST companies<sup>6</sup> and came to dominate the ST market. With their entry, ST advertising expenditures increased dramatically, using price-based promotions as a major marketing strategy.<sup>7</sup> In addition, new products, including dissolvable tobacco products and snus (a form of snuff), were introduced, often using brand name extensions (eg, Camel snus).<sup>6,7</sup> Industry documents also reveal that the industry began promoting ST products as a way for

smokers to satisfy nicotine cravings in places where smoking is not permitted.<sup>8,9</sup>

While ST products have been linked to oral cancers, they are generally recognized as less harmful than smoking cigarettes.<sup>10-12</sup> Yet there is considerable debate regarding whether they increase or decrease the overall harms of tobacco use at the population level.<sup>13-19</sup> Harm is reduced if adults use ST to quit cigarettes or youth who would otherwise smoke cigarettes instead use ST. However, harm increases if smokers turn to dual (cigarette and ST) use rather than quitting smoking, or ST acts as a gateway to smoking among youth who would not have otherwise started smoking or using ST. These effects may depend on cigarette-oriented, as well as ST-oriented policies. In particular, stronger policies directed at ST may reduce its use, but also increase cigarette use in the absence of strong cigarette policies. Alternatively, less stringent ST policies may encourage smoking cessation or reduce cigarette smoking or ST initiation among youth.

Understanding the effects of policies on ST use is especially important considering the changing regulatory environment for ST and other novel nicotine-delivery products. In recent years, some states have implemented policies directed at reducing ST use, including increasing taxes, education, cessation treatment, and restrictions on youth access.<sup>20</sup> In 2009, the Family Smoking Prevention and Tobacco Control Act authorized the FDA to regulate the marketing, promotion, and sale of cigarettes and some ST products and FDA recently asserted its authority over all remaining tobacco products and e-cigarettes. In addition, while the growth in ST use has been overtaken by the growth in e-cigarette use,<sup>21,22</sup> ST and e-cigarettes share similar research considerations and their respective industries are of increasing interest to major cigarette companies. The encroachment of cigarette manufacturers into the e-cigarette industry appears to be mirroring their prior behavior in the ST market.<sup>8,9</sup> E-cigarette use also shares similar research considerations as ST use. Like ST use, population harm may increase if e-cigarettes act as a gateway to smoking or inhibit smoking cessation, while harm may be reduced if they replace cigarettes or facilitate quitting smoking. With few studies evaluating e-cigarette policies, results from ST policy studies may provide some insight for policies directed at e-cigarettes.

A comprehensive evidence base is needed that considers policy effects across multiple tobacco products. This article provides a structured review of the effect of tobacco control policies on ST use and its relationship to cigarette use. Limitations of the existing research are also considered, with a focus on how studies may better distinguish the public health impact of policies directed at either cigarettes or ST.

## Methods

We conducted a systematic search of the literature through September 2015 to find studies on the effectiveness of tobacco control policies on ST use. Online databases, like PubMed, and the reference lists of recent articles were searched. The search strategy consisted of the following keywords: (“smokeless” OR “chewing tobacco” OR “snus” OR “snuff”) AND one of the individual tobacco control policies. The tobacco control policies included taxes (“cigarette tax,” “tax,” “price”), smoke-free air laws (SFALs) (“smoke-free air,” “clean air”), marketing restrictions (“advertising,” “marketing”), education, (“school,” “media”), media campaigns, health warnings, cessation treatment (“quit line,” “pharmacotherapy,” “health care provider”) and youth access policies (“minimum age,” “youth access”). We found no studies evaluating policies restricting marketing or product content, but because of their potential importance to

the effectiveness of other policies, we included studies of ST advertising and product introductions.

The eligibility criteria for inclusion are: (1) US population-based (2) Experimental, quasi-experimental, and observational in design, and (3) include an assessment of the relationship between an intervention and a ST behavioral outcome: that is, initiation, cessation, prevalence, or quantity used. Experimental, quasi-experimental, and observational studies were eligible, but our review focuses on population-level studies. We limit the review to policy evaluations for the United States to focus the discussion on a country with a specific pattern of ST and cigarette use and a relatively uniform set of policies. In addition, we found few studies of specific policies for other countries and those countries had very different ST use patterns than the United States (eg, Pakistan and India). Because the studies were generally very different in terms of the time periods and the type and number of policies considered, we did not conduct meta-analyses. However, we refer to several reviews and meta-analyses in our discussion of cessation treatment policies, which included non-US, but high-income countries.

