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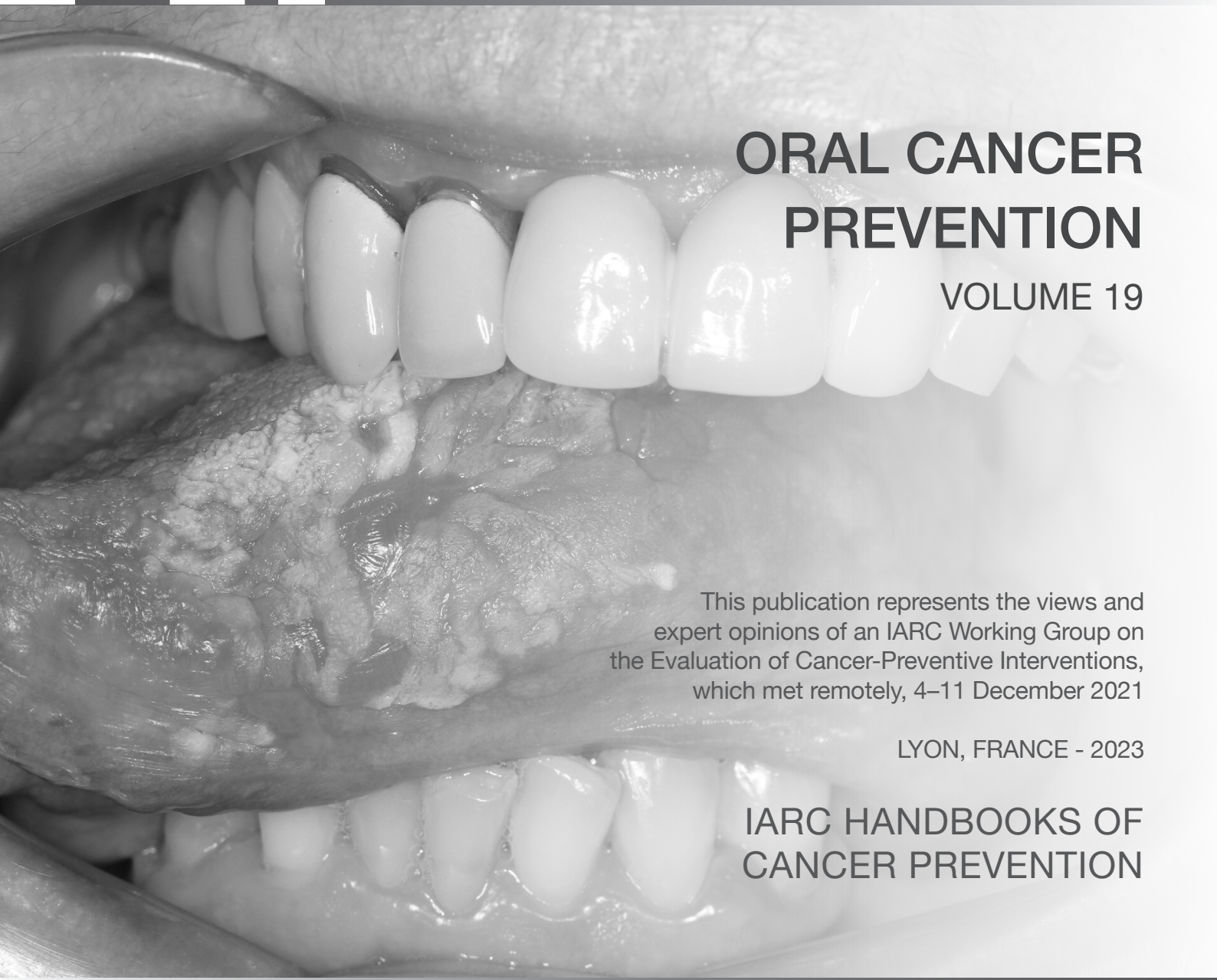

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IARC HANDBOOKS OF CANCER PREVENTION

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World Health Organization

3. CESSATION OF SMOKELESS TOBACCO AND/OR ARECA NUT USE

3.1 Product definition and description

The term "smokeless tobacco" refers to a large variety of commercially available or non-commercially available products that contain tobacco as the principal constituent and that are used either orally (chewing, sucking, placing in the cheek or lip pouch, or drinking) or nasally, without combustion (IARC, 2007; Siddiqi et al., 2020). Areca nut is the seed of the fruit of the *Areca catechu* L. (Palmaceae) tree, a palm that is indigenous to South Asia (IARC, 2004). Smokeless tobacco and areca nut may be consumed separately or combined (Mehrtash et al., 2017).

Although in some publications the term "smokeless tobacco" may include products with tobacco and areca nut combined, this *Handbook* considers the following three product categories: (i) "smokeless tobacco", defined as smokeless tobacco not containing areca nut; (ii) "areca nut without tobacco"; and (iii) "areca nut with tobacco" (Table 3.1).

Smokeless tobacco (SLT) is available as a myriad of products. They vary substantially in their names and their use in each region; the greatest diversity is observed in South and South-East Asia. For example, these products are known as *khaini*, *zarda*, *naswar*, and *gul* in South-East Asia, as *chimó* and *rapé* in South America, as plug, snuff, and *snus* in the USA, Canada, and Mexico, and as *shammah* in the Arabian Peninsula. In Sweden and some other Nordic countries, the use of *snus*, a particular type of moist snuff, is still prevalent (Siddiqi et al., 2020; WHO FCTC and ICMR-NICPR, 2022).

Preparations of areca nut mixed with tobacco are widely available commercially, such as betel quid and gutka. Areca nut may also be consumed on its own, especially in South Asia in the form of *supari*, *paan masala*, betel quid without tobacco, *binglang*, or *kili* (IARC, 2004; Cruising Maldives, 2016).

Both SLT and areca nut have been classified as carcinogenic to humans (Group 1) by the *IARC Monographs* programme (IARC, 2004, 2007, 2012). Multiple carcinogens have been identified in SLT, such as tobacco-specific *N*-nitrosamines, *N*-nitrosamino acids, volatile *N*-nitrosamines, and polycyclic aromatic hydrocarbons (IARC, 2012; Hecht and Hatsukami, 2022). Areca nut contains several alkaloids and tannins (polyphenols). Arecoline, which has been classified as possibly carcinogenic to humans (Group 2B), is the most abundant alkaloid and the key active ingredient in areca nut (IARC, 2012, 2021).

Table 3.1 Smokeless tobacco and areca nut products available in different regions

Product name	Alternative or colloquial names (if any) Location	Major constituents	Other features (mode of consumption, and processing and manufacturing)
Smokeless tobacco products (not containing areca nut)			
Chimó	WHO Region of the Americas (Venezuela, Colombia)	Tobacco leaf, baking soda, brown sugar, ashes from mamón tree	Oral (sucked, held in mouth) Cottage industry or manufactured commercially
Creamy snuff	Tobacco toothpaste Commonly used in WHO South-East Asia Region (India)	Tobacco, clove oil, glycerin, spearmint, menthol, camphor	Oral (applied to teeth and gums) Manufactured commercially
Dry snuff	Scotch snuff, snuff (USA, Canada, Germany), *taaba* (Burkina Faso), *snuif* (South Africa), *sneif* (Botswana, Lesotho, South Africa), *azǒ* (Benin), *simonte* (Kalunga community in Brazil), *tapkeer*, *tapkir*, *bajjar* (India)	Tobacco (fire-cured or air-cured, fermented, powdered), flavourings	Oral (sucked, held in mouth) or nasal Manufactured commercially
Moist snuff	Dip, spit tobacco (USA, Canada, Mexico) *Shammah*: *el-shama*, *bajeli*, *haradi*, *sharaci*, black *shammah* (Yemen), *al-shammah* (Saudi Arabia), *chemma* (Algeria)	Tobacco (air-cured or fire-cured), flavourings, inorganic salts, moisturizers, slaked lime, ash, black pepper, oil	Oral (sucked) Manufactured commercially
	Toombak: saute, *sute*, *ammari*, *saood* Commonly used in WHO Eastern Mediterranean Region (Sudan), WHO African Region (Chad)	Tobacco leaves (dried, fermented, ground, matured), sodium bicarbonate	Oral (sucked, held in mouth) or nasal Cottage industry and custom-made
Dissolvable tobacco	Dissolvables Commonly used in WHO Region of the Americas (USA)	Tobacco, moisturizers, preservatives, flavourings	Oral (sucked, held in mouth, dissolved) Manufactured commercially
Tobacco-based toothpaste or tooth powder	*Gudaku* Commonly used in WHO South-East Asia Region (India)	Tobacco powder, molasses, red soil, lime, water	Oral (applied to teeth and gums, teeth cleaning, held in mouth) Manufactured commercially and custom-made
	Gul or *gul manjan* Commonly used in WHO South-East Asia Region (India, Bangladesh)	Tobacco (fire-cured, fermented, powdered), molasses, unknown ingredients	
	Mishri or *masheri* Commonly used in WHO South-East Asia Region (India)	Tobacco (toasted on hot metal plate, powdered)	
	Tapkeer, *tapkir*, *bajjar* Commonly used in WHO South-East Asia Region (India)		
Iqmik	Blackbull, *dediguss* Commonly used in WHO Region of the Americas (USA, Alaska)	Tobacco (fire-cured), tree fungus ash or other ash derived from wood or bush	Oral (chewed) Custom-made
Khaini	*Chadha*, *sada*, *surti* (Nepal and neighbouring parts of India) Commonly used in WHO South-East Asia Region (India, Bangladesh, Nepal, Bhutan)	Tobacco leaves (coarsely cut, sun-dried, fermented), slaked lime	Oral (sucked, held in mouth) Manufactured commercially, cottage industry, and custom-made
Kiwam	*Qiwam*, *qimam*, *khiwam*, *kimam* Commonly used in WHO South-East Asia Region, WHO Eastern Mediterranean Region (Pakistan)	Paste of tobacco extract, spices (cardamom, saffron, aniseed), additives such as musk	Oral (chewed or held in mouth) Manufactured commercially

Table 3.1 (continued)

Product name	Alternative or colloquial names (if any) Location	Major constituents	Other features (mode of consumption, and processing and manufacturing)
Nass	*Naswar, niswar, nasway, nasvay* Commonly used in WHO Eastern Mediterranean Region (Pakistan, Islamic Republic of Iran, Afghanistan, United Arab Emirates), WHO African Region (South Africa), WHO European Region (Armenia, Kazakhstan, Kyrgyzstan, Uzbekistan, Poland, Slovakia)	Tobacco, ash, cotton or sesame oil, water, flavourings such as cardamom and menthol	Oral (chewed, sucked, held in mouth) Cottage industry and custom-made
Rapé	Commonly used in WHO Region of the Americas (Brazil)	Dried tobacco leaf, selected tree ashes, flavourings such as tonka bean, clove, cinnamon powder, and camphor	Nasal inhalation Cottage industry and custom-made
Red tooth powder	*Lal dant manjan* Commonly used in WHO South-East Asia Region (India)	Fine red tobacco powder, herbs, flavourings; in addition, ginger, pepper, and camphor may be used	Oral (teeth brushing, cleaning) Manufactured commercially
Snus	Commonly used in Nordic countries and some other European countries, WHO Region of the Americas (USA, Canada, Brazil), WHO African Region (South Africa)	Tobacco, moisturizers, sodium carbonate, salt, sweeteners, flavourings	Oral (held in mouth) Manufactured commercially
Tobacco leaf	*Sada pata*, *chadha* Commonly used in WHO South-East Asia Region (India, Bangladesh, Myanmar, Bhutan)	Tobacco leaf	Oral (chewed) Custom-made
	Hsey or *hsey wah* (Myanmar)	Dried raw tobacco leaves	
	Hsey me' (Myanmar)	Cured and roasted tobacco leaves	
	Hsey paung or *hnut hsey* (Myanmar)	Tobacco leaves treated with alcohol and honey	
Tobacco water	*Tuibur*, *hidakpha* Commonly used in WHO South-East Asia Region (India)	Tobacco smoke, water	Oral (sipped or gargled) Cottage industry and custom-made
Hsey paung yay or black water	Myanmar	Scented tobacco soaked in honey, lime juice, and water	
Zarda	*Dokta* Commonly used in WHO South-East Asia Region (India, Bangladesh, Myanmar, Nepal, Bhutan), WHO Eastern Mediterranean Region (Yemen)	Tobacco, lime, vegetable dyes, aromatic spices	Oral (chewed; sometimes chewed with areca nut or silver flecks) Manufactured commercially

