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The global impact of tobacco control policies on smokeless tobacco use: a systematic review

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Summary

Background Smokeless tobacco, used by more than 300 million people globally, results in substantial morbidity and mortality. For smokeless tobacco control, many countries have adopted policies beyond the WHO Framework Convention on Tobacco Control, which has been instrumental in reducing smoking prevalence. The impact of these policies (within and outside the Framework Convention on Tobacco Control) on smokeless tobacco use remains unclear. We aimed to systematically review policies that are relevant to smokeless tobacco and its context and investigate their impact on smokeless tobacco use.

Methods In this systematic review, we searched 11 electronic databases and grey literature between Jan 1, 2005, and Sept 20, 2021, in English and key south Asian languages, to summarise smokeless tobacco policies and their impact. Inclusion criteria were all types of studies on smokeless tobacco users that mentioned any smokeless tobacco relevant policies since 2005, except systematic reviews. Policies issued by organisations or private institutions were excluded as well as studies on e-cigarettes and Electronic Nicotine Delivery System except where harm reduction or switching were evaluated as a tobacco cessation strategy. Two reviewers independently screened articles, and data were extracted after standardisation. Quality of studies was appraised using the Effective Public Health Practice Project's Quality Assessment Tool. Outcomes for impact assessment included smokeless tobacco prevalence, uptake, cessation, and health effects. Due to substantial heterogeneity in the descriptions of policies and outcomes, data were descriptively and narratively synthesised. This systematic review was registered in PROSPERO (CRD42020191946).

Findings 14 317 records were identified, of which 252 eligible studies were included as describing smokeless tobacco policies. 57 countries had policies targeting smokeless tobacco, of which 17 had policies outside the Framework Convention on Tobacco Control for smokeless tobacco (eg, spitting bans). 18 studies evaluated the impact, which were of variable quality (six strong, seven moderate, and five weak) and reported mainly on prevalence of smokeless tobacco use. The body of work evaluating policy initiatives based on the Framework Convention on Tobacco Control found that these initiatives were associated with reductions in smokeless tobacco prevalence of between 4·4% and 30·3% for taxation and 22·2% and 70·9% for multifaceted policies. Two studies evaluating the non-Framework policy of sales bans reported significant reductions in smokeless tobacco sale (6·4%) and use (combined sex 17·6%); one study, however, reported an increased trend in smokeless tobacco use in the youth after a total sales ban, likely due to cross-border smuggling. The one study reporting on cessation found a 13·3% increase in quit attempts in individuals exposed (47·5%) to Framework Convention on Tobacco Control policy: education, communication, training, and public awareness, compared with non-exposed (34·2%).

Interpretation Many countries have implemented smokeless tobacco control policies, including those that extend beyond the Framework Convention on Tobacco Control. The available evidence suggests that taxation and multifaceted policy initiatives are associated with meaningful reductions in smokeless tobacco use.

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See **Comment** page e817

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Introduction

Tobacco products are broadly classified into two categories—smoking and smokeless tobacco. WHO's Framework Convention on Tobacco Control defines smokeless tobacco as "tobacco that is consumed in un-burnt form either orally or nasally".[1] A wide range of smokeless tobacco products are manufactured worldwide.[2] Consumed by more than 300 million people globally,[3] smokeless tobacco is estimated to contribute to over 650 000 deaths annually.[4] Smokeless tobacco products contain more than 30 carcinogens,[2] leading to various adverse health effects and cancers of the oral cavity.[4] An estimated 4·7 million disability-adjusted life years were lost and 204 309 people died in 2010 from coronary heart diseases attributed to smokeless tobacco use, based on the INTERHEART study[5] conducted in

Research in context

Evidence before this study

Unlike that of cigarettes, the prevalence of smokeless tobacco use is not declining and disease burden due to smokeless tobacco use is on the rise. We searched 11 databases and grey literature to identify studies describing smokeless tobacco policies between Jan 1, 2005, and Sept 20, 2021, in English and key south Asian languages. Search terms were a combination of free text and MeSH terms for each database, including "tobacco", "smokeless", "public policy", "legislation", and "government regulation". No systematic reviews were found evaluating the impact of tobacco control policies on smokeless tobacco use. A narrative review by Siddiqi and colleagues found a limited body of literature on the implementation of WHO Framework Convention on Tobacco Control policies on smokeless tobacco use and, therefore, the need to systematically assess and understand the impact of all smokeless tobacco policies on smokeless tobacco use, remained.

Added value of this study

In this systematic review, we provide, to our knowledge, the first ever comprehensive global overview of policies related to smokeless tobacco and their impacts. We found that smokeless tobacco control is an area of considerable national interest, with policy initiatives identified in 57 countries. Although some of these policy initiatives are aligned to the Framework Convention on Tobacco Control, many extend beyond the WHO Framework. This review highlights the need for developing standardised methodologies for smokeless tobacco policies and their impact assessment. The available evidence supports the likely beneficial impact of taxation policies and other measures outside the Framework Convention on Tobacco Control in reducing smokeless tobacco use.

Implications of all the available evidence

Taxation and other multifaceted policies are likely to be effective in reducing smokeless tobacco use. There is considerable opportunity for cross-country learning and sharing of experiences and insights with the goal to reduce smokeless tobacco use globally. There is a need for existing frameworks and guidelines to continue to strengthen their frameworks to incorporate new evidence.

52 countries. Smokeless tobacco use by pregnant women leads to a three-fold increased risk of stillbirth and of having low birthweight babies.[3,6–8] Due to its cultural acceptability and popularity among women compared with smoked tobacco, this is a growing challenge in south Asia.

WHO's Framework Convention on Tobacco Control, ratified in 2005 by 168 countries that are signatories and 182 parties in which it is legally binding,[1] aims to provide guidelines to implement effective tobacco control measures. Nearly 5 billion people are included under the MPOWER measures (prioritised from the Framework Convention on Tobacco Control) for tackling the global tobacco epidemic. Implementation of the Framework Convention on Tobacco Control has led to a significant reduction in smoking prevalence and associated hazardous consequences. Türkiye and Brazil have shown reduction in smoking prevalence and a decline in chronic conditions after implementation of MPOWER policies.[9] Findings from Ngo and colleagues[10] indicated that a one unit increase in composite MPOWER score was associated with a 0·2 percentage point reduction in smoking prevalence among adults and a reduction of 23 sticks of cigarettes (one pack) in cigarette consumption per capita per year, suggesting that if MPOWER measures had been enforced at their highest level between 2007 and 2014), a reduction of 7·3% in smoking among adults and a 13·8% reduction in cigarette consumption would have been experienced.[10]

For more on **MPOWER** see https://www.who.int/initiatives/mpower

A narrative review on WHO's Framework Convention on Tobacco Control demand reduction policies found a small amount literature on the implementation of these policies with respect to smokeless tobacco, and although most were found applicable to smokeless tobacco, their implementation was weak in comparison to cigarettes.[11] WHO's Framework Convention on Tobacco Control policies have typically been based on evidence gathered from research on cigarettes conducted in high-income countries; however, the translation of these policies into the control of tobacco use (smoking and smokeless forms, especially in low-income and middle-income countries [LMICs]) has been slow.[12] With an increasing prevalence of smokeless tobacco use and the entry of a myriad of new products in high-income countries and LMICs, considerable efforts to control smokeless tobacco use have been undertaken and several countries have gone beyond the policy measures of the Framework Convention on Tobacco Control. For example, Bhutan, Sri Lanka, Singapore, and several other countries have imposed bans on the manufacturing, sale, and import of smokeless tobacco products.[13] Thailand imposed a ban on the sale and import of smokeless tobacco products, and India has banned the manufacture and sale of commonly used smokeless tobacco products known as *gutka*.[11,14] The impact of policies relevant to smokeless tobacco (both within and outside the Framework Convention on Tobacco Control) and other country-specific laws that might have an impact on the consumption of smokeless tobacco is understudied.

We aimed to systematically review policies that are relevant to smokeless tobacco and its context and investigate their impact on smokeless tobacco use. Specific review questions included: what are the existing policies and legislation (within and outside the

Framework Convention on Tobacco Control) related to the control of smokeless tobacco products across the globe? And what is the impact of these policies on controlling smokeless tobacco use including its uptake, cessation, and related health outcomes?