## Results

Our search identified 119 potentially eligible studies. Forty-one studies were excluded—23 studies because they did not evaluate the effect of policies on an ST behavioral outcome, and 18 because the populations studied were not in the United States. A total of 78 studies were obtained that directly considered the relationship between tobacco control policies and patterns of smokeless use. We included four literature reviews summarizing the impact of cessation treatments on ST use. Studies of ST taxes, cigarette taxes, SFALs, and youth access were sufficiently comparable and are included in Supplementary Table 1.

### ST and Cigarette Tax Policies

ST taxes in the United States are implemented primarily at the federal and state level, as either specific or ad valorem taxes. These taxes influence use when they are passed onto consumers in terms of increased prices, since higher prices generally reduce purchases by consumers. While the ultimate impact of ST taxes depends on price, ST studies have focused on taxes, likely due to greater availability of this information. In addition, tax is the policy lever, and, unlike price, is not simultaneously determined by the industry.

The effects of taxes have been examined in the context of demand studies focused on either adults or adolescents. The effect of taxes is reported in terms of the tax elasticity, defined as the percent variation in ST use associated with a 1% increase in ST taxes, and provides a measure of relative responsiveness of use that can be compared across studies. This measure is often converted to a price elasticity, which relates consumer purchases directly to price, and thus can be directly applied in gauging the effect on ST use of a tax increase at current prices.

Two early studies<sup>23,24</sup> used the 1985 Current Population Survey Tobacco Use Supplement, and examined snuff and chewing tobacco use separately and combined. Ohsfeldt and Boyle<sup>23</sup> obtained tax elasticities for snuff of  $-0.4$  to  $-0.6$ , for chew of  $-0.6$ , and for any ST use of  $-0.55$ . Ohsfeldt et al.<sup>24</sup> obtained a tax elasticity of  $-0.27$  for snuff,  $-0.13$  for chew, and  $-0.15$  for +both combined, and obtained a higher snuff and total ST elasticity for males  $<25$  years old than for males  $\geq 25$  years old, but no difference for chew. Using the 1992–1993 Current Population Survey Tobacco Use Supplement, Ohsfeldt et al.<sup>25</sup> obtained a tax elasticity of  $-0.01$  for overall ST use, and

again obtained higher elasticities at younger ages. Using the 2003–2009 nationally representative National Consumer Surveys, Dave and Saffer<sup>26</sup> obtained suggestive evidence ( $p < .10$ ) that ST tax was related to ST use, especially among males, with tax elasticities in the range of  $-0.2$  to  $-0.4$ , implying price elasticities of  $-0.4$  and  $-0.8$ .

Demand studies have also considered adolescents. Using the 1992–1994 Monitoring the Future Surveys, Chaloupka et al.<sup>27</sup> considered adolescent ST use (ie, at least once in the last 30 days), frequency of use (number of days in last month), and average monthly ST consumption. They obtained tax elasticities for ST use ( $-0.07$  to  $-0.04$ ), ST use frequency ( $-0.04$  to  $-0.02$ ), and ST demand ( $-0.11$  to  $-0.06$ ) among young males, which translate to price elasticities of  $-0.30$  to  $-0.51$  for use,  $-0.16$  to  $-0.34$  for use frequency, and  $-0.46$  to  $-0.85$  for overall demand. Tauras et al.<sup>28</sup> applied four Youth Risk Behavior Surveys and obtained a use (once in the last 30 days) elasticity of  $-0.20$  and a frequency (number of days use during the past 30 days) elasticity of  $-0.12$ . Examining past 30-day tobacco use by youth ages 14–18 following a 2009 tax increase on all tobacco products, Huang and Chaloupka<sup>29</sup> obtained price elasticities from  $-1.2$  to  $-1.8$  for ST use compared with  $-0.44$  to  $-0.60$  for cigarette use.

Studies across a variety of data sources, time periods, and statistical methodologies, all found ST use sensitive to ST taxes. Except for one study,<sup>25</sup> tax elasticities for adult use mostly ranged from  $-0.1$  to  $-0.6$ . Implied price elasticities ranged from  $-0.2$  to  $-1.0$ , generally indicating higher price elasticities than for cigarettes.<sup>30,31</sup> Consistent with studies of cigarette price elasticities,<sup>31</sup> studies generally indicate greater effects on youth than older adults. Additional effects were found for frequency of use in youth studies, suggesting particular sensitivity among those initiating ST use.