Table 3.1 (continued)

Product name	Alternative or colloquial names (if any) Location	Major constituents	Other features (mode of consumption, and processing and manufacturing)
Chewing tobacco	Loose leaf, chew, chaw, spit tobacco Commonly used in WHO Region of the Americas (USA)	Tobacco leaf (air-cured), sugar, liquorice	Oral (chewed or held in mouth) Manufactured commercially
	Plug, chew, chaw, spit tobacco Commonly used in WHO Region of the Americas (USA, Canada)	Heavy-grade or cigar tobacco top leaves, immersed in liquorice or sugar, and pressed into a plug	Oral (chewed, sucked, held in mouth) Manufactured commercially
	Twist, chew, chaw, chewing tobacco Commonly used in WHO Region of the Americas (USA)	Tobacco, tobacco leaf extract, sweetener, flavourings	Oral (chewed, held in mouth)
	Paraky (rural Madagascar)		Oral (chewed) Manufactured mainly in cottage industry
	Hsey or *hsey-ywet kyee* (Myanmar)	Raw and cured tobacco	
	Hsey hmwe (Myanmar)	Other varieties of tobacco mixture with added fragrances	
	Bush tobacco, *pituri* or *mingkulpa* (Indigenous people in Australia)	Fresh or dry leaves of certain tobacco species, mixed with burned wood ash and chewed into a quid	Oral (sucked)
Areca nut products without tobacco			
Betel quid without tobacco	Southern China, Pacific Islands	Areca nut (fresh, unripe) alone or with lime	Oral (chewed) Cottage industry and custom-made: prepared by individual vendors for sale, or assembled at home by individual users
	Hunan Province (China)	Areca nut (dried, unripe) alone or with lime	
	South Asia	Areca nut (cured, ripe) alone or with lime	
	Taiwan (China), Hainan Island (China), Papua New Guinea, Pacific islands	Areca nut (fresh, unripe) with lime and betel leaves	
	Lao-hwa quid Taiwan (China), Papua New Guinea	Areca nut (fresh, unripe) with lime and betel inflorescence	
	Stem quid:		
	Taiwan (China)	Areca nut (fresh, unripe) with lime and betel stem	
	Guam (USA)	Areca nut (fresh, unripe) with betel leaves	
	South Asia	Areca nut (cured, ripe) with lime and betel leaves	
	Paan or *pan* (South Asia)	Areca nut (cured, ripe) with lime, an additional source of catechins, flavourings, betel leaves	
Paan masala	*Pan masala* Commonly used in WHO South-East Asia Region	Areca nut, slaked lime, catechu, flavourings, sweeteners	Oral (chewed) Manufactured commercially and cottage industry

Table 3.1 (continued)

Product name	Alternative or colloquial names (if any) Location	Major constituents	Other features (mode of consumption, and processing and manufacturing)
Areca nut	*Supari* (WHO South-East Asia Region, India), *doma khando* (Bhutan), *buah pinang* (Indonesia), *meeru bileygan'du* and *heera panna* (Maldives), *pugua* (Guam, USA), *binglang* (China) Federated States of Micronesia: *bu* (Yap), *bua* (Belau), *poc* (Pohnpei), *pu* (Chuuk) *Buai*, *dak* (Papua New Guinea), *pinang* (Malaysia), *puwak* (Sri Lanka), *gua* (Bangladesh), *mak* (Thailand), *kun-ywet* (Myanmar)	Areca nut	Oral (chewed raw, fermented, or ripened; held in mouth)
Kili	Commonly used in Maldives	Areca nut, betel, cloves, cardamom, sugar	Oral Cottage industry and custom-made: produced by individual vendors for sale in small homemade paper pouches
Areca nut products with tobacco			
Betel quid with tobacco	*Paan* or *pan* (India), *khilli pan* (Bangladesh) Commonly used in WHO South-East Asia Region, WHO Eastern Mediterranean Region, WHO Western Pacific Region	Tobacco, areca nut, slaked lime (calcium hydroxide), betel leaf, catechu (*Acacia catechu* tree extract)	Oral (chewed) Cottage industry and custom-made: prepared by individual vendors for sale, or assembled at home by individual users
Dohra	Commonly used in WHO South-East Asia Region (India)	Tobacco, areca nut, catechu, slaked lime, peppermint, cardamom	Oral (chewed) Custom-made: produced by individual vendors for sale
Gutka	Commonly used in WHO South-East Asia Region, WHO Eastern Mediterranean Region	Tobacco (sun-dried, finely chopped), areca nut, slaked lime, catechu, flavourings, sweeteners	Oral (chewed) Manufactured commercially and cottage industry
Mainpuri	*Kapoori* Commonly used in WHO South-East Asia Region (Uttar Pradesh, India)	Tobacco leaves (pieces), slaked lime, areca nut, flavourings (camphor, cloves)	Oral (chewed or held in mouth) Cottage industry and custom-made: produced by individual vendors for sale
Mawa	*Kharra* Commonly used in WHO South-East Asia Region (India)	Crushed tobacco leaves (sun-dried), areca nut (sun-cured), slaked lime	Oral (chewed) Cottage industry and custom-made: produced by individual vendors for sale
Tombol	Commonly used in WHO Eastern Mediterranean Region (Yemen)	Tobacco, areca nut, *noura*, slaked lime, catechu, *tombol* leaf	Oral (chewed, held in mouth) Custom-made

WHO, World Health Organization.

Compiled by the Working Group, with data from Atkinson et al. (1964); Ahluwalia and Duguid (1966); Gupta and Ray (2002); Gupta and Warnakulasuriya (2002); IARC (2004, 2012); Lim (2012); Blecher et al. (2014); Moghbel et al. (2016); Novais (2017); Buente et al. (2020); Gunjal et al. (2020); Joo et al. (2020); Siddiqi et al. (2020); WHO (2021a, b, c); WHO FCTC and ICMR-NICPR (2022).

3.2 Prevalence of consumption

3.2.1 WHO South-East Asia Region

There are almost 266 million adult users of SLT or areca nut with tobacco (184 million men and 83 million women) in the World Health Organization (WHO) South-East Asia Region; it is the WHO region with the highest prevalence of use of these products in adults (WHO, 2021a).

Estimates for all the countries in the WHO South-East Asia Region are given in Table 3.2. [Although several recent detailed publications are available on "smokeless tobacco" or "chewing tobacco" in the WHO South-East Asia Region, they have imprecise definitions of the products involved; also, the words "areca nut" or "betel quid" rarely appear. Therefore, it was not always possible to present quantitative information on the prevalence of use of the three important product categories, i.e. SLT alone, areca nut without tobacco, and areca nut with tobacco.]

Most of the countries in the region have reported a high overall prevalence (≥ 5%) of SLT use, ranging from 15.8% in Sri Lanka to 27.5% in Bangladesh, with a few exceptions, such as the Democratic People's Republic of Korea (0.0%) and Thailand (2.1%). The prevalence of SLT use is generally high in both men and women in most of the countries (WHO, 2021b). However, in several countries (e.g. Bangladesh, Indonesia, and Thailand), the prevalence of SLT use is slightly higher in women than in men (WHO, 2017, 2021b). Similar to the situation for adults, the WHO South-East Asia Region is the WHO region with the highest prevalence of SLT use in young people, with 4.2 million users (2.7 million boys and 1.5 million girls). Nepal has the highest reported prevalence of SLT use in adolescents (16.2%), followed by Timor-Leste (13.9%), Bhutan (12.5%), Maldives (6.2%), and Myanmar (5.7%). The prevalence of SLT use was higher in boys in all the countries, ranging from 1.4% in Indonesia to 19.7% in Nepal, except in Timor-Leste, which reported a slightly higher prevalence of SLT use in girls (14.8%) than in boys (12.2%) (WHO, 2021b). Such averages hide wide variations, given the cultural diversity of the region (Table 3.2).

In an extremely detailed global analysis of the prevalence of "chewing tobacco" in 1990–2019, unlike the trend for tobacco smoking, no significant decrease was noted in the trends of prevalence of SLT use in male or female individuals aged ≥ 15 years in countries in the WHO South-East Asia Region: Bangladesh, Bhutan, India, Myanmar, Nepal, and Sri Lanka (GBD 2019 Chewing Tobacco Collaborators, 2021). Some trends can also be interpolated from the repeated WHO Global Adult Tobacco Survey (GATS), which now includes data on SLT but not on use of areca nut products of any kind. For instance, the GATS India reported a significant decrease (–17.4%) in the percentage of current SLT users between 2009–2010 (25.9%) and 2016–2017 (21.4%) (TISS and MOHFW, 2017).

In the WHO South-East Asia Region, a common way of using tobacco is as an ingredient in betel quid (i.e. areca nut with tobacco) (see Section 3.1 and Table 3.1). Use of betel quid is an ancient practice; tobacco was added beginning in about 1600, and this is now done in many parts of South-East Asia, such as India, Bhutan, Myanmar, Nepal, and Sri Lanka (NCI and CDC, 2014). The largest variety of SLT and areca nut products are available in India, such as *khaini*, *gutka*, *zarda*, *gul*, *gudaku*, *mishri*, tobacco water, and snuff, to name a few. The GATS-2 reported the highest prevalence of use for *khaini* (11.2%), followed by *gutka* (6.8%), betel quid with tobacco (5.8%), and oral tobacco (*gul*, *mishri*, *gudaku*) (3.8%) (TISS and MOHFW, 2017). Products such as *gutka*, *khaini*, and *paan masala* have been manufactured commercially since 1975 (NCI and CDC, 2014). *Khaini* and *gutka* are also commonly used in Bangladesh (known as *khoinee*), Nepal, and Sri Lanka. In addition to chewable products, the above-mentioned SLT and areca nut with tobacco products administered through oral application,

Table 3.2 Prevalence of smokeless tobacco and areca nut use in adults and adolescents in the WHO South-East Asia Region

Country	Product type and/or most popular names	Prevalence of use (%)	Reference
Bangladesh	*Sada pata*[a], *zarda*[a], *gul*[a], *khoinee*[a], *gutka*[c], *gua*[b]	SLT: Adults: Overall: 27.5 Men: 26.9 Women: 28.1	WHO (2021b)
		Youth: Overall: 4.5 Boys: 5.9 Girls: 2.0	WHO (2021b)
		AN: 31 Three quarters of users chewed BQ with tobacco	Flora et al. (2012)
Bhutan	BQ (usually with tobacco[c], AN (called *doma khando*), *khaini*[a]	SLT: Adults: Overall: 19.7 Men: 26.5 Women: 11.0	WHO (2021b)
		Youth: Overall: 12.5 Boys: 17.0 Girls: 8.1	WHO (2021b)
India	*Khaini*[a], BQ (with and without tobacco)[b,c], *gutka*[c], *supari*[b], *mishri*[a], *gul*[a], *gudaku*[a]	SLT: Adults: Overall: 21.4 (199.4 million) Men: 29.6 Women: 12.8 AN with tobacco: 14.2 (95% CI, 13.5–14.9) Various products containing SLT alone or AN with tobacco: *Khaini*: 11.2 *Gutka*: 6.8 BQ with tobacco: 5.8 Oral tobacco (*gul*, *mishri*, *gudaku*): 3.8 *Paan masala* with tobacco: 2.8	TISS and MOHFW (2017); Singh et al. (2021); WHO (2021b)

Table 3.2 (continued)

Country	Product type and/or most popular names	Prevalence of use (%)	Reference
India (cont.)		SLT: Youth: Overall: 4.1 Boys: 4.6 Girls: 3.4	MOHFW and IIPS (2019)
		AN: ~23.9 (95% CI, 23.1–24.8) (223.79 million adults) National prevalence of use of plain AN products; lowest and highest prevalence among states Average % (statewise variation %): BQ without tobacco: 8.7 (0.3–64.9) *Paan masala* without tobacco: 4.8 (0.2–11.5) AN alone without tobacco: 8.0 (0.2–22.6)	Singh et al. (2021)
		Tribal/Indigenous people are at high risk. Of 2186 tribal households in South India, 47.6% reported daily use of BQ (with or without tobacco)	Sadath et al. (2022)
Indonesia	*Buah pinang*[b], *zarda*[a]	SLT: Men: 3.9 Women: 4.8	WHO (2017)
		SLT: Youth: Overall: 1.0 Boys: 1.4 Girls: 0.7	WHO (2021b)
		AN without tobacco: Women: 15.0 Men: 1.6 AN with tobacco: Women: 31.7 Men: 10.4	Lee et al. (2011)
Maldives	Chewing tobacco[a], snuff[a], dip[a], *supari*[b], *meeru bileygan'du*[b], *heera panna*[b]	SLT: Youth: Overall: 6.2 Boys: 9.2 Girls: 2.9	WHO (2020a, 2021b)
		SLT: Men: 8.5 Women: 4.2	WHO (2021b)