Methods

Search strategy and selection criteria

This systematic review was registered in PROSPERO (CRD42020191946), the study protocol was published elsewhere,[15] and it follows PRISMA guidelines (appendix pp 2–7).[16]

We developed a search strategy to identify relevant studies in consultation with the Information Specialist from the Centre for Reviews and Dissemination at the University of York, York, UK.[17] First, we searched for records published between Jan 1, 2005 (when WHO's Framework Convention on Tobacco Control came into effect) and Sept 20, 2021, in 11 scientific databases MEDLINE, CINAHL, Embase, EconLIT, APA PSYCInfo, Web of Science, Scopus, Cochrane Library (CENTRAL), LILACS, SciELO, and Global Index Medicus, with no geographical restrictions. Search terms were a combination of free text and MeSH terms for each database (appendix pp 8–14), including "tobacco", "smokeless", "public policy", "legislation", and "government regulation". Articles in English, Bengali, Hindi, Singhalese, and Urdu were included due to a special focus on the high smokeless tobacco burden region of south Asia.[3,11]

Second, we searched grey literature in the Google search engine and country-specific government ministry websites (eg, for health, commerce, finance, and environment). The first 100 hits going back to 2005 were considered for screening from the Google search and ministry websites were searched for any policies related to smokeless tobacco for four south Asian countries (Bangladesh, India, Pakistan, and Sri Lanka).[3,11] The searches were conducted by experienced researchers in smokeless tobacco policy (AC, NJ, MPM, SD, and ZK) in consultation with country-level experts.

Two reviewers (of AC, NJ, AV, AR, MPM, MAR, SF, SD, and MB) independently screened records using pre-defined eligibility criteria (appendix pp 40–42) in two stages: title and abstract screening, followed by full-text retrieval. Disagreements were resolved through discussions between the two reviewers, or with help of a third reviewer (OD or AC).

Inclusion criteria were all types of studies on smokeless tobacco users that mentioned any smokeless tobacco relevant policies since 2005, except systematic reviews. Policies issued by organisations (eg, educational institutions) or private institutions (eg, workplaces) were excluded. We also excluded studies on e-cigarettes and Electronic Nicotine Delivery System except where harm reduction or switching were evaluated as a tobacco cessation strategy. For impact assessment of these policies, further inclusion criteria were the presence of a comparator (no policy or usual care) and outcome of interest (smokeless tobacco prevalence, quitting, initiation, and health outcomes for cancers and cardiovascular diseases due to smokeless tobacco). A set of secondary outcomes and reported unintended effects were also considered (appendix pp 40–42).[15]

Records from scientific databases were imported into CADIMA software for de-duplication, screening, and data extraction. An Microsoft Excel spreadsheet (version 2013) was maintained for the grey literature to carry out all these steps.

For more on **CADIMA software** see https://www.cadima.info

For the **study protocol** see https://bmjopen.bmj.com/content/10/12/e042860

See **Online** for appendix

Data extraction and quality assessment

Data were extracted after standardising and pilot testing the data extraction forms (appendix pp 43–50, 51–56) by a team of reviewers (AC, NJ, AV, MPM, AR, SD, Safat Ullah [Khyber Medical University, Pakistan], Urooj Aftab [Khyber Medical University, Pakistan], and Nishigandha Joshi [HRIDAY, India]). Data extraction included the characteristics of the study population, smokeless tobacco policy description, and context and outcomes of interest. 10% of the data extraction forms were cross-checked for listing of smokeless tobacco policies and 100% cross-checked for impact of smokeless tobacco policies, for quality assurance (by OD).

A stepped approach to data extraction was employed, such that only the studies identified with information on smokeless tobacco policy were marked for inclusion in the impact assessment. The quality of all studies evaluating smokeless tobacco impact was assessed using the Effective Public Health Practice Project's Qualitative Assessment Tool for Quantitative Studies (appendix pp 15–23).[18,19]

Data analysis

The articles included in the review had insufficient information regarding policy content, context, and process and actors, making it challenging to use our pre-established contextual framework (derived from INFORMAS framework)[20] for analysis, as was originally planned.[15] A list of smokeless tobacco policies was therefore collated as within or outside the Framework Convention on Tobacco Control. Within policy measures aligned with the Framework Convention on Tobacco Control, the extent to which Articles 6, 9, 10, 11, 12, 13, and 16 were enforced (appendix pp 57–58) was presented in tabular form and described narratively. Policy measures outside the Framework Convention on Tobacco Control (eg, complete ban or partial ban, and policies related to environmental impact and others [eg, ban on smokeless tobacco at sports venue, requirements for manufacturer reporting, tobacco-free campus policy for all government facilities]) were also listed and described narratively.

Due to substantial heterogeneity in the descriptions of policies evaluated, different years of evaluations, different methods of measuring outcomes, and different age ranges of participants, we did not attempt a meta-analysis

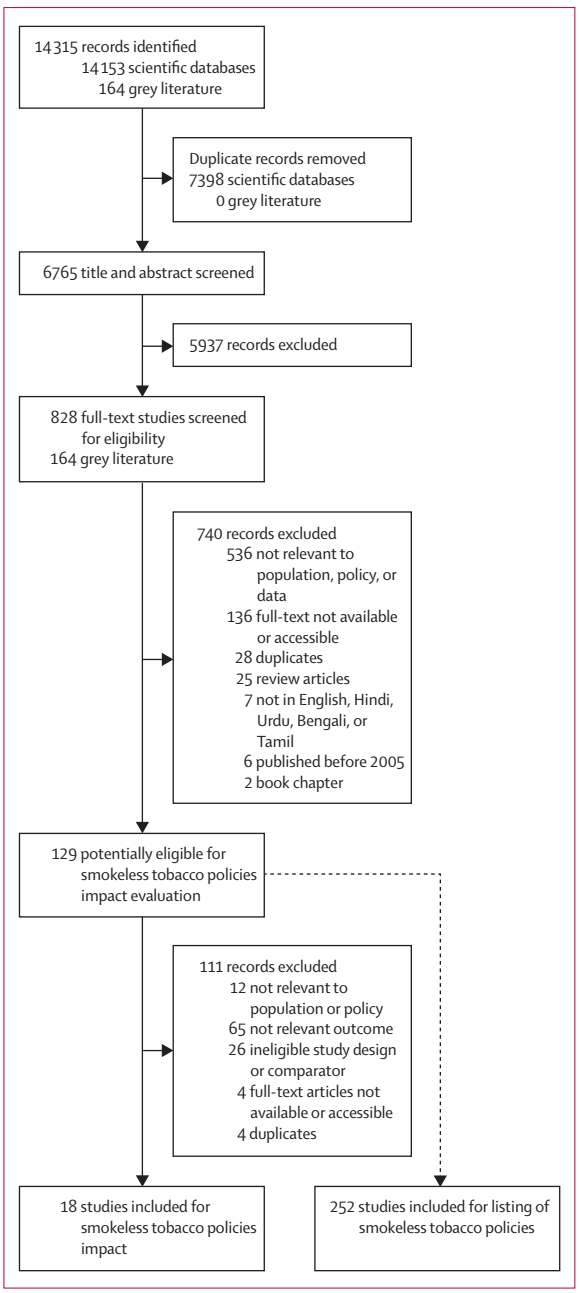

Figure 1: **Study selection**

to combine estimates of impact across studies. Results were described narratively and studies reporting change in smokeless tobacco prevalence due to a policy implementation were also presented as a forest plot using Microsoft Excel.

As this study is a review of published or publicly available data, there are no ethical concerns related to the involvement of humans. Permission for ethics exemption of the review was obtained from the Centre for Chronic Disease Control's Institutional Ethics Committee, New Delhi, India (CCDC_IEC_06_2020; 16 April, 2020). Data were collected from publicly available scientific and grey literature through the databases mentioned.