These studies apply generally accepted methods that control for other individual characteristics and policies, although results may depend on the other tobacco control policies included in the estimation equation; other policies may affect how responsive ST use is to price changes given the potential for substitution effects across tobacco products. The conversion of tax to price elasticities is based on the assumption that increases in taxes lead to corresponding increases in price. While that assumption has been confirmed for cigarettes,<sup>31</sup> studies also indicate that the mark-up for cigarettes varies by product (eg, discount vs. premium).<sup>32</sup> In addition, the effects of taxes may differ among different brands targeting different populations. The two studies<sup>23,24</sup> distinguishing snuff found some variation in elasticities, but the variation may be greater in recent years with the proliferation of products, especially snus. In particular, the effects may vary for brands used primarily by dual versus exclusive ST users. For example, a Bangladesh study<sup>33</sup> obtained a price elasticity of  $-0.64$  for the lower price brands usually bought by those of lower income compared with  $-0.39$  for higher priced brands. Another limitation is that past studies have measured ST taxes as a percentage of the price (ad valorem taxes), and have not distinguished whether the tax is implemented by weight or per unit (ie, specific taxes), which has become increasingly important in recent years and may lead to substitution between brands.<sup>34</sup> In some of the reviewed studies, it is unclear how specific taxes are treated and whether ad valorem taxes imposed at the manufacturer stage are treated differently from those at the wholesale stage. Like cigarettes,<sup>31</sup> ad valorem taxes may have less impact on lower priced brands than specific taxes.

### Cigarette Tax/Price Effects

Most ST demand studies considered cigarette as well as ST taxes. The effects are measured by cross-tax elasticities (the percent increase in

use of a product given a 1% increase in the price of another product). Ohsfeldt and Boyle<sup>23</sup> obtained a cross-tax elasticity for snuff of 0.4 to 0.6, for chew of 0.4 to 0.5, and either type of 0.41 to 0.44, indicating that an increase in the price of cigarettes leads to increased consumption of ST. Ohsfeldt et al.<sup>24</sup> obtained a cross-tax elasticity of 0.13 for snuff, 0.08 for chew, and 0.10 for either ST, with larger elasticities for age  $<25$  than for age  $\geq 25$ . Ohsfeldt et al.<sup>25</sup> found cross-tax elasticities in the range of 0.01 to 0.04, with greater effects for age  $<25$ . In contrast, Dave and Saffer<sup>26</sup> obtained cross-tax elasticities in the range  $-0.60$  to  $-0.32$  for males, but smaller when including females. For youth, Tauras et al.<sup>28</sup> obtained a cross-tax elasticity of  $-0.72$  for ST use and a cross-tax elasticity of  $-0.41$  for the number of days of ST use.

Studies of cigarette demand<sup>35,36</sup> that have included ST prices have obtained positive cross-price elasticities. Using US retail scanner data (1994–2007), Adhikari et al.<sup>35</sup> obtained cross-price elasticities of about 0.15, but the effect varied depending on the estimation technique. An online randomized experiment<sup>36</sup> assigned 1062 US cigarette smokers purchase tasks for snus, dissolvables, and nicotine lozenges, and obtained a positive cross-price elasticity of 0.3.

Mumford et al.<sup>37</sup> examined how taxes affect dual use among adult male smokers and among adult male ST users using the 1993–2002 Current Population Survey Tobacco Use Supplement. Neither cigarette nor ST prices were associated either dual use among smokers or dual use among ST users.

Studies of cross-price effects have obtained mixed results. The positive relationship found in earlier studies indicates that raising cigarette taxes increases ST use, suggesting substitution between products. The negative, complementary relationship in two<sup>26,28</sup> of the more recent studies may reflect industry pricing strategy in recent years of lowering prices to encourage ST use where smoking is restricted or to act as a gateway to smoking. The studies incorporate multiple policies, but the included policies vary. Further study is warranted on cross-price elasticities in recent years, and whether elasticities vary by age and socioeconomic status and whether by exclusive versus dual ST users.

### Smoke-Free Air Laws

SFALs regarding worksite, restaurant and bars and other public areas generally apply to cigarettes (or other combustible products), but may affect the use of ST. By increasing antitobacco social norms, they may discourage ST use. On the other hand, SFALs may encourage ST use as a substitute for cigarettes where smoking is not allowed.