Table 3.2 (continued)

Country	Product type and/or most popular names	Prevalence of use (%)	Reference
Myanmar	*Hsey* or *hsey-ywet kyee*, *hsey* or *hsey wah*, *hsey me'*, *hsey paung* or *hnut hsey*, *hsey paung ya* or black water, *hsey hmwe*[a], *kun-ya*[b]	SLT: Youth: Overall: 5.7 Boys: 11.0 Girls: 1.5	WHO (2018, 2021b, c)
	Also, imported commercial products	SLT: Men: 58.9 Women: 18.2	WHO (2021b)
	BQ with tobacco[c], such as tobacco leaf, *hnut hsey*, *hsey paung*, chewing tobacco leaf, *kun-ywet*[b]	AN with tobacco: 84% of respondents in a survey in Yangon	Papke et al. (2020)
Nepal	*Khaini*[a], *gutka*[c], *zarda*[a], *paan masala*[b], snuff[a], *gul*[a], BQ with tobacco[c]	Lifetime BQ (with tobacco) chewing: Men: 43.6 Women: 34.9	Lee et al. (2011)
		SLT: Adults: Overall: 18.3 Men: 33.3 Women: 4.9	WHO (2021b)
		SLT: Youth: Overall: 16.2 Boys: 19.7 Girls: 12.9	WHO (2021b)
Sri Lanka	BQ with tobacco[c], *paan masala*[b], *mawa*[a], red tooth powder[a], *khaini*[a], tobacco powder[a], *zarda*[a], *gutka*[c], *puwak*[b]	SLT: Adults: Overall: 15.8 Men: 26 Women: 5.3	WHO (2021b)
		SLT: Youth: Overall: 2.4 Boys: 4.2 Girls: 0.5	WHO (2021b)

Table 3.2 (continued)

Country	Product type and/or most popular names	Prevalence of use (%)	Reference
Sri Lanka (cont.)		AN without tobacco: Men: 11.6 Women: 10.4 AN with tobacco: Men: 6.4 Women: 3.2	Lee et al. (2011)
		AN with or without tobacco: Varies by ethnicity and geography; in one province in 1029 subjects (64.6% Sinhalese, 34.9% Tamil, 0.5% other) aged > 30 years, prevalence of daily BQ chewing was 53.8%: 15.7% without tobacco and 47.4% with tobacco	Amarasinghe et al. (2018)
Thailand	*Zarda*[a], *mak*[b]	SLT: Adults: Overall: 2.1 Men: 1.5 Women: 2.7	WHO (2021b)
		SLT: Youth: Overall: 2.7 Boys: 4.1 Girls: 1.3	WHO (2021b)
Timor-Leste	*Bua*[b]	SLT: Youth: Overall: 13.9 Boys: 12.2 Girls: 14.8	WHO (2021b)
		SLT: Adults: Men: 20.9 Women: 0.2	WHO (2021b)

AN, areca nut; BQ, betel quid; CI, confidence interval; SLT, smokeless tobacco; WHO, World Health Organization.
[a] SLT alone.
[b] AN alone (without tobacco).
[c] AN with tobacco.
Compiled by the Working Group.

such as *gul*, *gudaku*, and *mishri*, are also widely prevalent in Bangladesh and Nepal.

Consumption of areca nut is deeply embedded in the social and cultural history of the entire WHO South-East Asia Region. The *Areca catechu* palm tree is indigenous to the Malay Peninsula and Sri Lanka, and cultivation has been widespread across South-East and South Asia for millennia (Gupta and Warnakulasuriya, 2002). Areca nut or its preparations without tobacco are known by various colloquial names across the region, such as *doma khando* in Bhutan, *supari* in India and Maldives, *buah pinang* in Indonesia, *meeru bileyn'd* and *heera panna* in Maldives, and *bua* in Timor-Leste (Table 3.1). Areca nut is the primary component of betel quid, which may also be consumed without tobacco. The GATS-2 India reported the prevalence of the various plain areca nut products: betel quid (8.7%), areca nut (8%), and *paan masala* (4.8%) (Singh et al., 2021). The multicountry Asian Betel-Quid Consortium study, in 2009–2010, reported a high prevalence of chewing betel quid (without tobacco) in the adult population in Indonesia (15% in women and only 1.6% in men) and Sri Lanka (11.6% in men and 10.4% in women) (Lee et al., 2011). The prevalence of use of common SLT and areca nut with tobacco products (*paan* and *gutka*) was recently reviewed (Niaz et al., 2017).

In summary, the WHO South-East Asia Region has the highest prevalence of SLT and areca nut use among all WHO regions, and a large variety of both SLT and areca nut products are consumed in this region.

3.2.2 WHO Western Pacific Region

Areca nut or betel quid with tobacco are the main products consumed in the WHO Western Pacific Region. Chewing of areca nut is deeply embedded in the social and cultural history of many parts of the region; it may be consumed on its own (known by various colloquial names across the region) or as a component of betel quid. Areca nut chewing is a very ancient custom in the Philippines, from where it gradually spread across the Western Pacific islands, as planting of the *Areca catechu* palm increased (NCI and CDC, 2014).

A significant geographical variation is noted both within and among the countries in this region; in and close to continental Asia, the habits overlap with those in the WHO South-East Asia Region, whereas further east, they tend to mimic the habits of Chinese origin. Both the nature of the habits and the subpopulations in which particular constituents of a betel quid are favoured vary widely, and these are not always adequately described in the literature. Also, in the WHO and Global Burden of Disease analyses conducted for these subpopulations, SLT use is frequently referred to as the sole habit distinguished from smoked tobacco use, with no or rare mentions of areca nut (Siddiqi et al., 2020; GBD 2019 Chewing Tobacco Collaborators, 2021). As an example of the cultural variations, in Taiwan (China) and Palau, unripe nuts are used in the betel quid, whereas in Guam (USA), white immature or red mature nuts are preferred. Unwrapped quid is preferred in Papua New Guinea and the Solomon Islands, whereas wrapped betel quid (in betel leaf) is consumed in Cambodia, Palau, and the Federated States of Micronesia. Also, the use of tobacco with areca nut or in a betel quid is not seen in all cultures in the WHO Western Pacific Region. The multicountry Asian Betel-Quid Consortium study, in 2009–2010, reported a prevalence of chewing betel quid (without tobacco) ranging from 3.6% in Malaysia to 23.9% in China in men and from 1.8% in China to 17.5% in Malaysia in women (Lee et al., 2011). Similarly, users in island countries of Melanesia are unlikely to add tobacco to the quid. Certain specific subpopulations in a few countries have a higher prevalence of use of areca nut and SLT products, such as South Asian immigrants in Australia, Fiji, and Singapore, and

Indigenous people in Australia (Kuek et al., 1990; Nambiar et al., 2020; Greenhalgh et al., 2022).

There are about 13.3 million users of SLT (11 million male and 2.3 million female) in the WHO Western Pacific Region; it is the WHO region with the lowest average prevalence of SLT use in adults (0.9% overall, 1.4% in men, and 0.3% in women) (WHO, 2021a). The WHO Western Pacific Region is socially, culturally, economically, politically, and ethnically diverse, containing both the world's most populous country, China, and the smallest territory in the world, Pitcairn Island (NCI and CDC, 2014). The prevalence of SLT use varies widely, ranging from 0.1% in women in China to 48.8% in women in Palau (WHO, 2020b, 2021b).

There are limited robust longitudinal epidemiological studies on the prevalence of use of these products, although estimates from many countries in this region are presented in Table 3.3. Based on the available information, 4 countries in the WHO Western Pacific Region have reported a high overall prevalence (≥ 5%) of SLT use; the prevalence was highest in Palau (44.4%), followed by the Marshall Islands (21.6%), the Federated States of Micronesia (11.4%), and Malaysia (10.9%) (WHO, 2020b, 2021b). The prevalence of SLT use is generally higher in men in most of the countries in the region (WHO, 2021b). However, countries such as Palau (48.8%), Cambodia (8.6%), and the Lao People's Democratic Republic (8.6%) have a significantly higher prevalence of SLT use in women than in men (WHO, 2020b, 2021b). The WHO Western Pacific Region is the WHO region with the lowest prevalence of SLT use in adolescents (aged 13–15 years), with 0.9 million users (0.6 million boys and 0.3 million girls), but the prevalence of use is significantly high in Kiribati (38.6%), the Federated States of Micronesia (16.0%), the Marshall Islands (14.9%), Palau (14.7%), and Papua New Guinea (12.2%) (WHO, 2021a, b). The prevalence of SLT use was higher in boys in most of the countries, ranging from 1.3% in Cambodia to 42.5% in Kiribati, except in three countries that reported a relatively higher prevalence of SLT use in girls – Palau (16.8%), Papua New Guinea (13.6%), and Tuvalu (3.3%) – than in boys (WHO, 2021b).

In the extremely detailed global analysis of the prevalence of "chewing tobacco" in 1990–2019, unlike the trend for tobacco smoking, no significant decrease was noted in the trends of prevalence of SLT use in male or female individuals aged ≥ 15 years in countries in the WHO Western Pacific Region: Cambodia, the Marshall Islands, and Palau (GBD 2019 Chewing Tobacco Collaborators, 2021). Increases in the prevalence have been reported in specific communities, such as South Asian immigrants in Australia and non-Chamorros in Guam (USA), whereas decreases have been seen in Indigenous people in Australia, and in a few other locations, such as Papua New Guinea, Singapore, Taiwan (China), and Viet Nam.

In summary, although the WHO Western Pacific Region has reported the lowest average prevalence of SLT use of all WHO regions, the prevalence of consumption of areca nut products is high and this practice is spreading further across the region.

3.2.3 WHO European Region

In recent years, mass migration patterns and commercial integration have affected the historical regional prevalence of use of SLT products, which are now widely available in the WHO European Region (IARC, 2007; NCI and CDC, 2014; WHO, 2017, 2019).

Table 3.4 provides data for countries for which the estimated prevalence of SLT use was ≥ 2% in adults. Overall, the prevalence of SLT use is low in the WHO European Region, with diverse geographical and subregional trends that are greatly influenced by cultural and migration patterns.