Role of the funding source

This work is funded by the UK's National Institute for Health Research (Addressing Smokeless Tobacco and Building Research Capacity in South Asia [ASTRA], grant reference number 17/63/76). The funder of the study had no role in the study design, data collection, data analysis, data interpretation, or writing of the report.

Results

Of the 14 317 records identified (14 153 via scientific database searches and 164 via grey literature sources), 992 full-text articles were reviewed, and 252 relevant articles were included for the listing of smokeless tobacco policies (figure 1). Of these, 129 articles were potentially eligible for evidence of impact and, on full-text screening, 18 articles were included.

Smokeless tobacco policies were identified from 57 countries worldwide (16 policies from the region of the Americas, ten policies from the Eastern Mediterranean region, nine policies from the African region, eight polices from the Western Pacific region, seven policies from the European region, and seven polices from the South-East Asia region; figure 2, figure 3; appendix pp 59–62). Two studies focused on the European region and Eastern Mediterranean region, rather than any specific country.

Most countries were found to have integrated policies for all tobacco products, including smokeless tobacco. We found no national regulation specifically for smokeless tobacco in the USA, therefore information on policies and regulations related to smokeless tobacco in individual states and cities was included from the literature. Our review found several acts and agreements: the Comprehensive Smokeless Tobacco Health Education Act, 1986, which requires health warnings to be displayed on all packages of smokeless tobacco marketed in the USA (Article 11); the Master Settlement Agreement, 1998, prohibits tobacco companies from billboard and transit advertising, print advertising to underage youth, and cigarette and smokeless tobacco advertising on television and radio (Article 13); and the Family Smoking Prevention and Tobacco Control Act, 2009, has provisions aligned with Articles 9, 10, 11, 12, and 13 of the Framework Convention on Tobacco Control. Furthermore, there are several regulations implemented across various states and cities in the USA aligned to Articles 6, 11, 12, 13, 14, and 16.

Article 6 (taxation and pricing measures) was found to be implemented in 11 countries (Bahrain, Bangladesh, Guam, India, Kuwait, Oman, Qatar, Saudi Arabia, Sweden, United Arab Emirates [UAE], and USA [not ratified to WHO's Framework Convention on Tobacco Control]). The amount and type of taxation on smokeless tobacco products, however, differed from country to country and within countries (appendix pp 24–39).

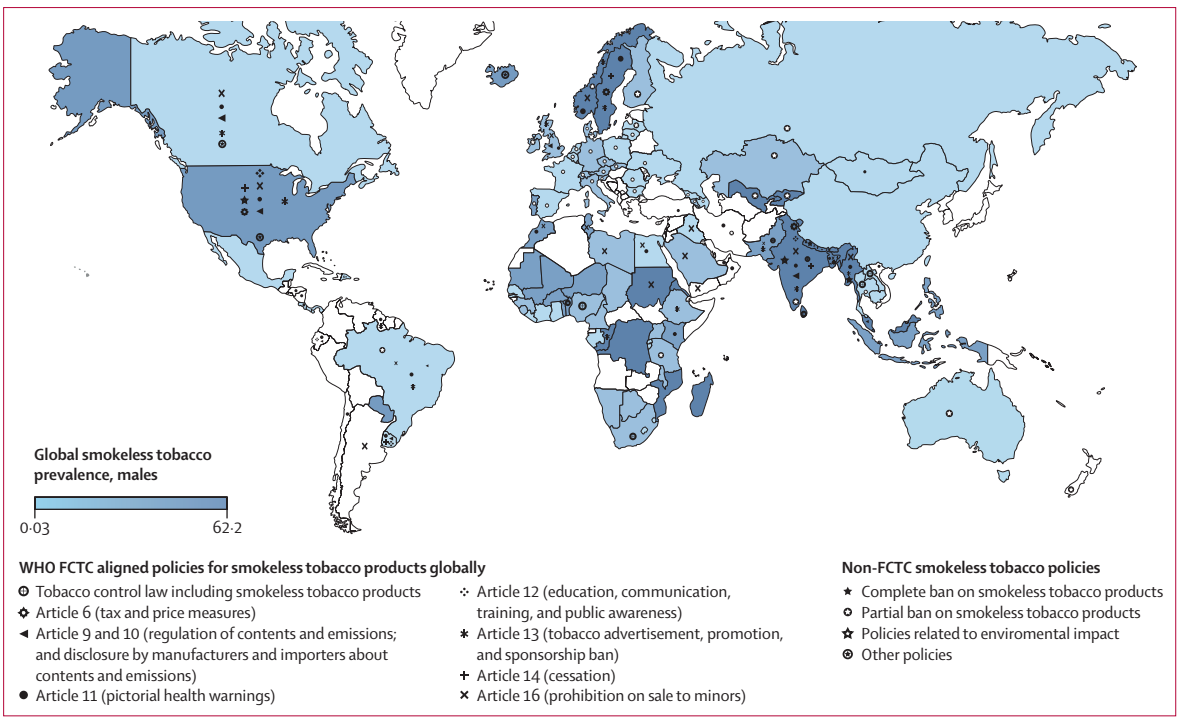

Figure 2: **Global distribution of policies within and outside the Framework Convention on Tobacco Control (FCTC) overlayed with smokeless tobacco prevalence in males**

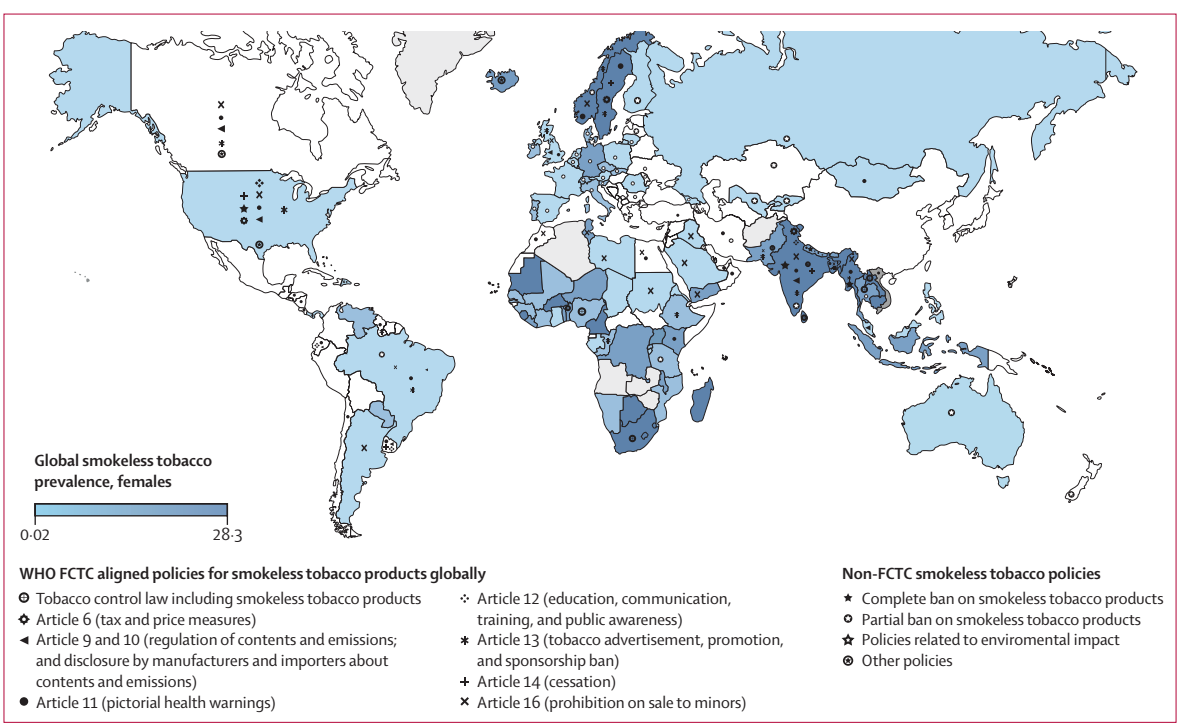

Figure 3: **Global distribution of policies within and outside the Framework Convention on Tobacco Control (FCTC) overlayed with smokeless tobacco prevalence in females**