Ohsfeldt and Boyle<sup>23,24</sup> did not find a significant relationship between SFALs and ST use using a simple binary indicator. Using an index with greater weight to private workplace restrictions, Ohsfeldt et al.<sup>25</sup> found a negative relationship with snuff use among those ages  $\geq 25$ . Mumford et al.<sup>37</sup> found that workplace bans were associated with reduced dual use among adult cigarette smokers. Although not controlling for price, Dietz et al.<sup>38</sup> also found that ST use was lower among those in smoke-free workplaces based on the 1987–2005 National Health Interview Surveys. A weak negative relationship was also found by Huang and Chaloupka for youth.<sup>29</sup>

Studies have consistently found that smoking restrictions are associated with less ST use, suggesting that policies directed at reducing cigarette use also reduce the use of other tobacco products. While the studies are generally of high quality, the studies may not adequately control for existing antitobacco norms, as reflected in media campaigns, and all studies used surveys conducted prior

to 2006. With recently adopted SFALs and the marketing by cigarette firms of new ST products to smokers, smokers may be more inclined toward dual use (ie, a positive relationship) in reaction to SFALs. One study<sup>39</sup> found that smokers increased ST use following the implementation of bar SFALs. Studies using more recent samples and allowing for variation in effects by age, socioeconomic status, and exclusive versus dual use are needed.

### Media and Other Education-Oriented Policies

Educational interventions, including media campaigns, school-based education programs, and community interventions, can inform the public about the risks of ST use, their harms relative to smoking cigarettes, promote cessation, and counter tobacco industry marketing tactics. Media campaigns are often part of larger tobacco control programs, which include school-based and other local efforts.

Three years following implementation of high-intensity media campaigns in Massachusetts, the decline in current ST use among middle and high school students in the state was greater than for students nationwide.<sup>40</sup> ST use was also shown to decrease following a 4-year campus-wide antitobacco intervention that combined a tobacco ban with provision of tobacco cessation services and information.<sup>41</sup> One year after a community-based intervention directed at adolescents, ST use among boys decreased, whereas school-based interventions showed no effects.<sup>42</sup> Other studies have found community interventions and middle and high school educational programs to be effective.<sup>6,43</sup>

While educational policies can reduce ST use by communicating their harm, studies also generally indicate that consumers overestimate harms of ST relative to cigarettes,<sup>44–48</sup> and smokers report that such misperceptions kept them from switching to ST.<sup>49,50</sup> A study of 73 smokers and 324 nonsmokers (nine ST users) found that educational information on ST constituents (ie, nicotine and toxicity) increased knowledge about the relative toxicity across products.<sup>51</sup> Of 1836 US current and former smokers provided counter-marketing messages to discourage dual use,<sup>52</sup> the messages perceived as most effective (stressing negative health effects) did not affect attitudes and openness to using snus, while those ads perceived as ineffective (antitobacco industry ads) decreased favorable attitudes to snus. In an online auction revealing consumer valuations,<sup>53</sup> providing smokers with antismoking information was found to be a more effective way to increase the demand for ST products than providing information about the benefits of ST.

The studies of educational policies vary in the methods employed, but do not generally consider the role of other ST and cigarette-oriented policies already in effect. They indicate that the policies can be effective in reducing ST use, but the effects depend on the type of message conveyed. Further research is needed to determine which information is most effective at discouraging ST use, while not discouraging those smokers who would have not otherwise quit from switching to ST.

### Health Warnings

In the United States, ST packaging is now required to display large text warnings covering two principal sides of the package and covering at least 30% of each side, larger than warnings on cigarette packages. ST advertisements (eg, in magazines) are also required to display text warnings. Like media policies, health warnings can deter ST use by providing information on the harms.

For smaller-sized warnings, less than half of subjects recalled seeing the text-only labels on ST packages.<sup>54</sup> Among males aged 16 to

24 years,<sup>55</sup> doubling the font size from 10 to 20 point on advertisements increased recall from 63% to 76%. From the 2012 National Youth Tobacco Survey,<sup>56</sup> 40% of adolescents who saw a ST product reported seeing the warning label “most of the time” or “always,” of which 25% reported that it made them think “a lot” about health risks.