Table 3.3 Prevalence of smokeless tobacco and areca nut use in adults and adolescents in the WHO Western Pacific Region

Country or territory	Product type and/or most popular names	Prevalence of use (%)	Trends of prevalence Reference
Australia	Both tobacco and AN products[a,b,c] (South Asian immigrants)	SLT: Overall: 0.4 Men: 0.6 Women: 0.3 No national data on AN products	Increasing in immigrants WHO (2021b)
	Bush tobacco, *pituri* or *mingkulpa* (Indigenous people)	Chewing tobacco prevalence in Indigenous people in the Northern Territory (central Australia) in 1986–1987: Women: 61 Men: 20	Decreasing in Indigenous people Greenhalgh et al. (2022)
Cambodia	AN with tobacco[c]	AN with tobacco: Women: 12.8 Men: 1.7 SLT: Overall: 4.9 Men: 0.8 Women: 8.6	Decreased slightly Chher et al. (2018); Gunjal et al. (2020); WHO (2021b)
China	AN with or without quid[b], *binglang*[b]	AN prevalence in 11 046 individuals in Xiangtan City, Hunan Province: Overall: 1.2 Men: 0.6 Women: 0.6 AN without tobacco: Men: 23.9 Women: 1.9 SLT: Overall: 0.9 Men: 1.6 Women: 0.1	Tang et al. (1997); Lee et al. (2011); WHO (2021b)
Cook Islands	SLT, AN	SLT: Overall: 3 Boys: 3.8 Girls: 2.4	AN: although use is spreading rapidly, no data are available WHO (2021b)
Fiji	*Paan masala*[b] and other imported packaged ingredients (South Asians)	SLT: 14.2 AN or *paan masala*: 20	In Fijians of Indian descent in Suva aged ≥ 18 yr Nambiar et al. (2020)
Guam (USA)	AN with or without tobacco[c], *pugua*[b]	Adults (AN with tobacco): 46 Youth (*pugua*): 48 AN (5-yr prevalence): 11	AN: increased (in non-Chamorros) Paulino et al. (2017a)

Table 3.3 (continued)

Country or territory	Product type and/or most popular names	Prevalence of use (%)	Trends of prevalence Reference
Kiribati		SLT: Adults Overall: 4.2 Men: 7.6 Women: 1.4 Youth: Overall: 38.6 Boys: 42.5 Girls: 35.3	WHO (2021b)
Lao People's Democratic Republic	BQ[b,c], AN[b]	SLT: Overall: 4.3 Men: 0.5 Women: 8.6	WHO (2021b)
Malaysia	BQ with or without tobacco[b,c], *pinang*[b]	SLT: Adults: Overall: 10.9 Men: 20.4 Women: 0.8 Youth: Overall: 6.3 Boys: 8.2 Girls: 4.3 AN with tobacco: Women: 12.0 Men: 6.2 AN without tobacco: Women: 17.5 Men: 3.6	Lee et al. (2011); WHO (2020b, 2021b)
Marshall Islands		"Chewing tobacco": Men: 10.36 Women: 4.06 SLT: Adults: Overall: 21.6 Youth: Overall: 14.9 Boys: 18.9 Girls: 11.8	Increasing GBD 2019 Chewing Tobacco Collaborators (2021); WHO (2021b)

Table 3.3 (continued)

Country or territory	Product type and/or most popular names	Prevalence of use (%)	Trends of prevalence Reference
Micronesia (Federated States of)	*Bu*, *bua*, *poc*, *pu*[b], BQ[b,c]	AN: School students: 63.4 In families: 42 (from 3 in the Marshall Islands to 94 in Yap) AN with tobacco: 84 SLT: Adults: Overall: 11.4 Men: 22.4 Women: 3.0 Youth: Overall: 16.0 Boys: 20.0 Girls: 12.7	Oakley et al. (2005); Paulino et al. (2017b); WHO (2021b)
Mongolia		SLT: Overall: 8.2 Boys: 11.8 Girls: 4.5	WHO (2021b)
Palau	BQ with or without tobacco[b]	AN without tobacco: Men: 70 Women: 80 AN with tobacco: 80 SLT: Adults: Overall: 44.4 Men: 40.2 Women: 48.8 Youth: Overall: 14.7 Boys: 12.2 Girls: 16.8	Ysaol et al. (1996); WHO (2020b, 2021b)
Papua New Guinea	*Buai*[b], *dak*[b]	Chewing tobacco: Men: 40 Women: 18 SLT: Youth: Overall: 12.2 Boys: 10.9 Girls: 13.6	Decrease (slight) WHO (2021b); GBD 2019 Chewing Tobacco Collaborators (2021)

Table 3.3 (continued)

Country or territory	Product type and/or most popular names	Prevalence of use (%)	Trends of prevalence Reference
Singapore	*Paan*[b], *makan sirih*[b]	AN: 6.4	Decreased (AN); more common in Indian community Kuek et al. (1990); Lim and Pakiam (2020)
Solomon Islands	AN[b]	AN: 94 in a sample of 400 people aged 15–24 yr	Increased Quinn et al. (2017); Moore (2020)
Taiwan (China)	BQ with and without tobacco[b,c], *binglang*[b]	AN without tobacco (in the multicountry ABC study): Men: 10.7 Women: 2.5 AN: 0.3 in 429 108 participants from the Senior Citizen Health Examination in Taiwan (China) over 10 yr (2001–2010)	Decreased Lee et al. (2011); Tsou et al. (2022)
Tonga		SLT: Men: 5 Women: 2	GBD 2019 Chewing Tobacco Collaborators (2021)
Vanuatu		SLT: Overall: 5.2 Boys: 5.9 Girls: 4.6	WHO (2021b)
Viet Nam	AN[b]	Women: 6.7 (in Ho Chi Minh City)	Decreased Reichart and Nguyen (2008); Gunjal et al. (2020)

ABC, Asian Betel-Quid Consortium; AN, areca nut; BQ, betel quid; SLT, smokeless tobacco; WHO, World Health Organization; yr, year or years.

[a] SLT alone.

[b] AN alone (without tobacco).

[c] AN with tobacco.

Compiled by the Working Group.

Table 3.4 Countries with high prevalence of smokeless tobacco and areca nut use in adults in the WHO European Region[a]

Country or population	Product name or colloquial name	Prevalence of use (%)			Reference
		Men	Women	Overall	
Czechia	Snuff and chewing tobacco[b]	5.9	2.5	4.2	NCI and CDC (2014); WHO (2021b)
Denmark	*Snus*[b]	4.0	1.0	3.0	Siddiqi et al. (2020); WHO (2021b)
Estonia	Not reported	9.2	2.3	5.1	WHO (2021b)
Finland	*Snus*[b]	9.2	1.0	5.2	Siddiqi et al. (2020); WHO (2021b)
Germany	Dry snuff[b]	3.4	3.4	2.0	Agaku et al. (2014); NCI and CDC (2014)
Iceland	*Snus*[b]	8.7	3.5	6.6	Siddiqi et al. (2020); WHO (2021b)
Kyrgyzstan	*Naswar*[b]	10.1	0.1	5.2	Siddiqi et al. (2020); WHO (2021b)
Malta	Chewing tobacco[b]	5.5	1.5	3.5	Agaku et al. (2014); NCI and CDC (2014)
Norway	*Snus*[b]	25.0	10.0	18.0	Siddiqi et al. (2020); WHO (2021b)
Portugal	Not reported	4.4	1.1	2.7	Agaku et al. (2014)
Slovenia	Not reported	3.1	1.2	2.2	WHO (2021b)
Spain	Not reported	2.1	2.9	2.5	Leon et al. (2016)
Sweden	*Snus*[b]	22.0	6.0	14.0	Siddiqi et al. (2020); WHO (2020b)
Switzerland	Snuff and chewing tobacco[b]	4.2	1.2	2.7	NCI and CDC (2014); WHO (2017)
South Asian immigrants in the United Kingdom	*Paan*[c,d], *gutka*[d], *zarda*[d], *khaini*[b], *naswar*[b]	7.0	6.0	7.0	ASH (2019)
Uzbekistan	*Naswar*[b]	19.8	0.4	9.9	Siddiqi et al. (2020); WHO (2021b)
WHO European Region		1.9	0.4	1.1	WHO (2021a)

WHO, World Health Organization.

[a] Countries with a prevalence of smokeless tobacco and areca nut use of ≥ 2% are included in the table; countries with a prevalence of < 2% (Armenia, Austria, France, Hungary, Ireland, Italy, Kazakhstan, Poland, Slovakia, Turkmenistan, and the United Kingdom) have been excluded.

[b] Smokeless tobacco alone.

[c] Areca nut without tobacco.

[d] Areca nut with tobacco.

Compiled by the Working Group.

Population-specific studies describing the patterns and prevalence of SLT use were not available for several countries in the WHO European Region in which isolated SLT use had previously been reported (Leon et al., 2016). However, 34 of 53 countries (64.1%) presented data on SLT use in adults; the regional average prevalence was 1.1%, with a higher prevalence in men (1.9%) than in women (0.4%) (WHO, 2021a). Prevalence of SLT use was high in Estonia (5.1%), Finland (5.2%), Iceland (6.6%), Kyrgyzstan (5.2%), Norway (18%), Sweden (14%), and Uzbekistan (9.9%) and in South Asian immigrants in the United Kingdom (WHO, 2020b, 2021b). Four of these countries exceeded the global average prevalence of SLT use (6%) (WHO, 2021a). In the countries where the practice is highly prevalent, hotspots of high prevalence of SLT use by men are observed in subregions, including the Nordic countries and in populations in central Asia (Ansara et al., 2013; WHO, 2020b, 2021b).

The WHO European Region is the WHO region with the second-lowest prevalence of SLT use in adolescents (aged 13–15 years), after the WHO Western Pacific Region (WHO, 2021b). Based on data from 12 countries, the prevalence of SLT use in adolescents was 1.5% (1.8% in boys and 1.1% in girls) (WHO, 2021a). The lowest prevalence of SLT use in adolescents was observed in Belarus, Kazakhstan, and San Marino (0.6%), and the highest prevalence was observed in Poland (5.6%), followed by Latvia (5.3%), Czechia (4.7%), and Georgia (4.4%) (WHO Regional Office for Europe, 2020). These hotspots of high prevalence of SLT use by adolescents, such as Latvia, may be due to the geographical proximity to Sweden, where the prevalence of SLT use is one of the highest among countries in the WHO European Region (Leon et al., 2016). In the United Kingdom, evidence about SLT use in adolescents is limited (WHO Regional Office for Europe, 2020).

Few specific data are available about the spectrum of products used, which encompass commercial and mixed-use preparations, or their variation in terms of natural and chemical compositions (IARC, 2007; NCI and CDC, 2014; WHO, 2017, 2019). Table 3.4 shows a limited variation in terms of the products and their use in the WHO European Region. Regulations for the consumption of SLT vary widely within countries in this region (WHO, 2017); however, in the European Union (EU), SLT is regulated under the scope of the EU Tobacco Products Directive 2014/40/EU (European Parliament, 2014), which banned all tobacco products for oral use. Although most SLT products were banned by the European Council Directive in 1989, in western Europe the use of *snus*, a particular type of moist snuff (see Section 3.1), is still prevalent among Scandinavian people, living mostly in Norway and Sweden (which are exempted from the ban) as well as in other Nordic countries, such as Denmark, Finland, and Iceland (Council of the European Communities, 1989; IARC, 2007; Leon et al., 2016). Other SLT products such as chewing tobacco and dry snuff are also allowed for sale and marketing in the WHO European Region (Leon et al., 2016). Originally from India, *gutka* and *zarda* (see Section 3.1) are the most consumed products in the United Kingdom, where about 75% of Asian immigrants had already consumed them. Similarly, areca nut products are also often consumed within immigrant communities from Pakistan and Bangladesh, among others, living in other parts of the WHO European Region (IARC, 2004; Lechner et al., 2019; Siddiqi et al., 2020).

In summary, a relatively small range of SLT products is currently consumed in nearly half of the countries in the WHO European Region, with large regional and cultural variations.

3.2.4 WHO Region of the Americas

Despite the heritage of SLT as an early American product (Shafey et al., 2009), SLT use is not heavily culturally embedded in

Table 3.5 Countries with high prevalence of smokeless tobacco use in adults in the WHO Region of the Americas[a]

Country	Product name or colloquial name	Prevalence of use (%)[b]			Reference
		Men	Women	Overall	
Haiti	Not reported	N/A	3.1	N/A	WHO (2021b)
Paraguay	Not reported	3	1.6	2.3	WHO (2021b)
USA	Snuff[b], *snus*[b], *iqmik*[b], plug[b]	6.2	0.6	3.3	Siddiqi et al. (2020); WHO (2021b)
Venezuela	*Chimó*[b]	6.2	0.9	3.5	Siddiqi et al. (2020); WHO (2021b)
WHO Region of the Americas		2.5	0.3	1.4	WHO (2021a)

N/A, not available; WHO, World Health Organization.

[a] Countries with a prevalence of smokeless tobacco use of ≥ 2% are included in the table; countries with a prevalence of < 2% (e.g. Argentina, Barbados, Canada, Dominican Republic, and Grenada) have been excluded.

[b] Smokeless tobacco alone.

Compiled by the Working Group.

contemporary societies in the WHO Region of the Americas, and only limited data are available about the prevalence of SLT use in this region (IARC, 2007; NCI and CDC, 2014). Recent evidence on the patterns and prevalence of SLT use was not found for several countries in this region in which isolated SLT use had previously been reported (WHO, 2017, 2019). Although countries in this region have a markedly low overall prevalence of SLT use, there are several subregions, with wide population diversity and a potentially variable prevalence of SLT use (Ansara et al., 2013). Table 3.5 provides the overall prevalence of SLT use in some of the countries in the WHO Region of the Americas for which the estimated prevalence of SLT use was ≥ 2% in adults. The regional average prevalence was 1.4%, and overall the prevalence was higher in men (2.5%) than in women (0.3%) in this region (WHO, 2021a); however, in countries such as Argentina (0.2%), Barbados (0.6%), and Haiti (3.1%), the prevalence was higher in women. Hotspots of high prevalence of SLT use by men were identified in the USA (6.2%), Venezuela (6.2%), and Paraguay (3%) (WHO, 2017, 2021b).