Articles 9 and 10 (Regulation of contents and emissions) were found explicitly for smokeless tobacco in nine countries (Bangladesh, Brazil, Canada, Ecuador, India, Malaysia, UK, USA, and Uruguay). Measures ranged from licensing for selling smokeless tobacco products (Bangladesh), the ban on additives (Canada), the

mandatory depiction on tobacco packs of ingredients (tar and nicotine contents; India, UK, and USA) to the prohibition of representation or graphics that state grading, quality, or supremacy of the product (Malaysia).[21–26] In addition, the Tobacco Products Directive (2014/40/EU), which came into force on May 19, 2014, and became applicable in EU countries on May 20, 2016, required the tobacco industry to report to EU countries on the ingredients used in any tobacco products.[27] Similarly, under its Organic Law for the Regulation and Control of Tobacco (2011), Ecuador requires manufacturers to submit information regarding the ill-health effects of tobacco products, including smokeless tobacco, to authorities and the general public.[26]

Article 11 (labelling and packaging measures) was reported to be implemented in 36 countries globally. Pictorial health warnings covering 30% or more of the package area (Georgia, Sweden, and USA),[28–30] 50% or more (Argentina, Bangladesh, Egypt, Seychelles, Chile, Costa Rica, Ecuador, El Salvador, Honduras, Iran, Kuwait, Morocco, Oman, Qatar, UAE, Nicaragua, Mongolia, Trinidad and Tobago, Türkiye, and Viet Nam),[31–34] 60% front and back (Guyana),[33] 75% of the two principal display surfaces (Canada),[26] 85% of the principal display areas on smokeless tobacco products (India),[35–39] and 90% of the principal display areas on smokeless tobacco products (Nepal)[37,38] were reported to be mandatory in countries. In Brazil, health warnings were required on 30% of the front and 100% of the back of the package.[30] Countries including Australia, Saudi Arabia, Thailand, and Uruguay required plain packaging of tobacco products, including smokeless tobacco.[26–28,40] In addition, textual health warnings were reported to be obligatory in Canada, Dominican Republic, Myanmar, Sweden, UK, and USA.[21,23,41–44] The EU Tobacco Products Directive highlighted that European countries require health warnings on tobacco and related products.[33]

Article 12 (Education, communication, training, and public awareness) was reported in studies from five countries (Ecuador, India, Lebanon, USA, and Uruguay). Provisions under the Family Smoking Prevention and Tobacco Control Act 2009 in the USA and Lebanon reported to offer education of the public or awareness raising about the risks associated with tobacco use, including smokeless tobacco use.[45] India was the only party to the Framework Convention on Tobacco Control that reported having implemented a comprehensive mass media campaign against smokeless tobacco use.[37]

Article 14 (offering tobacco cessation) was found in four countries (India, Sweden, USA, and Uruguay) only.

Article 13 (tobacco advertisement, promotion, and sponsorship) was reported in 13 countries and Europe through the EU Tobacco Products Directive.[33] Studies from countries including Bangladesh, Canada, India, and Myanmar reported having a ban on all forms of direct and indirect advertisements.[33,46–54]

From the ministry website search (appendix pp 63–65), we found that India was the only country in the world to implement Tobacco-Free Film and Television Rules including for smokeless tobacco, making it mandatory to display health warnings and provide justification for the display of tobacco products to the Central Board of Film Certification. In addition, Pakistan, through the Pakistan Tobacco Ordinance of 1968, also restricts tobacco advertising in any media if advertisements are not aligned to guidelines prescribed by a Federal committee.

Article 16 (restrictions on sale to and by minors) was found in 13 countries (Argentina, Bangladesh, Brazil, Canada, Dominican Republic, India, Myanmar, Nepal, Norway, Pakistan, Trinidad and Tobago, UK, and USA) and the Eastern Mediterranean region.[55] Studies from Argentina, Bangladesh, Brazil, Canada, Dominican Republic, India, Myanmar, Nepal, Pakistan, Trinidad and Tobago, and USA reported having laws prohibiting the sale of tobacco products, including smokeless tobacco to minors (below the age of 18 years).[25,30,33,42,56–61] In addition, studies from India and Myanmar[33,62] reported prohibition on the sale of tobacco products within 100 yards of educational facilities. From the ministry's website search results, it was found that Pakistan also prohibited the sale of tobacco products within 50 metres of educational institutes.[63]

Policies outside the Framework Convention on Tobacco Control were reported by 17 countries across all regions (appendix pp 66–70).

A complete ban on smokeless tobacco, including comprehensive bans on cultivation, manufacture, distribution, and sale of smokeless tobacco products, was found in Bhutan, Singapore, and Sri Lanka.[33,38,64–68] Australia, Bahrain, Brazil, India, Iran, Tanzania, Thailand, New Zealand, and UK reported having partial import and sale bans on some forms of smokeless tobacco products.[33,38,64–67,69]

Policies related to the environmental impact of tobacco products, such as the prohibition of the use of plastic sachets for packaging of smokeless tobacco products (only in India) and a ban on tobacco use in public places (Guam, India, Myanmar, Nepal, Pakistan, and USA) were being implemented as policy measures drawing strength from Article 18 of the Framework Convention on Tobacco Control but going beyond Framework and MPOWER measures.[58,70,71] A spitting ban was found in several states of India during the COVID-19 pandemic to restrict the spread of SARS-CoV-2 transmission.[25] Myanmar also imposed bans on the use of smokeless tobacco in metropolitan areas and Nepal imposed bans on the use of smokeless tobacco in government workplaces and public spaces.[33,38]

Other measures outside the Framework Convention on Tobacco Control, such as a ban on smokeless tobacco at sport venues in city baseball parks were observed in the US cities of Chicago, New York, San Francisco, Boston, and Los Angeles.[72–75] In addition, policies being implemented in Canada (requirements for manufacturer

reporting) and Guam (tobacco-free campus policy for all government facilities) were found to extend beyond Framework Convention on Tobacco Control measures.[33,76]

18 studies evaluating the impact of smokeless tobacco policies were included (table 1). Nine of 18 studies were from USA,[72,77–84] three studies were from India,[85–87] two studies were from Norway,[88,89] and one study each was from South Africa,[90] Finland, [91] Pakistan,[92] and Sweden.[29] Eight of 18 studies reported changes in smokeless tobacco prevalence[29,77,79,82–84,86,90] and one study reported a change in quit attempts.[87] Children and young people were study participants in four of 18 studies,[79,82,83,91] adults in three studies,[77,84,86] all age groups in one study, and ten studies did not specify the age range. Four of these 18 studies used simulation models.[29,77,84,87]

Nine of 18 studies reported a range of secondary outcomes, which included a mix of measures oriented towards tobacco retailers (change in unit sales of flavoured smokeless tobacco, per capita sales volume and percent of stores selling flavoured smokeless