Two studies compared modified warnings for snus to the current warning label that ST use is unsafe.<sup>57,58</sup> An online experiment<sup>57</sup> of young adults found that participants viewing a label communicating the reduced harm when switching completely from cigarettes to snus perceived snus to be less harmful than cigarettes, and nonsmokers viewing warnings about the potential reduced harms of snus reported fewer thoughts about not using snus. Based on a large-scale survey funded by Swedish Match (a firm selling snus),<sup>58</sup> tobacco users perceived snus as less harmful and reported greater likelihood of using snus when given warning labels indicating less harm than cigarettes. Never-smokers were also more likely to use snus, while no impact was found for former smokers.

Pictorial warnings on packages were found effective in online surveys.<sup>59,60</sup> More respondents, especially among youth and young adults, selected the pack with the graphic warning label as making them consider the health risks associated with SLT use, attract their attention, and be least attractive to a smoker.<sup>59</sup> For 611 Canadian young adult smokers,<sup>60</sup> pictorial warnings reduced product appeal, but increased beliefs that ST and cigarette smoking are equally harmful. Pictorial warnings on ST advertisements reduced their perceived appeal and perceived safety of young adults<sup>61</sup> and increased perceived harm for moist snuff, but not for snus among nonsmokers.<sup>62</sup>

Similar to cigarettes,<sup>63,64</sup> the evidence indicates limited effectiveness of text-only warnings, while pictorial warnings have been associated with less susceptibility to youth ST use and greater cessation interest among adults. The framing of messages about health risks of STs relative to cigarette messages also appears important, but health warnings communicating that ST health risk increases with concurrent cigarette use and the concurrent use of both cigarette and ST have not been evaluated.

### Cessation Treatment Policies

Treatment policies, including the use of some pharmacotherapies and behavior treatments (including health care provider interventions, quit lines, and web-based aids) have been found effective in promoting smoking cessation.<sup>65</sup> Similar policies may promote ST cessation.

A Cochrane review<sup>66</sup> of randomized trials of pharmacological ST interventions found that varenicline was effective in increasing cessation at 6-month follow-up, but evidence for other pharmacotherapies was lacking. Other reviews obtain similar results,<sup>6,67</sup> although one review found that effectiveness declines over time.<sup>68</sup> While studies show limited or no effects for nicotine replacement therapy,<sup>6,66,67</sup> an 8-week trial of 4-mg nicotine lozenge and tobacco-free snuff for 81 ST users with no immediate intention to quit found 12% biochemically-confirmed abstinence at week 26.<sup>69</sup>

Reviews<sup>6,66,67</sup> have also found behavioral interventions, particularly telephone counselling or health care provider interventions, to promote quitting among ST users. A 57% seven-month tobacco quit rate was found for ST users contacting the South Dakota QuitLine.<sup>70</sup> The number of quit line calls between 2004 and 2012 was associated with reported 30-day abstinence from tobacco at 7-month follow-up among male ST users.<sup>71</sup> Quit line and web-based support for quitting were found effective in

increasing tobacco abstinence for ST users who wanted to quit.<sup>72</sup> A randomized controlled trial of 406 adult ST users<sup>73</sup> found that prolonged abstinence from all tobacco at 6 months was 31% with telephone counseling compared to 11% using a self-help manual. Similar results were found with a web-based intervention.<sup>74</sup> Advice by health care providers can be better tailored to ST cessation.<sup>43,66,75-77</sup> However, a study of tobacco control professionals found that 31% of participants did not know that ST is less harmful than cigarettes, and 81% did not know that the newer snus products are lower in tobacco-specific carcinogens than conventional ST products.<sup>78</sup>

Thus, studies indicate that many cessation treatment policies, especially quit lines, can promote abstinence from ST. Since ST users currently use these resources at low rates,<sup>79</sup> media campaigns may be needed to increase awareness of their availability and effectiveness. Studies of cessation treatment effectiveness have not generally distinguished dual use from either exclusive ST or cigarette use or by age or socioeconomic status.<sup>6,66,67</sup> As with other interventions, the effectiveness of programs to increase ST quit attempts and quit success may depend on the existing tobacco control policy environment at the time of the study.