The average prevalence of SLT use reported in adolescents was 2.6% (3.4% in boys and 1.7% in girls) (WHO, 2021a). A total of 27 countries in the WHO Region of the Americas reported SLT use in adolescents, of which Saint Vincent and the Grenadines (6.3%), Venezuela (5.1%), and Barbados (5.0%) had the highest prevalence (PAHO, 2018).

There is significant variation in terms of the products used in the subregions (Siddiqi et al., 2020; Table 3.1). For example, *chimó* is the most widely consumed product in Venezuela and Colombia, whereas *rapé* is more common in Brazil. In the USA, Canada, and Mexico, plug, snuff, and *snus* are the major oral SLT products, whereas *iqmik* is commonly consumed by Alaska Natives (Siddiqi et al., 2020; Table 3.5). Areca nut consumption is reported among the residents of Hawaii, with a low prevalence in young people (ever use of 3.1% in high school students; current use of 1.3% in middle school students and 2% in high school students) compared with a much higher prevalence in immigrants from the Federated States of Micronesia (20.6%) (Pobutsky and Neri, 2012).

In summary, a relatively small range of SLT or areca nut products are currently consumed by nearly 1.5% of the population of the WHO Region of the Americas.

Table 3.6 Countries with high prevalence of smokeless tobacco use in the WHO African Region[a]

Country	Product name or colloquial name	Prevalence (%) Overall (male; female)	Trends of prevalence[b]	Reference
Algeria	*Chemma* or *shammah*[c]	8.9 (17.3; 0.4)	Increasing (men), decreasing (women)	NCI and CDC (2014); Oudjehih et al. (2020); WHO (2021b)
Benin	*Azô*[c]	5.7 (8; 3.2)	Decreasing	Siddiqi et al. (2015); WHO (2020b)
Burkina Faso	*Taaba*[c]	8.9 (5.6; 11.7)	Unknown	NCI and CDC (2014); WHO (2021b)
Central African Republic	Snuff[c]	16.3 (17.3; 15.5)	Unknown	NCI and CDC (2014); WHO (2021b)
Comoros	Unknown	18.4 (19.5; 17.4)	Unknown	WHO (2021b)
Madagascar	*Paraky*[c]	17.3 (24.6; 9.6)	Unknown	Blecher et al. (2014); WHO (2021b)
Mozambique	Unknown	5.6 (2.5; 7.9)	Unknown	WHO (2021b)
Sierra Leone	Snuff[c], chewing tobacco[c]	7.8 (2.9; 12.1)	Decreasing (slightly)	Samai et al. (2011); WHO (2021b); Drope et al. (2022)
Togo	Unknown	3.6 (5.1; 2.2)	Unknown	WHO (2021b)

WHO, World Health Organization.
[a] Countries with a prevalence of smokeless tobacco and areca nut use of ≥ 5% (either overall or in males or females) are included in the table.
[b] Unknown: no comparable data over a time period to make a call on trend.
[c] Smokeless tobacco alone.

3.2.5 WHO African Region

There are an estimated 15 million adult users of SLT (8 million men and 7 million women) in the WHO African Region; it is the WHO region with the second-highest prevalence of SLT use in adults, after the WHO South-East Asia Region (WHO, 2021a). The prevalence of use varies widely, ranging from 0.1% in women in Eritrea and Senegal to 24.6% in men in Madagascar (WHO, 2021b). Of the 46 countries in the WHO African Region, only 8 countries (Algeria, Benin, Burkina Faso, Central African Republic, the Comoros, Madagascar, Mozambique, and Sierra Leone) had a moderate to high (≥ 5%) overall prevalence of SLT use (WHO, 2020b, 2021b).

The prevalence of SLT use is generally high in both male and female individuals in Burkina Faso, the Central African Republic, the Comoros, and Madagascar (WHO, 2021b; Table 3.6). The high overall prevalence (17.3%) of SLT use in Madagascar may be attributed to the large number of residents of South Asian origin (Mamudu et al., 2013; WHO, 2021b). In the Comoros, which has a high overall prevalence of SLT use, the prevalence of SLT use in women (17.4%) is the highest of the African countries (WHO, 2021b). However, in some countries with a relatively low overall prevalence (< 5%) of SLT use, use is reported predominantly in women (prevalence > 5%), such as Botswana and Cabo Verde. The prevalence of SLT use is much higher in men than in women in countries such as Algeria (17.3% vs 0.4%), Eritrea (11.6% vs 0.1%), and Madagascar (24.6% vs 9.6%) (WHO, 2021b; Table 3.6).

Information about the trends in prevalence of SLT use has been reported for few countries. The available data suggest a decreasing trend in SLT use in women in Algeria, from a reported prevalence of 0.8% in 2010 to a prevalence of 0.4% in 2017, whereas the estimated prevalence in men increased, from 9.8% in 2010 to 17.3% in 2017 (Oudjehih et al., 2020; WHO, 2021b). Recent data

from a 2016 survey in South Africa also show a marked decrease in the prevalence of SLT use in women, from 10.9% in 2003 to 1.3% in 2016, whereas the prevalence in men increased, from 2.4% in 2003 to 6.4% in 2016 (Siddiqi et al., 2015; WHO, 2021b).

Youth surveys have suggested an increased uptake of SLT use in adolescent boys and girls, even in countries with a relatively low prevalence of SLT use in adults, such as Botswana, Eswatini, Liberia, Malawi, Nigeria, Rwanda, South Africa, and Uganda (WHO, 2021b). In countries with a moderate or high overall prevalence of SLT use, such as Burkina Faso and Mozambique, SLT use is also common in adolescents, with a reported prevalence of 10.2% in Burkina Faso and 7.5% in Mozambique and not much difference between sexes (WHO, 2021b). In contrast, recent data from Madagascar suggest a very low prevalence of SLT use in adolescents (1.6%); this is an indicator that this practice is probably becoming unpopular there (WHO, 2021b).

The dominant SLT product type used in the WHO African Region is snuff (moist and dry) (see Table 3.1) (NCI and CDC, 2014). It is also locally known as *taaba* in Burkina Faso, *chemma* or *shammah* (moist snuff) in Algeria, *snuif* in South Africa, Botswana, and Lesotho, and *azô* in Benin (NCI and CDC, 2014; Oudjehih et al., 2020). The use of chewing tobacco is less common. However, *paraky* is mostly used in rural areas of Madagascar (Blecher et al., 2014), and use of betel quid without tobacco (areca nut) is common in a minority population of South Asian descent in some parts of South Africa and the United Republic of Tanzania (Bissessur and Naidoo, 2009; Bhat et al., 2010; NCI and CDC, 2014). SLT use through the nasal route in the form of dry snuff is still a common practice in some parts of the WHO African Region (Sinha et al., 2018a), but oral application remains more popular (Table 3.1). In 2005, Scandinavian-type *snus* was also introduced to the South African market, but data on its use have not been reported, possibly because there was little or no uptake by most South Africans (Tobacco Control Research Group, 2021).

3.2.6 WHO Eastern Mediterranean Region

There are an estimated 20.9 million adult users of SLT (17.7 million men and 3.2 million women) in the WHO Eastern Mediterranean Region (WHO, 2021a). The prevalence of SLT use varies widely, ranging from null in women in Egypt, Iraq, and Kuwait and in both men and women in the Syrian Arab Republic to 33.7% in men in Afghanistan (WHO, 2021b; Table 3.7). The prevalence of SLT use is generally high in adults in Afghanistan, Yemen, the Sudan, Pakistan, and Tunisia (WHO, 2020b, 2021b). In Afghanistan, the 2019 WHO STEPwise Approach to Surveillance (STEPS) survey showed an overall prevalence of SLT use of 19.3% (33.7% in men and 3.7% in women); it is the country with the highest percentage of SLT users in the WHO Eastern Mediterranean Region (WHO, 2021b). Although in this region SLT is consumed predominantly by men, Yemen has reported a substantial prevalence of use (5.9%) in women (WHO, 2021b; Table 3.7).

Information about trends in prevalence of SLT use is available for some countries in this region (Table 3.7). In Pakistan, in adult men the prevalence of SLT use decreased from 16.3% in 2012–2013 to 11.4% in 2014 and to 14.6% in 2017–2018, but in women it increased from 2.44% in 2012–2013 to 3.7% in 2014 and to 3.4% in 2017–2018 (Siddiqi et al., 2015; WHO, 2020b, 2021b). In the Sudan, the 2005 STEPS country report showed a prevalence of SLT use of 24.1% in men and 1% in women, but recent data from the 2016 STEPS survey revealed a decreasing trend in the prevalence of SLT use in both men (to 14.3%) and women (to 0.2%) (Siddiqi et al., 2015; WHO, 2021b). In Yemen, when comparing the recent Demographic and Health Survey 2013 data with the 2003 Individual Country Survey

Table 3.7 Countries with high prevalence of smokeless tobacco use in the WHO Eastern Mediterranean Region[a]

Country	Product name or colloquial name	Prevalence (%) Overall (male; female)	Trends of prevalence	Reference
Afghanistan	*Naswar* or *nass*[b]	19.3 (33.7; 3.7)	Unknown	WHO (2021b)
Pakistan	*Gutka*[c], *naswar*[b], *chalia* or *supari*[d], *paan*[c,d], *zarda*[c]	9[e] (14.6; 3.4)	Decrease (males) Increase (females)	Siddiqi et al. (2015); WHO (2020b, 2021b)
Sudan	*Toombak*[b], *saffa*[b], *saod*[b]	7.9 (14.3; 0.2)	Decrease	Siddiqi et al. (2015); Abakar et al. (2020); WHO (2021b)
Yemen	*Shammah*[b], *toombak*[b], *tombol*[c]	11.3 (17.0; 5.9)	Increase (males)	Siddiqi et al. (2015); Al-Tayar et al. (2017); WHO (2021b)

WHO, World Health Organization.
[a] Countries with a prevalence of smokeless tobacco and areca nut use of ≥ 5% (either overall or in males or females) are included in the table.
[b] Smokeless tobacco alone.
[c] Areca nut with tobacco.
[d] Areca nut and/or betel quid alone.
[e] Overall prevalence data were not provided in the data source; therefore, the estimate provided here was computed by the Working Group.

data, the percentage of male SLT users appears to have increased slightly (from 15.1% in 2003 to 17% in 2013), but the percentage of female SLT users seems to have remained almost stable (from 6.2% in 2003 to 5.9% in 2013) (Siddiqi et al., 2015; WHO, 2021b).

In the WHO Eastern Mediterranean Region, SLT use seems to be relatively less common in adolescents than in adults (WHO, 2021a). The prevalence in adolescents is highest in Djibouti (6.2%), followed by the occupied Palestinian territory (6%), Pakistan (5.3%), and Yemen (5.1%) (WHO, 2021b). A relatively low prevalence of SLT use in adolescents in the Sudan (4.9%) compared with that in adult men suggests that this practice is becoming unpopular there, or that there is a cultural tendency towards uptake in adulthood (Idris et al., 1998; WHO, 2021b).

The dominant product types used in the WHO Eastern Mediterranean Region are plain SLT, or areca nut mixed with tobacco (NCI and CDC, 2014). A variety of products are available in the region, of which the most common forms are betel quid with tobacco (*paan*), *naswar*, *chalia*/*supari*, and *gutka*. A study in Pakistan reported that in a group of male and female users of SLT or areca nut products, the prevalence of use of *naswar* (4.1%) was the highest, followed by *paan* (2.6%) (Abbas et al., 2014). The use of these products is also culturally acceptable in Afghanistan, predominantly a local product known as *naswar* or *nass*. In the Sudan, SLT is referred to as *toombak*, *saffa*, or *saod* (Abakar et al., 2020). In Yemen, some of the commonly used products are *shammah*, *tombol*, and *toombak* (Al-Tayar et al., 2017; Table 3.7; see Section 3.1).

3.2.7 Determinants of use

Both SLT and areca nut contain addictive substances; this explains their continued use despite the proven adverse health effects, including oral cancer (Sumithrarachchi et al., 2021). Therefore, to effectively eliminate these practices, it is imperative to understand the reasons that influence the initiation and continued use of these products. Whereas cigarette smoking has been widely studied because

it is the causative factor for many noncommunicable diseases (Bergen and Caporaso, 1999), studies on determinants of use of SLT and areca nut are fewer in comparison.