	Country	Study design	Policy	Age of participants	Outcome	Comparator	Quality of study
Primary outcomes							
Smokeless tobacco prevalence—pricing and taxation policies							
Huang and Chaloupka (2012)[82]	USA	Quasi-experimental (difference-in-differences study on a pre-post survey with a control group)	FCTC, Article 6 (April 2009 federal tobacco excise tax)	Children and youth	% change in smokeless tobacco use prevalence after tax increase	Pre-tax smokeless tobacco use	Strong
Hawkins et al (2018)[79]	USA	Quasi experimental (difference-in-differences study on repeated cross-sectional surveys)	FCTC, Article 6 (State tax on chewing tobacco)	Children and youth	% change in smokeless tobacco use probability with a 10% tax increase	Pre-tax smokeless tobacco use	Moderate
Ayo-Yusuf (2005)[90]	South Africa	Cross-sectional surveys (descriptive trend analysis)	FCTC, Article 6	Adult and youth	Annual % change in smokeless tobacco use prevalence (relative change in tobacco use rates between the two reporting periods 1998–2003)	Prevalence in 1998	Moderate
Grube et al (2021)[83]	USA	Cross-sectional surveys (interrupted time-series analysis)	FCTC, Article 16 (minimum age to purchase tobacco increased to 21 years in June, 2016, in California)	Adolescents	Change in lifetime smokeless tobacco use prevalence by 2017–18, and change in the past 30 days smokeless tobacco use prevalence by 2017–18	Prevalence in 2010–11	Moderate
Smokeless tobacco prevalence—multiple policies							
Abdulkader et al (2019)[86]	India	Cross-sectional surveys (descriptive trend analysis)	FCTC Articles 6, 9, 11, 13, 16 and non-FCTC complete ban in 2011	Adults	% change in smokeless tobacco use prevalence (relative percentage change was calculated for two-time intervals 1987–2005 and 2005–16 to assess the impact of FCTC)	Prevalence in 2005	Weak
Smokeless tobacco prevalence—multiple policies (using simulation models)							
Near et al (2014)[29]	Sweden	Markov simulation modelling (SimSmoke Tobacco Control Policy Model)	FCTC Articles 6, 11, 12, and 14	..	% change in snus prevalence between 2010 and 2020 or 2040 by men and women (projected for future years)	Prevalence in 2010	Strong
Levy et al (2018)[77]	USA	Markov simulation modelling (SimSmoke Tobacco Control Policy Model)	FCTC Articles 6, 11, 12, 13, 14, and 16	Adults	% change in smokeless tobacco use prevalence by 2017 (relative change measured as the absolute difference in prevalence between the end and the initial year of the specified period divided by the prevalence of the initial year)	Prevalence in 1993	Strong
Sánchez-Romero et al (2022)[84]	USA	Markov simulation modelling (Kentucky SimSmoke Tobacco Control Policy Model)	FCTC Articles 11, 12 (national anti-tobacco campaigns in 2014), 13, and 14	Adults	% change in smokeless tobacco use prevalence between two scenarios: policies implemented in 1993 and policies implemented from 1993 to 2018, projected for 2040 or 2060 (relative difference in prevalence between the counterfactual [1993] and status-quo [2018] scenarios)	Prevalence in 1993	Moderate
Smokeless tobacco cessation							
Murukutla et al (2018)[87]	India	Modelling study (using secondary datasets)	FCTC Article 12 (Mass media campaign in 2009)	..	% increase in quit attempts, net increase in sustained quit of smokeless tobacco a year after launch of the campaign, and future deaths averted (expected number of tobacco-attributable deaths averted among cohort of quitters)	Quit attempts in individuals unaware of the campaign	Weak

(Table 1 continues on next page)

	Country	Study design	Policy	Age of participants	Outcome	Comparator	Quality of study
(Continued from previous page)							
Secondary outcomes							
Rogers et al (2017)[78]	USA	Quasi-experimental comparison design (using retail scanner data between 2010–14)	Non-FCTC ban on flavoured non-cigarette tobacco products (implemented in July, 2010, in New York City)	NA	% change in unit sales of restricted (flavoured) smokeless tobacco products degree to which changes in the level and slope of unit sales of restricted products in New York were coincident with ordinance implementation (in January, 2014, and different from those seen in comparison areas)	Unit sales of restricted (flavoured) smokeless tobacco products in comparison areas without policy	Strong
Huhtala et al (2006)[91]	Finland	Cross-sectional surveys (trend analysis)	Non-FCTC: smokeless tobacco complete ban, total snus sales ban in 1995	Adolescents	Trends of snus use—experimental use and current use, and snus acquisition	Trends of cigarette use	Strong
John and Dauchy (2021)[85]	India	Repeated cross-sectional surveys (trend analysis)	FCTC Article 6 (Goods and Services Tax on smokeless tobacco in India 2017–18)	..	Affordability of smokeless tobacco, measured in terms of relative income price*	Affordability of smokeless tobacco pre-goods and services tax	Strong
Hrywna et al (2019)[80]	USA	Cross-sectional (biannual market-level retail scanner data)	FCTC Article 6 (state-level taxes on moist snuff)	NA	Per capita sales volume of moist snuff (2010)†	Per capita sales volume of moist snuff (2005)	Moderate
Klein et al (2017)[81]	USA	Experimental design (participants were randomly assigned to one of two conditions with a health warning covering 20% of an SLT advertisement: a control condition using one of four TCA-mandated text-based warnings; or an intervention condition using one of four TCA-mandated text-based warnings plus a graphic image)	FCTC Article 11 (Tobacco Control Act by FDA mandating Graphic Health Warning on tobacco packs)	..	Recall of health warnings among those exposed to the Graphic Health Warning packs	Recall of health warnings among individuals exposed to the text-only packs	Moderate
Nilsen et al (2018)[88]	Norway	Pre-post design with a control group	FCTC Article 11 (changes in text warnings on snus in 2016)	..	Risk perception after seeing warning labels	Control group of snus product with no warning, and risk perception before seeing warning labels	Moderate
Scheffels and Lavik (2013)[89]	Norway	Repeated cross-sectional surveys	FCTC Articles 9 and 13	..	Consumer perceptions and experiences of POS display ban: difficulty choosing brand post-POS display ban (post-ban 2010), and difficulty buying brand post-POS display ban (post-ban 2010)	Temptation to buy tobacco due to POS display (pre-ban 2009)	Weak
Datta et al (2019)[92]	Pakistan	Cross-sectional surveys (trend analysis)	FCTC Articles 12 (national anti-tobacco campaigns in 2014) and Article 13	NA	Change in household tobacco consumption between 2005 and 2008, 2012, 2016, and change in average tobacco expenditure share in household budget between 2005 and 2008, 2012, 2016‡	% household tobacco consumption and average tobacco expenditure share in 2005	Weak
Kephart et al (2019)[72]	USA	Cross-sectional surveys	FCTC Article 16 (restriction on the sale of flavoured smokeless tobacco products to minors January, 2016)	NA	% stores selling flavoured tobacco products, average number of flavoured tobacco products being sold, and % of stores with flavoured product advertisements	Same outcomes pre-restriction on the sale of flavoured smokeless tobacco	Weak

FCTC=Framework Convention on Tobacco Control. FDA=Food and Drug Administration. POS=point of sale. SLT=smokeless tobacco. TCA=Family Smoking Prevention and Tobacco Control Act. *Defined as the % of per-capita GDP required to purchase 100 g of smokeless tobacco in a year. †Calculated by dividing the total moist snuff sales volume in a market by the market population size for each year. ‡Extensive margin is the average for all households including tobacco non-user households and reflects population level impact of tobacco use on household resources.

Table 1: **Study characteristics presented for primary and secondary outcomes**

tobacco products) and tobacco users (perception and experiences of point-of-sale display ban, perception of risk to harms of tobacco use, affordability of smokeless tobacco, and recall of health warnings and average tobacco expenditure; table 1). We did not find any studies reporting changes in smokeless tobacco

initiation or change in health outcomes of cancers and cardiovascular disease.

The studies evaluating the impact on smokeless tobacco prevalence looked at a range of Framework Convention on Tobacco Control policies between 2005 and 2021. Three of 18 studies looked exclusively at Article 6 (pricing and taxation),[79,82,90] two of which focused on youth. Three of 18 studies looked at a mix of Framework Convention on Tobacco Control policies,[29,77,84] one study looked at Article 12 (mass media campaign),[87] and another looked at Article 16 (sale to minors).[83] Two[78,91] of the nine studies reporting secondary outcomes evaluated policies outside the Framework Convention on Tobacco Control—mainly a ban on smokeless tobacco products in some form. In total, six of 18 studies were deemed to be strong, seven moderate, and five weak