### Youth Access

While a minimum legal purchase of 18 was originally applied in the United States to cigarettes, it has been applied to all tobacco products, including STs, since 2009. Two youth demand studies discussed above included variables to capture youth access enforcement. Chaloupka et al.<sup>27</sup> found that tobacco licensing provisions and minimum purchase age signs were associated with reduced ST use and frequency of use. Tauras et al.<sup>28</sup> found that state enforcement authority reduced frequency of past 30-day ST use, but did not find an association with purchase, use, and possession laws, vending machine restrictions, or random inspection. However, a Minnesota study<sup>80</sup> found that 43.7% of retailers carried snus and 12.9% sold snus to underage buyers, higher than that of cigarette sales to minors. Further study is needed on the effect of youth access policies, particularly the size of fines and the number of compliance checks, on purchase and use of cigarettes and ST. A number of states have raised the minimum purchase age to 21 for tobacco products, and a recent Institute of Medicine report<sup>81</sup> found that raising the minimum purchase age for cigarettes has the potential to improve public health, especially if also applied to other tobacco products. These policies and the role of enforcement as applied to ST have been largely neglected in the literature.

### Marketing and Advertising Influences

Marketing in various forms have been effectively used by tobacco companies to sell their product.<sup>6,82</sup> In addition to direct promotions through advertisements, packaging and product differentiation, such as the use of flavorings, provide indirect ways to market products. Marketing may also include price promotions, which provide discounts to more price sensitive users. In general, the four Ps<sup>83</sup> (promotions, products, placement, and price) are often used to target specific niches, such as youth or specific socioeconomic groups. Studies have not been conducted to examine the effect of ST marketing restrictions on ST use. However, studies have considered the role of industry marketing in increasing ST use.

While Federal law prohibits ST advertising on television and radio, ST advertising in US magazines increased substantially between 1998–1999 and 2005–2006,<sup>84</sup> with more recent ads

displaying flavored products and portraying ST products as alternatives to cigarettes in indoor settings. ST advertising in magazines with substantial adolescent readership<sup>85</sup> and in media other than print ads have also increased.<sup>7</sup> In 2012, tobacco companies spent \$436 million on ST advertising and promotions through nonelectronic media,<sup>7</sup> with most (63%) of these expenditures for price promotions, coupons, and other activities to lower ST prices. The rest was spent primarily on point-of-sale, direct mail, internet, magazine, and outdoor advertising.

Based on 1990, 1992, and 1993 California surveys, exposure to ST advertisements was associated with ST use by men and susceptibility to ST use among boys. Dave and Saffer<sup>26</sup> found that ST advertising exposure, measured as advertising expenditures on magazines weighted by the respondent's reading habits, was directly related to ST use, especially among males. In addition, Timberlake and Pechman<sup>86</sup> found that discount snuff advertising was associated with publication in high youth readership magazines and that discount snuff is increasingly being used by youth.

Marketing through new product introductions, which have been used to promote cigarettes,<sup>82</sup> may also apply to STs. An online experiment<sup>36</sup> of current US cigarette smokers found that exposure to novel ST products, including snus, dissolvable tobacco, and lozenges, increased demand for ST products, but overall effects of ST advertising on demand and demand elasticity were modest and demand was generally low among adult smokers. The odds of youth experimenting with snus increased with the number of different types (internet, newspapers/magazines, and retail store) of tobacco advertisements viewed by youth.<sup>87</sup> In-store, magazine, and mail promotions predicted awareness, and magazine ads and online promotions predicted the trial of dissolvable tobacco products by adults.<sup>88</sup>

Tobacco companies have also differentiated products by promoting flavored ST. A survey of US young adult chewing tobacco users<sup>89</sup> found that 72% report using flavored products. Similar patterns were found among Canadian youth.<sup>90</sup> Among adult ST users who initiated ST use as youth,<sup>91</sup> most subjects' first and current choice of ST was flavored, and ST users often switched from a non-flavored to a flavored brand. Teens who had ever tried flavored tobacco products were found to be three times more likely to be current smokers than those who never tried flavored tobacco products.<sup>92</sup> Packaging has also been found important in product choice.<sup>93</sup> An online experiment<sup>59</sup> found that packaging and corporate branding encouraged ST use, especially among youth and young adults.

Like cigarette marketing,<sup>4,43,82</sup> ST advertising, new product introductions, and packaging are associated with greater product use, particularly among youth. Brand extensions by cigarette manufacturers, for example, Camel and Marlboro snus, have been applied across a full range of ST products from traditional products to dissolvables.

### Discussion

ST taxes, media campaigns, health warnings, and cessation treatment policies were found to be effective tools in reducing ST use. Further research is needed on the role of youth access policies on ST use, including evaluations US states raising the minimum purchase age to 21. Studies have not yet been conducted on policies regulating marketing or product content; restrictions on ST advertising may also serve an important function.