Multiple factors determine the initiation and continued use of SLT and areca nut, with an interplay between some of the factors. These determinants may be broadly grouped as (i) individual factors (knowledge and perceptions), (ii) social factors (sociodemographic, socioeconomic, and sociocultural), and (iii) environmental factors (Table 3.8) (Singh et al., 2016).

Identifying the individual, social, and environmental determinants of the initiation and continuation of SLT and areca nut use is required when planning programmes on awareness and cessation interventions for these established risk factors.

(a) Individual factors

Inculcating appropriate knowledge or raising awareness has the ability to induce a desired health-related behavioural change. Several studies have shown that knowledge levels and perceptions are associated with the use of SLT and areca nut (Singh et al., 2016). A few selected studies are described here to illustrate this determinant (Table 3.8).

A cross-sectional study conducted in adolescents in the USA reported a moderate level of knowledge about the undesirable effects of SLT, which had only little impact on male users (Lee et al., 1994). In another cross-sectional study in school students in the USA, significant differences were observed in the knowledge level and attitudes between SLT users and non-users; students with higher knowledge and attitude scores were less likely to use SLT (Goebel et al., 2000). In contrast, a study in a sample of university students in the USA reported no influence of the observed high knowledge level on the prevalence of SLT use, indicating a probable influence of multiple factors (Monson and Beaulieu, 2011). A school-based cross-sectional study in Pakistan conducted in adolescent users of areca nut and/or SLT reported that adolescents who had not attended the knowledge-based sessions on the harmful health effects of areca nut and/or SLT use were more likely to use these products (Hussain et al., 2017). In another study in adult chewers in Myanmar, use of areca nut was found to be significantly associated with low knowledge scores with respect to adverse health effects of areca nut use (Myint et al., 2016).

The level of knowledge about the harmful effects of areca nut or SLT use may also depend on the level of education, as reported in multiple studies, in which individuals with lower education levels had less awareness of the adverse effects of these substances (Khawaja et al., 2006; WHO Regional Office for South-East Asia, 2012; Myint et al., 2016; Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019).

Beliefs or perceptions about substances such as SLT or areca nut are another important factor determining their use. Some users believe that the use of SLT offers health benefits, such as improving sleep quality and relieving toothaches, headaches, and tiredness (Solhi et al., 2021). There is also a belief that SLT is less harmful than smoked tobacco (Singh et al., 2016). Certain perceived positive effects of chewing areca nut have been proven to be important determinants of its use; these include inducing relaxation, enhancing concentration and aiding decision-making, relieving boredom, improving stamina, curing cold, inducing a pleasant sensation, feeling energized, and conferring cosmetic benefits (Changrani et al., 2006; Banerjee et al., 2014; Myint et al., 2016; Lin et al., 2017; Hussain et al., 2018; Do and Vu, 2020).

(b) Social factors

(i) Sociodemographic determinants

Multiple studies in India have ascertained the role of age at initiation for SLT use; younger age at initiation is associated with a higher

Table 3.8 Determinants of use of smokeless tobacco and areca nut products

Determinants	Facilitators	Barriers	Country or territory	Reference
Individual factors				
Knowledge	Higher tendency to use SLT or AN if lower knowledge level about their harmful effects		India	Singh et al. (2016)
			Bangladesh	Bangladesh Bureau of Statistics and National Tobacco Control Cell (2019)
			USA	Lee et al. (1994); Goebel et al. (2000)
			Myanmar	Myint et al. (2016)
			Pakistan	Hussain et al. (2017)
	Lower knowledge level about the harmful effects of SLT or AN was also due to low education level		Pakistan	Khawaja et al. (2006)
			Myanmar	Myint et al. (2016)
			Bangladesh	Bangladesh Bureau of Statistics and National Tobacco Control Cell (2019)
			Indonesia	WHO Regional Office for South-East Asia (2012)
Perceptions	SLT use not as harmful as the other tobacco types (smoking) SLT perceived as suitable for dental health and treatment of dental pain		India	Singh et al. (2016); Shah et al. (2018)
			USA	Goebel et al. (2000)
		Belief that SLT causes one or more of the following: serious illnesses, serious illnesses in pregnancy, stroke, heart attack, oral cancer	Indonesia	WHO Regional Office for South-East Asia (2012)
			Bangladesh	Bangladesh Bureau of Statistics and National Tobacco Control Cell (2019)
			India	TISS and MOHFW (2017)
		Belief that SLT use has undesirable effects, such as oral diseases or hypertension, chest pain or burning	USA	Lee et al. (1994); Goebel et al. (2000); Changrani et al. (2006); Monson and Beaulieu (2011)
	Perceived positive effects of AN chewing: considered cool in youth, as a cooling-off agent, improves work efficiency, improves stamina, relieves tension, cures cold, provides relaxation, relieves boredom, reduces stress, increases alertness, provides pleasant sensation, aids in digestion, prevents bad breath, reduces appetite, cosmetic benefits (red teeth as a sign of beauty).		Taiwan (China)	Lin et al. (2017); Yang and Lin (2017)
			USA (migrants)	Changrani et al. (2006); Banerjee et al. (2014)
			Pakistan	Rozi and Akhtar (2007); Hussain et al. (2017, 2018); Saqib et al. (2018)
			Sri Lanka	Lee et al. (2011); Sinha et al. (2012)
			India	Shah et al. (2018)
			Guam (USA)	Murphy and Herzog (2015)

Table 3.8 (continued)

Determinants	Facilitators	Barriers	Country or territory	Reference
Social factors				
1. Sociodemographic				
Age	Initiation of SLT and AN use at younger age		India	Singh et al. (2016); Sharapova et al. (2020)
			USA	
			Bangladesh	Bangladesh Bureau of Statistics and National Tobacco Control Cell (2019)
	Continuation of AN and SLT use increases with age		Bangladesh	Bangladesh Bureau of Statistics and National Tobacco Control Cell (2019)
			Cambodia	Sreeramareddy et al. (2014a)
			Indonesia	Lee et al. (2011)
			India	Rani et al. (2003); TISS and MOHFW (2017)
			Sri Lanka	Sinha et al. (2012)
			Thailand	WHO Regional Office for South-East Asia (2011)
			Nepal	Shrestha et al. (2019)
			Malaysia	IPH (2012)
			United Arab Emirates (migrants)	Ali et al. (2020)
			Uganda	Kabwama et al. (2016)
			United Kingdom (migrants)	Núñez-de la Mora et al. (2007)
			Pakistan	Hussain et al. (2017)

Table 3.8 (continued)

Determinants	Facilitators	Barriers	Country or territory	Reference
Sex	Higher prevalence of SLT use in males (reported that SLT includes all types of non-smoked tobacco products and AN)		Sri Lanka	Lee et al. (2011); Sinha et al. (2012)
			India	Sinha et al. (2012); TISS and MOHFW (2017)
			Pakistan	Hussain et al. (2017)
			Malaysia	IPH (2012)
	Higher prevalence of SLT use in females (reported that SLT includes all types of non-smoked tobacco products and AN, BQ)		Thailand	WHO Regional Office for South-East Asia (2011)
			Bangladesh	Bangladesh Bureau of Statistics and National Tobacco Control Cell (2019)
	Higher prevalence of AN use in males		Myanmar	Myint et al. (2016)
			Sri Lanka	Lee et al. (2011)
			Nepal	Lee et al. (2011)
			Pakistan	Hussain et al. (2017)
			Taiwan (China)	Lee et al. (2011)
			China	Lee et al. (2011)
	Higher prevalence of AN (BQ) use in females		Malaysia	Lee et al. (2011)
			Indonesia	Lee et al. (2011)
Ethnicity	Higher initiation and continued use of SLT noted in White people		USA	Ebbert et al. (2006); Chaffee et al. (2018)

Table 3.8 (continued)

Determinants	Facilitators	Barriers	Country or territory	Reference
Residence	Higher prevalence of SLT use in rural areas than in urban areas		Indonesia	WHO Regional Office for South-East Asia (2012)
			India	MOHFW and IIPS (2019); Singh et al. (2020)
			Bangladesh	Bangladesh Bureau of Statistics and National Tobacco Control Cell (2019)
			Thailand	WHO Regional Office for South-East Asia (2011)
			Malaysia	IPH (2012)
			WHO African Region	Kabwama et al. (2016); Bonnechère et al. (2019); WHO FCTC and ICMR-NICPR (2022)
			WHO Eastern Mediterranean Region	Al-Tayar et al. (2017); Alemi et al. (2021)
			Myanmar	Myint et al. (2016)
			Nepal	Shrestha et al. (2019)
2. Socioeconomic				
Income level	Higher prevalence of SLT use in poorer groups/ lowest-income groups/lowest-wealth-index groups		Cambodia	Sreeramareddy et al. (2014a)
			Bangladesh	WHO Country Office for Bangladesh (2018); Bangladesh Bureau of Statistics and National Tobacco Control Cell (2019)
			India	Thakur et al. (2015); Bhan et al. (2016); Singh et al. (2016); Sinha et al. (2018a)
			Nepal	Shrestha et al. (2019)
Employment status	Higher prevalence of SLT use in unemployed people and homemakers		Indonesia	WHO Regional Office for South-East Asia (2012)
			India	Singh et al. (2016, 2020)

Table 3.8 (continued)

Determinants	Facilitators	Barriers	Country or territory	Reference
Type of occupation	Higher prevalence of AN use in taxi drivers, three-wheel taxi drivers, transportation workers, security guards, labourers, construction workers, agriculture workers, and plantation workers		Taiwan (China)	Yang and Lin (2017); Huang et al. (2020)
			Sri Lanka	Mahees et al. (2021)
			United Arab Emirates (migrants)	Ali et al. (2020)
	Higher prevalence of SLT use in military personnel (higher percentage of users serving as infantry and gun crew specialists, and enlisted personnel)		USA	Lin et al. (2018)
Education level	Higher prevalence of SLT and AN use with lower education levels Households with uneducated or less-educated members tend to consume more SLT		India	Palipudi et al. (2012); Singh et al. (2016); TISS and MOHFW (2017)
			Egypt	Palipudi et al. (2012)
			Philippines	Palipudi et al. (2012)
			Bangladesh	WHO Country Office for Bangladesh (2018); Bangladesh Bureau of Statistics and National Tobacco Control Cell (2019)
			Nepal	Lee et al. (2011); Sreeramareddy et al. (2014a); Shrestha et al. (2019)
			Thailand	WHO Regional Office for South-East Asia (2011)
			Cambodia	Sreeramareddy et al. (2014a)
			Malaysia	Lee et al. (2011); IPH (2012)
			Taiwan (China)	Lee et al. (2011)
			Indonesia	Lee et al. (2011); WHO Regional Office for South-East Asia (2012)
			Sri Lanka	Lee et al. (2011)
			Myanmar	Myint et al. (2016)
			United Arab Emirates (migrants)	Ali et al. (2020)

Table 3.8 (continued)

Determinants	Facilitators	Barriers	Country or territory	Reference
3. Sociocultural				
Family or peer pressure	One of the main determinants for initiation of SLT or AN use		Pakistan	Rozi and Akhtar (2007); Hussain et al. (2017)
			Myanmar	Myint et al. (2016)
			Guam (USA)	Murphy et al. (2019)
	Considered rude and disrespectful to refuse chewing of AN (BQ) if family members or peers are chewing		Guam (USA)	Murphy and Herzog (2015); Murphy et al. (2019)
			Federated States of Micronesia	
			Pakistan	Hussain et al. (2017); Hussain et al. (2018)
Social reasons	During interactions with friends and peers and for social acceptability		Taiwan (China)	Lin et al. (2017)
			Guam (USA)	Murphy and Herzog (2015)
	Symbol of love and marriage		Taiwan (China)	Ma et al. (2017)
			India	Ahuja and Ahuja (2011)
	AN offered to visitors on special occasions		Sri Lanka	Wijesinghe (2018)
Cultural reasons	An acceptable alternative to smoking in Indian culture		India	Singh et al. (2016); Shah et al. (2018)
	Ancestral practice of the Kalunga community (the largest *quilombola* community in Brazil)		Brazil	Novais (2017)
Use of multiple substances	Strong association between current smoking practice and initiation of SLT use		USA	Ebbert et al. (2006)
	Concurrent AN (BQ) chewing in people who consume alcohol and/or smoke		Myanmar	Myint et al. (2016)
			Malaysia	Lee et al. (2011)
			Taiwan (China)	Lee et al. (2011); Lin et al. (2017); Yang and Lin (2017)
			United Arab Emirates (migrants)	Ali et al. (2020)
			Sri Lanka	Lee et al. (2011)