	Sample size	Sex	Before policy	After policy	Change (%)	Effect estimates
Primary outcomes						
Smokeless tobacco prevalence—pricing and taxation policies						
Huang and Chaloupka (2012)[82]	46 000	Combined	Prevalence 6·06% (March 2009; n=4804)	Prevalence 4·22% (May 2009; n=5676)	–30·3%	Adjusted estimate of percent decrease in smokeless tobacco use after tax increase in difference-in-differences model –16%
Hawkins et al (2018)[79]	499 381	Males	Prevalence 12·3%	..	..	Adjusted marginal effects model: tobacco tax increase 0·0001 (95% CI –0·0001 to 0·0002)
Hawkins et al (2018)[79]	499 381	Females	Prevalence 2·0%	..	..	Adjusted marginal effects model: tobacco tax increase –0·0000 (95% CI 0·0001 to 0·0000)
Ayo-Yusuf (2005)[90]	Not specified	Adult males	Prevalence 0·9% (1998)	Prevalence 0·4% (2003)	–11·1%	..
Ayo-Yusuf (2005)[90]	Not specified	Adult females	Prevalence 10·2% (1998)	Prevalence 6·6% (2003)	–7·1%	..
Ayo-Yusuf (2005)[90]	Not specified	Adolescent males (snuff)	Prevalence 20·7% (1998)	Prevalence 15·9% (2003)	–7·7%	..
Ayo-Yusuf (2005)[90]	Not specified	Adolescent females (snuff)	Prevalence 15·1% (1998)	Prevalence 13·1% (2003)	–4·4%	..
Grube et al (2021)[83]	2 956 054	Combined	..	..	..	Odds ratio 0·97 (95% CI 0·95 to 1·00)
Smokeless tobacco prevalence—multiple policies						
Abdulkader et al (2019)[86]	Not specified	Combined	Prevalence 23·4% (2005)	Prevalence 19·3% (2016)	–17·6%	..
Abdulkader et al (2019)[86]	Not specified	Males	Prevalence 36·9% (2005)	Prevalence 28·7% (2016)	–22·2%	..
Abdulkader et al (2019)[86]	Not specified	Females	Prevalence 9·0% (2005)	Prevalence 9·4% (2016)	4·3%	..
Smokeless tobacco prevalence—multiple policies (using simulation models)						
Near et al (2014)[29]	Not specified	Males	Prevalence 14·6% (2010)	Prevalence 12·7% (2011); 12·0% (2020); 10·4% (2040)	–12·8% (2011); –16·5% (2020); –22·7% (2040)	..
Near et al (2014)[29]	Not specified	Females	Prevalence 3·3% (2010)	Prevalence 2·9% (2011); 2·9% (2020); 2·8% (2040)	–13·2% (2011); –16·0% (2020); –21·9% (2040)	..
Levy et al (2018)[77]	Not specified	Males	Prevalence 3·2% (1993)	Prevalence 2·4% (2015)	–24·2%	..
Levy et al (2018)[77]	Not specified	Females	Prevalence 0·4% (1993)	Prevalence 0·1% (2015)	–70·9%	..
Sánchez-Romero et al (2022)[84]	Not specified	Males	Prevalence (counterfactual) 7·1% (1993); 5·6% (2018); 4·8% (2040); 4·5% (2060)	Prevalence (status quo) 7·1% (1993); 5·3% (2018); 4·7% (2040); 4·5% (2060)	–1·5% (2040, range 1·1 to –4·3); 0·9% (2060, range 2·8 to –1·4)	..
Sánchez-Romero et al (2022)[84]	Not specified	Females	Prevalence (counterfactual) 0·5% (1993); 0·1% (2018); 0·1% (2040); 0·1% (2060)	Prevalence (status quo) 0·5% (1993); 0·1% (2018); 0·1% (2040); 0·1% (2060)	6·2% (2040, range 5·6 to 6·7); 12·1% (2060, range 9·5 to 14·5)	..
Smokeless tobacco cessation						
Murukutla et al (2018)[87]	129 768 030	Combined	Rate (status quo) 34·2%	Rate (campaign scenario) 47·5%	13·3%	..

(Table 2 continues on next page)

	Sample size	Sex	Before policy	After policy	Change (%)	Effect estimates
(Continued from previous page)						
Secondary outcomes						
Rogers et al (2017)[78]	Not specified	NA	Unit sales of flavoured smokeless tobacco: New York 5057·30; comparison areas: proximal to New York 30 558·89, USA 3 745 451·02	Unit sales of flavoured smokeless tobacco: New York 123·17; comparison areas: proximal to New York 28 606·18, USA 4 354 275·17	New York: –97·6%; comparison areas: proximal to New York –6·4%, USA –16·3%	..
Huhtala et al (2006)[91]	Varies across surveys	..	..	..	..	A significantly increasing trend (p=0·05) from 1995 to 2001 in experimental use of snus in all age and sex groups; an increase in current use was observed in boys aged 16 years and 18 years (p<0·001)
John and Dauchy (2021)[85]	Not specified	..	..	..	..	By 2018–19, 2 years into the Goods and Service Tax introduction, the affordability of smokeless tobacco had increased by 8·5%
Hrywna et al (2019)[80]	4104–49 288 sales records	..	Moist snuff consumption per capita 1·65 units (2005)	Moist snuff consumption per capita 2·38 units (2010)	44·2%	..
Klein et al (2017)[81]	142	..	53%	76%	..	Odds ratio 2·79 (95% CI 1·36 to 5·71)
Nilsen et al (2018)[88]	423	..	Mean (SD) before seeing warning labels: control 5·68 (1·93); causes cancer* 5·90 (2·21); Can-can† 5·96 (2·11); Can-is‡ 5·89 (1·91); Will-is§ 5·89 (1·96)	Mean (SD) after seeing warning labels: control 5·72 (2·05); causes cancer* 6·22 (2·24); Can-can† 5·97 (2·21); Can-is‡ 6·03 (1·99); Will-is§ 6·03 (2·15)	..	..
Scheffels and Lavik (2013)[89]	900	..	Consumer perceptions and experiences of POS display ban: 25% reported being tempted to often or sometimes buy tobacco	Consumer perceptions and experiences of POS display ban: 31% found it difficult to choose brand due to the new ban; 20% found it difficult to buy tobacco products due to the new ban	..	..
Datta et al (2019)[92]	Number of households: 2005 (14 697); 2008 (15 512); 2012 (15 807); 2016 (24 238)	..	% of households consuming smokeless tobacco in 2005: 21·17 (95% CI 19·98-22·37)	% of households consuming smokeless tobacco in 2008: 16·73 (95% CI 15·67–17·79); in 2012: 18·32 (17·37–19·26); in 2016: 18·51 (17·61–19·40)	..	Adjusted relative risk ratio 0·62 (2008), 0·77 (2016)
Kephart et al (2019)[72]	353 tobacco retailers	..	Stores selling flavoured tobacco products is 100%; average number of flavoured products sold is 19·5; stores with flavoured product advertisements is 58·9%	Stores selling flavoured tobacco products is 14·4%; average number of flavoured products sold is 0·39; stores with flavoured product advertisements is 28%	..	..

POS=point of sale. *This reference denotes "this tobacco product severely damages your health. Causes cancer." †This reference denotes "this tobacco product can damage your health and be addictive." ‡This reference denotes "this tobacco product can damage your health and is addictive." §This reference denotes "this tobacco product damages your health and is addictive."

Table 2: **Impact of smokeless tobacco control policies on smokeless tobacco prevalence, cessation, and secondary outcomes**

when assessed for quality using the Qualitative Assessment Tool for Quantitative Studies.

Three of the eight studies on smokeless tobacco prevalence were modelling studies. All three studies used the well established SimSmoke simulation model adapted to incorporate smokeless tobacco; two[29,84] of the three studies projected population growth and tobacco use rate from the base year to future years, and one study[93] used actual data to estimate the impact of tobacco control policies between the base year 1993 and 2017. SimSmoke is a simulation model that incorporates population and smoking dynamics and looks at the effect of the major tobacco control policies over time on smoking initiation and cessation.[94,95] The model uses standard attribution methods to estimate lives saved as a result of new policies. SimSmoke has been used for advocacy and planning purposes to examine the impact of past and projected future policies individually and in combination. The model has been developed and validated for over 25 nations and eight states with a wide

range of different policy changes.[77] The study[77] that did an empirical assessment of actual effects (as compared with projections in the other two studies[29,84]) used data from the large-scale US National Cancer Institute's Tobacco Use Supplement to the Current Population Survey with 1993 policy levels, and incorporated US national and state policy changes occurring between 1993 and 2017. The model was updated and extended to incorporate smokeless tobacco use. After validating against Tobacco Use Supplement survey data up until and including 2015, the model was used to estimate the impact of policies implemented between 1993 and 2017.