While we found no studies examining the effect of ST marketing restrictions on ST use, indirect evidence on the effect of cigarette marketing restrictions is provided from a cross-county study by Chaloupka and Saffer.<sup>94</sup> They find larger effects of a comprehensive cigarette advertising ban on cigarette consumption than on overall tobacco consumption, suggesting that there may be some substitution to tobacco products not covered by the ban. In addition, point-of-sale restrictions have been found effective at reducing smoking initiation and increasing cessation among smokers.<sup>4,43,95</sup> These policies affect pricing patterns as well as point-of-sale advertising. Similar restrictions are likely to be effective for ST, where users, especially youth, have been found to be particularly responsive to price and advertising.

Evidence indicates that flavorings and novel ST products influence ST use, especially among youth. This suggests that regulations requiring the contents of tobacco products to meet certain criteria (eg, maximum levels of harmful constituents, eliminating flavorings) may reduce ST use and associated harm. A ban on menthol (flavor) in cigarettes was found to reduce smoking-attributable deaths.<sup>96</sup> Similar restrictions may be effective in reducing youth initiation of ST, although it may also deter some cigarette smokers from switching to ST. Further study is needed to assess restrictions on ST flavorings and toxic ingredients as they affect behavioral transitions between cigarette smoking and ST use.

Our review highlights other gaps in the literature. Few studies separately evaluate the effects of policy on female ST use, and those that did often obtained insignificant results due to low female ST prevalence in the United States. All but one study<sup>29</sup> of tax and smoke-free air policies were conducted using data prior to 2006. The impact may have changed in recent years with the marketing of ST products by cigarette manufacturers. A recent survey of dual users<sup>97</sup> found that 68% reported using ST in places where they could not smoke. Studies also do not distinguish policy effects by individual characteristics, such as age and socioeconomic status, which may affect dual versus exclusive use or transitions from ST to cigarette use.

There has been less research focused on the effectiveness of ST policies due in part to the absence of policies directed at reducing ST use more generally. Because of this limitation, this review draws upon research evaluating other tobacco control measures such as SFALs. The existing literature on ST policies focuses on ST use without considering the role of cigarette-oriented policies other than taxes, just as most research evaluating cigarette policies do not consider the influence of ST policies. In particular, ST policy effectiveness may differ in states with strong as opposed to weak cigarette policies, for example, ST users may be less likely to switch to exclusive or dual cigarette use in states with stronger cigarette policies. Similarly, the effect of cigarette policies may depend on ST-oriented policies, since cigarette users may be more likely to substitute toward exclusive and dual ST use in the absence of effective ST policies.

Our study focused on the United States, but studies for South Asian countries with greater ST prevalence,<sup>6</sup> such as India and Pakistan, obtain similar results, although they were excluded from the present review. A study for Indian adults<sup>98</sup> and another for Indian youth<sup>99</sup> obtained price elasticities for ST use at the high end of US studies, and similarly for a Bangladesh study<sup>33</sup> which also obtained a positive cross-price elasticity for cigarettes. Two Indian studies<sup>98,100</sup> found advertising exposure related to ST use and another study<sup>101</sup> found high levels of awareness which

were associated with perceptions of harm. Two studies found that media campaigns targeting ST use in India were associated with increased cessation behaviors<sup>102,103</sup> and ST health warnings were found to be effective in India and Bangladesh.<sup>104</sup> As in the United States, policies directed at ST use in other countries are often weak.<sup>105-107</sup> With weak ST policies, the effect of cigarette-oriented policies may be dampened due to substitution toward exclusive and dual ST use.

Although the evidence base is less established for ST policies than for cigarette-oriented policies, the existing literature finds that ST use generally responds to tobacco control policies. These policies should be structured in a way that aims to reduce all tobacco use while at the same time increasing the likelihood that continuing tobacco users use the least risky products. Policies can work in tandem to apply the greatest barriers to the most harmful products, so that even if taxes are raised on all tobacco products, the price advantage of ST compared to cigarettes corresponds to their risk relative to each other.<sup>108</sup> While ST policies can play an important role in promoting public health, given the magnitude of harm caused by cigarettes the best defense against the harms from overall tobacco use remain those policies directed at smoking.

## Supplementary Material

Supplementary Table 1 can be found online at <http://www.ntr.oxfordjournals.org>

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## Declaration of Interests

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