Table 3.8 (continued)

Determinants	Facilitators	Barriers	Country or territory	Reference
Environmental factors				
Easy availability	Around the house In neighbourhood stores From hawkers around educational institutions		Guam (USA) USA (migrants) India Pakistan	Murphy and Herzog (2015) Banerjee et al. (2014); Do and Vu (2020) Sinha et al. (2016) Hussain et al. (2017)
Family	Preparing the AN quid for elderly family members Strong influence from family members		Guam (USA) United Kingdom (migrants)	Murphy and Herzog (2015) Núñez-de la Mora et al. (2007)
School type	Higher tendency to use by students attending government schools than those attending private schools		Pakistan	Rozi and Akhtar (2007); Hussain et al. (2017)
Advertisements	Exposure to tobacco advertisements is a factor in SLT use, especially by young people Not seeing anti-tobacco advertisements		USA India Sudan Pakistan	Timberlake (2016) Arora et al. (2008) Almahdi et al. (2020) Rozi and Akhtar (2007)
Sports figures	SLT use by favourite professional baseball players (determinant for initiation and continuation of SLT use in youth)		USA	Chaffee et al. (2018)
Health messages	Lack of anti-AN and anti-SLT public health messages		USA (migrants)	Banerjee et al. (2014)

AN, areca nut; BQ, betel quid; SLT, smokeless tobacco; WHO, World Health Organization.
Compiled by the Working Group.

level of use and more prolonged use. In addition, the GATS-1 India documented that female individuals and people living in rural areas had a younger age at initiation (Singh et al., 2016). In Bangladesh, the GATS also documented a younger age at initiation of areca nut use in women (Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019). A study in middle school and high school students in the USA reported similar findings; male students initiated SLT use at a slightly older age compared with their female counterparts (Sharapova et al., 2020).

With regard to continuation of SLT or areca nut use, in a study in Pakistan conducted in adolescent users of areca nut (including betel quid) and/or SLT, age was positively associated with continued use (Hussain et al., 2017). In India, an increased likelihood of SLT use with increasing age was also observed; men aged ≥ 60 years were 4 times as likely and women aged ≥ 60 years were 8 times as likely to use SLT compared with younger individuals (aged 15–24 years) (Rani et al., 2003). The GATS-2 India further confirmed the increasing likelihood of SLT use with increasing age (TISS and MOHFW, 2017). This finding has also been noted in Afghanistan, Bangladesh, Malaysia, Nepal, and Thailand (WHO Regional Office for South-East Asia, 2011; IPH, 2012; Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019; Shrestha et al., 2019; Alemi et al., 2021). Another study in adolescent male SLT users in Pakistan reported a similar association; however, this weakened on multivariate analysis (Rozi and Akhtar, 2007).

With regard to sex, a higher prevalence of SLT use has been noted in male individuals in many countries, such as India, Malaysia, Pakistan, and Sri Lanka, whereas in Bangladesh and Thailand the reported prevalence of SLT use is higher in female individuals (Lee et al., 2011; WHO Regional Office for South-East Asia, 2011; IPH, 2012; Sinha et al., 2012; Hussain et al., 2017; TISS and MOHFW, 2017; Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019). Similarly, in a cross-sectional study in Myanmar men were 3 times as likely as women to chew areca nut (Myint et al., 2016). In Pakistan, men were also found to have a higher probability than women of initiating use of areca nut (including betel quid) (Hussain et al., 2017). Furthermore, a multicountry study also documented a higher prevalence of areca nut chewing in men than in women in China, Nepal, Sri Lanka, and Taiwan (China), whereas the opposite was observed in Indonesia and Malaysia (Lee et al., 2011).

Ethnicity was also reported to be a predictor of the initiation and continuation of SLT use; in the USA, a higher prevalence of initiation and continuation was found in White people than in individuals of other ethnicities (Ebbert et al., 2006; Chaffee et al., 2018).

Evidence from some countries in the WHO African Region and the WHO Eastern Mediterranean Region has shown a higher prevalence of SLT use in people living in rural areas (Al Tayar et al., 2017; Bonnechère et al., 2019; Alemi et al., 2021; WHO FCTC and ICMR-NICPR, 2022). In general, there are a higher percentage of adult SLT users in rural areas than in urban areas, especially in the countries in the WHO South-East Asia Region, such as Bangladesh, India, Myanmar, Nepal, and Thailand (WHO Regional Office for South-East Asia, 2011; Myint et al., 2016; Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019; MOHFW and IIPS, 2019; Shrestha et al., 2019). A recent report of the Global Youth Tobacco Survey (GYTS) India suggests a higher prevalence of SLT use in school-going adolescents in rural areas than in urban areas (MOHFW and IIPS, 2019; Table 3.8).

(ii) Socioeconomic determinants

The socioeconomic determinants of use of SLT and areca nut are income level, employment, and education level (Table 3.8).

A sufficient amount of literature is available on the role of these factors in India (Singh et al., 2016). A clear trend has been observed of higher prevalence of SLT use with lower income levels (Bhan et al., 2016). Thakur et al. (2015) showed that the probability of SLT use decreases with increasing income; wide economic inequalities in the patterns of SLT use were observed in all the states of India. The association between SLT use and low income levels was also observed in other countries in the WHO South-East Asia Region, such as Bangladesh, Cambodia, and Nepal (Sreeramareddy et al., 2014a; WHO Country Office for Bangladesh, 2018; Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019; Shrestha et al., 2019), and in countries in sub-Saharan Africa (Sreeramareddy et al., 2014b). An analysis of 140 countries by Sinha et al. (2018a) showed that, in general, the burden of SLT use is greatest in the lowest-income segments of the population.

Unemployment was found to be another predictor of increased likelihood of SLT use in India (Singh et al., 2020). Similarly, in Indonesia, the largest proportion of SLT users are homemakers (WHO Regional Office for South-East Asia, 2012). In contrast, it has also been reported that the expense incurred, especially for an unemployed person, is an important reason for quitting this practice (Murphy and Herzog, 2015). This may be due to the wide differential pricing of the various SLT products or even different brands of the same product (Nargis et al., 2014). Also, increases in the taxation of smoked tobacco products have led to comparatively lower prices of SLT.

The type of occupation may also determine the prevalence of use of SLT and areca nut. A high prevalence of SLT use has been reported in military personnel (especially in the infantry or gun crew specialists) in the USA (Lin et al., 2018). In Taiwan (China), drivers and construction workers were reported to have a higher prevalence of use of areca nut (including betel quid) (Huang et al., 2020). In Sri Lanka, three-wheel taxi drivers, transportation workers, security guards, construction workers, plantation workers, and fishers had a very high prevalence of use of commercially prepared SLT products (Mahees et al., 2021). It has been hypothesized that individuals in such occupations that require long working hours or continuously repeated activities benefit from the perceived positive effects of areca nut use, such as improving concentration, reducing hunger, inducing a sense of well-being, and relieving boredom (Winstock, 2002; Yang and Lin, 2017).

With regard to education level, the GATS-1 India reported clear educational gradients; individuals with no formal education or less than primary education were much more likely to be users of SLT or areca nut compared with individuals with secondary education or above (MOHFW and IIPS, 2010). This pattern persisted over time; the GATS-2 India reported that despite the decreasing trend in SLT use in all households, an association between lower education levels and higher prevalence of SLT use remained (TISS and MOHFW, 2017). A large multicountry study involving 13 low- and middle-income countries also reported high prevalence of tobacco use (including SLT) in individuals in the lower educational attainment category in Egypt and the Philippines, among other countries (Palipudi et al., 2012). The association between prevalence of SLT use and lower education levels was also observed in Bangladesh, Cambodia, Malaysia, Nepal, and Thailand (WHO Regional Office for South-East Asia, 2011; IPH, 2012; Sreeramareddy et al., 2014a; Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019). Similarly, the large Asian Betel-Quid Consortium study, which

involved 8922 chewers of areca nut (betel quid with or without tobacco), reported that individuals with higher education levels in Indonesia, Malaysia, Sri Lanka, and Taiwan (China) were less likely to be users of areca nut (Lee et al., 2011). The outcomes of another study, in adult chewers of areca nut in Myanmar, further corroborated these findings (Myint et al., 2016). However, individuals with higher education levels in Hunan (China) were slightly more likely to be users of areca nut, probably because of the influence of other factors (Lee et al., 2011).

(iii) Sociocultural determinants

Many studies have reported an association between various sociocultural factors and use of SLT and areca nut (Table 3.8).

Studies in Guam (USA), Myanmar, and Pakistan have documented that use of SLT and/or areca nut by family members and peer pressure are among the main determining factors for initiation of these practices (Rozi and Akhtar, 2007; Myint et al., 2016; Hussain et al., 2017; Murphy et al., 2019). The effect of peer pressure on SLT use was also reported in a review in India (Shah et al., 2018). Moreover, in a recent study in adolescent chewers in Pakistan, not chewing was considered rude if family members or friends were chewing (Hussain et al., 2018); this sentiment was shared by adults in Guam (USA) (Murphy et al., 2019).

The practice of areca nut chewing reinforces positive acceptance when socializing with friends in Taiwan (China), because sharing of areca nut is a usual practice during social gatherings (Lin et al., 2017; Ma et al., 2017). It is also considered a symbol of love and marriage in China, India, and Taiwan (China) (Ahuja and Ahuja, 2011; Ma et al., 2017). In Sri Lanka, areca nut is also offered to visitors on important occasions (Wijesinghe, 2018).

In India, tobacco smoking in the presence of elders is a social taboo, whereas wide social acceptance exists for tobacco chewing because it is deeply embedded in the Indian culture (Singh et al., 2016; Shah et al., 2018). The Kalunga community, the largest *quilombola* community in Brazil, still preserves ancestral practices such as the use of a type of snuff called *simonte* (Novais, 2017).

Current tobacco smoking was found to be a strong predictor of the initiation of SLT use (Ebbert et al., 2006). In addition, concurrent use of areca nut (including betel quid) was observed along with alcohol consumption and/or smoking in various settings (Lee et al., 2011; Myint et al., 2016; Lin et al., 2017; Yang and Lin, 2017; Ali et al., 2020).

(c) Environmental factors

Some of the adult participants in a pilot study conducted in Guam (USA) cited readily available areca nut, especially around the house, and the practice of preparing the areca nut by softening it orally to enable use by the toothless elders in the family as the main reasons for initiation of areca nut chewing (Murphy and Herzog, 2015).

Evidence from India and Pakistan has also shown that the easy availability of SLT and areca nut from hawkers around educational institutions, such as schools, plays a major role in facilitating their use in adolescents (Sinha et al., 2016; Hussain et al., 2017). The school environment may also play a role in determining use of SLT and areca nut. A study conducted in adolescent male high school students in Pakistan observed a higher prevalence of SLT use in students attending government schools than in those attending private schools (Rozi and Akhtar, 2007).

Exposure to advertisements for SLT and areca nut products is another determining factor for the use of these products. A cross-sectional study in 11 462 adolescent students in India reported that greater exposure to tobacco advertisements significantly increased the risk of initiating tobacco use; a dose–response effect was noted for a subset of students (Arora et al., 2008). In

addition, a study in male high school students in Pakistan found a significantly higher tendency to SLT use in those who did not see anti-tobacco advertisements (Rozi and Akhtar, 2007). In the Sudan, exposure to the advertisement of *toombak* at point of sale is associated with its increased perceived accessibility (Almahdi et al., 2020). Lack of anti-areca nut and anti-SLT public health messages was also cited as a facilitator of areca nut and SLT use by a group of South Asian immigrants in the USA (Banerjee et al., 2014). In the USA, perceived SLT use by favourite professional baseball players was shown to increase the susceptibility to initiation and continuation of SLT use in adolescent baseball players (Chaffee et al., 2018).

3.3 Interventions for cessation of use

The review included published intervention studies with intervention and control groups, such as randomized controlled trials (RCTs) and cohort studies. For those on behavioural interventions alone, studies with follow-up from the start of the intervention of ≥ 6 months were included, and for those on pharmacological interventions (alone or in combination with behavioural interventions), studies with follow-up of ≥ 6 weeks were included.