Table 2 outlines the impact of smokeless tobacco policies on smokeless tobacco outcomes. Seven of eight studies on smokeless tobacco prevalence found a positive impact of Framework Convention on Tobacco Control policies: a reduction in smokeless tobacco prevalence of between 4·4% and 30·3% for taxation and between 22·2% and 70·9% for multifaceted policies (excluding two predictive modelling studies).[29,84] The reduction of 70·9%[77] should be considered with caution as the baseline prevalence from which this change was noted was 0·4%, making this a small absolute change. Hawkins and colleagues[79] found no evidence of an effect of smokeless tobacco taxes on adolescent use over the last 15 years. In contrast, the study found that a 1% increase in cigarette taxes was associated with a 0·1% point increase in smokeless tobacco use (0·0010, 95% CI 0·0003 to 0·0017) among males.

Figure 4 shows the forest plot for studies reporting change in smokeless tobacco prevalence; CIs were only reported in two of 18 studies (appendix p 71). Abdulkader and colleagues[86] evaluated the impact of multiple Framework Convention on Tobacco Control policies and a non-Framework policy (complete smokeless tobacco ban in 2011) on smokeless tobacco prevalence and reported a positive impact in males (–22·2%) but an increased prevalence (4·3%) in females (combined –17·6%).[86] Given the baseline prevalence of 0·9%, this is a small absolute change and the authors noted that smokeless tobacco prevalence increased in India from 15% in 1987 to 24·2% in 2009 and thereafter declined to 19·3% in 2016. Although they observed a similar pattern among men and women, in males, the decline began earlier than in females (2005 *vs* 2009).

The two SimSmoke modelling studies that projected the effect of policies on future years found similar estimates to the overall results for smokeless tobacco prevalence. Near and colleagues[29] modelled the impact of multiple policies (Articles 6, 11, 12, and 13), and future policies on smoking and snus prevalence, concluding that premature deaths can be prevented when large taxes are implemented in combination with other tobacco control policies. Sanchez-Romero and colleagues[84] modelled the impact of multiple Framework Convention on Tobacco Control policies by 2060, estimating an increased smokeless tobacco prevalence (0·9% in males and 12·1% in females) for a status-quo scenario (ie, policies implemented between 1993 and 2018) compared with a counterfactual scenario (ie, policies set at 1993 level). The study also estimated that a smokeless tobacco tax increase of US$2 would yield a 10% (5·2–15·2%) immediate relative reduction for male and a 9·3% (4·8–14·1%) immediate relative reduction for female exclusive smokeless tobacco users, increasing to 18·5% for males and 12·7% for females by 2060.

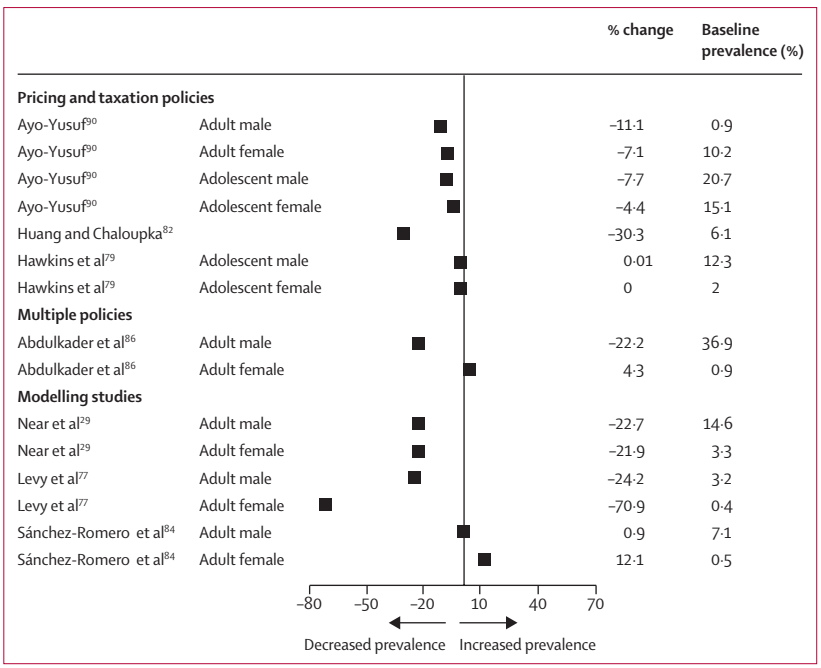

Figure 4: **Percentage change in smokeless tobacco prevalence following implementation of smokeless tobacco policies**

The only study reporting on cessation[87] found a 13·3% increase in quit attempts in those exposed (47·5%) to smokeless tobacco control mass media campaigns in India in 2009, compared with non-exposed (34·2%).

All secondary outcomes showed a positive impact of the policies. One study[78] evaluating the non-Framework policy of sales bans reported significant reductions in smokeless tobacco sales (–6·4%) but the other[91] reported an increased trend in experimental snus use in youth after a total sales ban in 1995 in Finland, likely due to cross-border smuggling. Kephart and colleagues[72] looked at sales of flavoured smokeless tobacco products in the USA and found that the policy restricting the sale of flavoured tobacco products was associated with a decrease in the sale from an average of 19·5 flavoured products at baseline to an average of 0·39 products at follow-up, among all stores. Klein and colleagues' study,[81] which followed an experimental study design, found that male smokeless tobacco users who were exposed to a smokeless tobacco advertisement with a graphic health warning had an increased recollection of health warnings (76%) as compared with those exposed to only textual health warnings (53%). John and Dauchy[85]

concluded that the Goods and Services Tax on smokeless tobacco in India in 2017–18 had little impact on real prices for smokeless tobacco. It seems that the increase in real income (of individuals) has completely overshadowed the price effects, resulting in increased affordability of smokeless tobacco by the first year after the Goods and Services Tax.

Discussion

We identified smokeless tobacco policies from 57 countries worldwide; Article 11 (Pictorial health warnings) and Article 13 (Tobacco advertisement, promotion, and sponsorship ban) of the Framework Convention on Tobacco Control were the most implemented. Studies evaluating the impact of these policies reported a reduction in smokeless tobacco prevalence; the relative percentage decrease in smokeless tobacco prevalence attributed to taxation on products varied from 4·4% (baseline prevalence 15·1%) to 30·3% (baseline prevalence 6·1%).

Non-Framework measures identified in this systematic review included: a complete ban on smokeless tobacco products in Bhutan, Singapore, and Sri Lanka; a partial ban on smokeless tobacco products in nine countries in addition to all European countries (except Sweden); an import ban of smokeless tobacco products in Thailand, Iran, and Niue; and a ban on tobacco use in public places in Guam, India, Myanmar, Pakistan, Nepal, and the USA.

Most reports were on overall tobacco use with a focus on smoking forms rather than issues related to smokeless tobacco. Smokeless tobacco policies were vaguely addressed in tobacco control laws, guidelines, and interventions in most countries. Policy research around smokeless tobacco use, cessation, environmental impact of smokeless tobacco, and second-hand impact of spitting associated with smokeless tobacco use were not comprehensively addressed in scientific or grey literature. Our review also found that there is no standard definition of measures used for evaluating the impact of smokeless tobacco policies, including the way prevalence is measured and reported, with no standard or recommended outcomes to use for impact evaluation of smokeless tobacco policies.

An earlier systematic review[96] highlighted that 138 parties to WHO's Framework Convention on Tobacco Control defined smokeless tobacco in their statutes, underscoring the gap in the scientific literature on studying the impact of smokeless tobacco policies. This gap is further amplified by policy documents from countries that only mention tobacco, without making a distinction between smoking and smokeless tobacco-specific provisions. A previous paper by Siddiqi and colleagues[97] reported a wide disparity between policies related to smoking and those related to smokeless tobacco in Pakistan. Apart from restricting general advertisement and sale of smokeless tobacco products in the vicinity of educational institutes, all other policies were not applied to smokeless tobacco in Pakistan. Omitting detailed administrative and technical instructions increases the likelihood of implementation barriers, leaving too much room for discretion in the implementation and enforcement of regulatory approaches, and reducing the effectiveness of policies. It is also evident from earlier literature that smokeless tobacco requires focused interventions for product-specific characteristics (eg, spitting behaviour) associated with chewing smokeless tobacco products. This systematic review highlights how the integration of smokeless tobacco and smoking products under Tobacco Regulations makes it difficult to study the differential impact of tobacco control policies on different tobacco product use.

With over 140 countries reporting smokeless tobacco use globally,[98,99] the sixth session of the Conference of Parties agreed to accelerate research on smokeless tobacco and stringent regulation for new and existing products in 2014.[100] WHO's Framework Convention on Tobacco Control is a landmark global treaty that provides a framework to combat the use of all forms of tobacco; however, to date, the regulatory measures have focused more on smoking than smokeless tobacco.[101] WHO MPOWER strategies are data driven, cost-effective approaches that monitor, evaluate, and measure progress on tobacco control at the global level in a systematic manner, and evidence suggests that countries implementing these strategies have been able to achieve significant progress in tobacco control.[9] Our systematic review highlights several research gaps and insufficient evidence on smokeless tobacco policies, their descriptions, and impact evaluations, emphasising the need to continually evolve existing guidelines and frameworks to incorporate new evidence on policies that might work for smokeless tobacco control.

With regard to implementation of Framework Convention on Tobacco Control articles for smokeless tobacco, a policy analysis from another publication by Mehrotra and colleagues[96] revealed Article 11 was implemented by 41 parties and Article 13 was implemented differentially—16 parties had a comprehensive ban on tobacco advertisement, promotion, and sponsorship of smokeless tobacco products and 47 parties had a complete ban on sponsorship. In addition, the WHO Global Tobacco Epidemic Report 2021 ascertained enforcement of Article 6 (price and taxation measures) related to smokeless tobacco in more than 20 countries, whereas our review found implementation of Article 6 in 11 countries. Even though policies around smokeless tobacco prevention and control exist in countries, they are not being adequately researched and their impacts are not fully assessed and published in the main section of tobacco reports or in scientific literature. This information might appear in appendices and supplementary files, which might not be accessed by policy makers and other key stakeholders. Even though

tobacco control policies work for both smoking and smokeless forms of tobacco products, smokeless tobacco requires special focus, for example with taxation. In fact, the taxes imposed on smokeless tobacco products were reported to be lower than on smoking products in many countries.[102] These differences could potentially lead to an unintended increase in the prevalence of smokeless tobacco as a direct consequence of disparity in cigarette taxation, as people switch from cigarettes to cheaper forms of tobacco.[79]

This review is unique in the approach taken to summarise and synthesise a broad range of policies implemented for addressing smokeless tobacco use globally, without restricting to only Framework Convention on Tobacco Control measures, because previous reviews have highlighted that Framework Convention on Tobacco Control measures significantly impact the use of smoking but might have little impact on the use of smokeless tobacco.[97,103] For comprehensive coverage of the topic, we included grey literature and ministry websites in addition to extensive searching of scientific databases. We defined smokeless tobacco control policies as those being implemented or enforced by law or government authorities. Community-based interventions (awareness or cessation efforts led by non-governmental organisation) or region-specific guidelines and experimental initiatives were not included.

Limitations of this review include the low number of studies evaluating the impact of smokeless tobacco policies, heterogeneity in descriptions and reporting (of both policies and outcomes), and robustness of methods used. Our original aim was to present data using the contextual framework as envisaged in our published protocol,[15] but sparse descriptions of important policy indicators did not allow this analysis. Some policy descriptors were available on the ministry websites but an advanced document analysis that would involve cross-linking of different data sources and possibly retrieving more documents was considered out of scope due to time and resource limitations. Some of the important information regarding smokeless tobacco-related policies in countries could have been missed while conducting the systematic review. The WHO Global Tobacco Epidemic Report 2019 was analysed, and results were included in this review; however, some of the important information regarding smokeless tobacco-related policies in countries were mentioned only in the technical notes and appendices, but not in the main report. As we did not review appendices and supplementary files due to a restricted timeline, this information was not captured in our review. Thus, we recommend smokeless tobacco-related measures be included in MPOWER policies.

It is crucial to enforce policies specific to smokeless tobacco and study the impact of such policies to understand the burden attributable to smokeless tobacco and its trajectory in high-burden countries and globally. The gap between policy impact assessments for smokeless tobacco compared with other forms of tobacco is wide. For example, even with a comprehensive review of literature, we did not find any studies of impact that reported changes in health outcomes of cancers. Only a few countries have published papers on impact assessment, underscoring the need to step up smokeless tobacco research and funding to support smokeless tobacco prevention and control efforts in countries around the globe. Four of the 18 studies evaluating impact of smokeless tobacco policies used simulation models, three used quasi-experimental designs (a pre-post survey design with a control group,[82] a repeated cross-sectional survey design,[79] and a comparison design using retail scanner data[78]), and all the rest used cross-sectional designs, highlighting the low number of experimental study designs for smokeless-tobacco-specific impact assessment. Another important finding is the small number of studies evaluating the impact of measures outside the Framework Convention on Tobacco Control. Furthermore, there is a crucial need to develop common outcome measures (eg, adverse health outcomes and prevalence of smokeless tobacco use) to record, report, and assess the impact of smokeless tobacco policies and to monitor the smokeless tobacco epidemic across countries.

WHO's Framework Convention on Tobacco Control has helped to develop an ecosystem of research, policy, and advocacy in tobacco control, which has enabled countries to innovate policy measures beyond the Framework to tackle smokeless tobacco burden. Future iterations of tobacco control policies and guidelines should consider expanding the scope of measures and terminology used to include creating tobacco-free and not just smoke-free environments, enforcing anti-spitting laws to prevent spread of communicable diseases (eg, COVID-19), prohibiting use of tobacco in dental care products, and aligning with environmental laws to prevent plastic packaging of smokeless tobacco products. Smokeless tobacco control policies and programmes can be included in national multisectoral frameworks and related guidelines. Terminology used for tobacco control policies needs special attention to be more comprehensive and should clearly highlight and define smokeless tobacco products. Gaps in impact assessment underscore the need to develop and consistently use standardised measures for smokeless tobacco impact evaluation and outcomes in future research studies.

In conclusion, the findings from this systematic review highlight the need to emphasise the importance of smokeless tobacco control. Given the special context of smokeless tobacco consumption, we need to refocus efforts to make it more visible in existing tobacco control guidelines. The use of terminology to describe smokeless tobacco and related measures, whether in policy or research, needs standardisation. Adding 'S', representing

smokeless-tobacco-specific measures, to existing tools and guidelines might offer the possibility for the required focus, but this is a suggestion for further debate and discussion. This review gives important insights into smokeless tobacco-related policies and contexts that can ultimately strengthen existing frameworks, such as the Framework Convention on Tobacco Control, as these continue to evolve and embrace new evidence.

Contributors

MA, MPM, KS, and OD conceptualised the study. AC, NJ, AV, AR, MPM, MAR, SF, SD, and MB contributed to the screening of the studies (title and abstract, and full-text), guided by MA and OD. Data extraction tools were developed by AC and NJ with inputs from co-authors. Data extraction, cleaning, and analysis were undertaken by AC, NJ, and AV, guided by OD and MA. All co-authors contributed to the interpretation of findings through discussions at two important meetings (Advisory Board meeting and Addressing Smokeless Tobacco and Building Research Capacity in South Asia [ASTRA] final meeting). AC, MA, and OD drafted the manuscript, with inputs from co-authors, and MA and OD verified the data. All authors approved the final version of the manuscript and had final responsibility for the decision to submit for publication.

Declaration of interests

We declare no competing interests.

Data sharing

Data collected and extracted for the review through data searches on various databases will be made available to others. Data extracted (eg, author name, year of publication, type of article, policy details, impact evaluation data) from the included studies for the review can be made available in an Excel format and shared through a URL. The data will be available from the date of publication, upon request to the corresponding author via email at monika@hriday-shan.org. The request sent should outline the purpose for which the data are required in detail. The data will be made available after seeking necessary approvals from the Principal Investigator of the ASTRA Project, or as applicable.

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