The review excluded studies such as those not targeted at SLT or areca nut use but at smoking cessation, those targeted at SLT or areca nut use but non-cessation studies, non-randomized intervention trials, and studies with SLT quit attempts, reduction, or withdrawal symptoms as the primary end-point.

When the RR and 95% CI for cessation of SLT use were not provided by the authors, they were calculated by the Working Group for each outcome with the longest follow-up period. In most studies assessing the effectiveness of pharmacological interventions alone or in combination with behavioural interventions, abstinence is defined by 7-day point-prevalence abstinence (short-term abstinence assessment) and prolonged or continuous abstinence (long-term abstinence assessment) confirmed by biochemical validation or self-reporting. Prolonged or continuous abstinence was defined as a preferred measure, and point prevalence was defined as a secondary measure recommended by Hughes et al. (2003).

3.3.1 Behavioural interventions

This section reviews studies assessing the effectiveness of behavioural interventions alone for cessation of SLT and/or areca nut use, both in adults and in youth.

(a) Behavioural interventions in adults

Nine studies (7 RCTs and 2 cohort studies) using behavioural interventions for SLT cessation were conducted in adults. Two of the largest studies were cohort studies conducted in India (Gupta et al., 1992; Anantha et al., 1995); most of the studies (6) were conducted in the USA (Stevens et al., 1995; Severson et al., 1998, 2007, 2008, 2009; Walsh et al., 1999), and one study was conducted in Sweden (Virtanen et al., 2015) (Table 3.9).

The earliest interventions took place in India. One quasi-experimental cohort trial was carried out for 10 years in Ernakulam District, Kerala, India, in 7033 users of betel quid with tobacco, to reduce the incidence of oral mucosal lesions by persuading participants to quit tobacco use. Interventions were carried out through house-to-house visits followed by an oral examination and an educational talk by a dentist and social scientist, along with relevant information, education, and communication materials such as films, radio broadcasts, posters, local newspaper articles, and lantern slides in local cinemas. [At 10 years of follow-up, a statistically significant effect was noted for the cessation intervention: relative risk (RR), 2.81; 95% confidence interval (CI), 2.38–3.32] (Gupta et al., 1992). The incidence

Table 3.9 Behavioural interventions for cessation of smokeless tobacco and/or areca nut use in adults

Reference Location	Study design Study population	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Gupta et al. (1992) Ernakulam District, Kerala, India	Cohort study (quasi-experimental) Men and women, aged ≥ 15 years Betel quid with tobacco[b] 10-year follow-up	4619 House-to-house survey/interview, oral examination, educational talk by dentist and social scientist, tailored films, radio broadcasts, posters, local newspaper articles, exhibition of lantern slides in local cinemas, dental camps	2414 Interview, oral examination, brief educational talk, advice to quit tobacco by dentist	At 120 months (10 years), quit rate: Men: I: 15.1% C: 2.3% Women: I: 18.4% C: 7.8% [RR (95% CI): Men: 6.52 (3.96–10.76) Women: 2.37 (1.98–2.83) Overall: 2.81 (2.38–3.32)]	Strengths: large sample size; long follow-up on cessation and OPMDs Limitations: ITT data absent; control group was not concurrent in time; not an RCT; results were not confirmed biochemically
Anantha et al. (1995) India	Cohort study (quasi-experimental) Men and women, all ages Chewed tobacco[a,b] 5-year follow-up	6714 Anti-tobacco education through handbills, folders, cards, a photo album, portable display boards, and audiovisual aids (films in local languages)	Two control areas: Control area 1: 12 152 Control area 2: 8171 No anti-tobacco education	At 60 months (5 years), quit rate in men: I: 30.2% Control area 1: 1.2% Control area 2: 1.1% [RR (95% CI): 25.70 (13.26–49.84)]	Strengths: long-term intervention; large sample size Limitations: age group of participants in intervention and control arms not mentioned; no randomization; quit rate in women not mentioned; ITT data absent; results were not confirmed biochemically RR was calculated by the Working Group comparing intervention with combination of both control arms and only for men
Stevens et al. (1995) USA	RCT Men, aged ≥ 15 years Moist snuff and chewing tobacco[a] 12-month follow-up	245 Oral examination, prophylactic treatment, patient education (with feedback), advice to quit SLT products by DH, follow-up by dentist, video and brief counselling session, brief self-help booklet, telephone number of a 24-hour advice line, a quit kit and follow-up call by DH after 1 week, tip sheets, monthly newsletters	273 Oral examination, brief advice to quit	At 12 months, quit rate: I: 18.4% C: 12.5% RR (95% CI): 1.47 (0.83–2.6)	Strength: long-term follow-up Limitations: this study was contaminated with NRT use by 4.5% in the intervention arm and 6.4% in the control arm; results were not confirmed biochemically RR calculated by Ebbert et al. (2015)

Table 3.9 (continued)

Reference Location	Study design Study population	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Severson et al. (1998) USA	RCT Men and women, aged ≥ 15 years SLT[a] 12-month follow-up	394 Oral examination, advice to quit SLT use, informative pamphlets, quit kit, setting of a quit date, motivational video, telephonic follow-up within 2 weeks	293 Advice to quit	At 12 months, quit rate: I: 10.2% C: 3.3% RR (95% CI): 3.03 (1.44–6.37)	Strength: long-term follow-up Limitation: results were not confirmed biochemically RR calculated by Ebbert et al. (2015)
Walsh et al. (1999) USA	RCT Men College baseball and football athletes SLT[a] 12-month follow-up	171 Oral examination by dentist, advice to quit tobacco use, self-help guide, brief counselling by DH (to SLT users, and also in groups to non-users), nicotine gum, telephone support	189 No intervention	At 12 months, quit rate: I: 35.1% C: 15.9% RR (95% CI): 2.21 (1.50–3.25)	Strength: long-term follow-up Limitations: nicotine gum was used by only 10% in the intervention group; no biochemical confirmation; 4% (7 in the intervention group and 5 in the control group) of the SLT users who were non-smokers at baseline started smoking cigarettes; of these athletes, only 1 in the intervention group quit SLT use Quit rates and RR calculated by Ebbert et al. (2015)
Severson et al. (2007) USA	RCT Men (majority) and women, aged 17–82 years SLT[a] 12-month follow-up	535 Assisted self-help: SLT quitting manual, video, telephone counselling	534 SLT quitting manual only	At 12 months, quit rate (based on ITT): I: 12.9% C: 9.7% RR (95% CI): 1.32 (0.94–1.86)	Strength: long-term follow-up Limitation: results were not confirmed biochemically RR calculated by Ebbert et al. (2015)
Severson et al. (2008) USA	RCT Men SLT[a] 6-month follow-up	1260 Enhanced website: guided, interactive programme to help each user create a tailored plan for quitting and relapse prevention, streaming video, broader range of printable useful resources, annotated links to external websites, two web forums, two modules (planning to quit and staying quit)	1263 Basic website: printable pocket guide and useful resources, links to external websites on SLT cessation and oral cancer	At 6 months, quit rate: [I: 21.4% C: 16.8% RR (95% CI): 1.28 (1.09–1.50)]	Limitation: results were not confirmed biochemically

Table 3.9 (continued)

Reference Location	Study design Study population	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Severson et al. (2009) USA	RCT Male military personnel SLT 6-month follow-up	392 SLT cessation manual, video cessation guide tailored to military personnel, telephone counselling	393 Advice to quit SLT use, referral to local military installation tobacco cessation programmes	At 6 months, quit rate: I: 30.3% C: 15.3% RR (95% CI): 1.98 (1.50–2.61)	Limitation: results were not confirmed biochemically Quit rates and RR calculated by Ebbert et al. (2015)
Virtanen et al. (2015) Sweden	RCT (FRITT study) Men and women, aged 18–75 years *Snus*[a] 6-month follow-up	225 94 SLT users Structured brief advice based on the 5A model[c]	242 100 SLT users Usual care	At 6 months, quit rate: I: 7.5% C: 2% RR (95% CI): 3.72 (0.79–17.47)	Limitations: number of SLT users in intervention and control groups was limited; large loss to follow-up; results were not confirmed biochemically Quit rates and RR calculated by Ebbert et al. (2015)

AN, areca nut; C, control; CI, confidence interval; DH, dental hygienist; FRITT, Free from Tobacco in Dentistry; I, intervention; ITT, intention-to-treat analysis; NRT, nicotine replacement therapy; OPMDs, oral potentially malignant disorders; RCT, randomized controlled trial; RR, relative risk; SLT, smokeless tobacco.

[a] SLT only.

[b] AN with tobacco.

[c] 5A model: (1) Asking about tobacco use, (2) Advising to quit, (3) Assessing willingness to quit, (4) Assisting the tobacco user in quitting, for instance by providing information on available counselling and medications, and (5) Arranging follow-up contacts.

rate of leukoplakia decreased significantly over the 10-year study period, and much more so in the intervention cohort than in the control cohort. [The results were based only on the response of participants and were not confirmed biochemically. RR with 95% CI and intention-to-treat analysis were not provided by the authors, and the control group was not concurrent in time.]

An anti-tobacco community education programme was conducted through trained health workers in Kolar District, Karnataka, India, in an intervention area (n = 6714) and two control areas (n = 12 152 in control area 1 and n = 8171 in control area 2) (Anantha et al., 1995). The intervention, which included anti-tobacco education through handbills, folders, cards, a photo album, portable display boards, and films in local languages, was provided only to the intervention group. After 5 years, the prevalence of tobacco chewing in men decreased significantly in the intervention group, from 16.8% to 8.1%, and remained almost unchanged in the control group (6.9% vs 7.1% in control area 1, and 11.4% vs 11.4% in control area 2) [RR, 25.70; 95% CI, 13.26–49.84]. [The age group of the participants was not mentioned. Results were not confirmed biochemically. RR with 95% CI and intention-to-treat analysis were not provided.]

More recently, the 7 RCTs conducted in the USA and Sweden assessed the impact of SLT cessation interventions. Most of these studies used one or more of the following behavioural interventions: brief advice to quit SLT use, a self-help booklet or cessation manual, tip sheets, monthly newsletter, pamphlets, and/or video and telephone calls for brief counselling and follow-up (Table 3.9). Of the 7 RCTs, 4 studies (Severson et al., 1998, 2008, 2009; Walsh et al., 1999) showed statistically significant effects and are described below.

Severson et al. (1998) conducted a brief dental office-based intervention in 687 SLT users (n = 394 in the intervention arm and n = 293 in the control arm) at 75 dental practices in Oregon (USA). For the participants in the intervention arm, an oral examination was conducted, followed by advice to quit SLT use and the setting of a quit date, informative pamphlets, a quit kit and a motivational video, and telephonic follow-up within 2 weeks. Participants in the control arm were provided with usual care and only advice to quit. At 12 months, the cessation rate of SLT use was 10.2% in the intervention group compared with 3.3% in the usual-care group (RR, 3.03; 95% CI, 1.44–6.37; Ebbert et al., 2015). [Results were not confirmed biochemically.]

Walsh et al. (1999) conducted an athletic team-based SLT cessation programme based on cognitive social learning theory in 360 male college baseball and football athletes. The intervention included an oral examination by a dentist, advice to quit SLT use, a self-help guide, individual or group counselling by a dental hygienist, telephone support, and nicotine gum in some participants. At 12 months, the cessation rate of SLT use was 35.1% in the intervention colleges and 15.9% in the control colleges (RR, 2.21; 95% CI, 1.50–3.25; Ebbert et al., 2015). [Results were not confirmed biochemically. Nicotine gum was used by 10% of participants at intervention colleges, and 4% of the SLT users who were non-smokers at baseline started smoking cigarettes.]

Severson et al. (2008) assessed the impact of an interactive, tailored web-based intervention (enhanced condition) versus a more linear, text-based website (basic condition) in 2523 adult SLT users in the USA. At 6 months of follow-up, the cessation rate of SLT use was 21.4% in the enhanced condition and 16.8% in the basic condition [RR, 1.28; 95% CI, 1.09–1.50]. [Results were not confirmed biochemically.]

An RCT was conducted in 785 male military personnel who used SLT, recruited from 24 military dental clinics across the USA during annual dental examinations (Severson et al., 2009). The behavioural intervention included an SLT cessation manual, a videotape cessation guide tailored

to military personnel, and three 15-minute telephone counselling sessions using motivational interviewing methods. The usual care provided to the controls consisted of standard procedures of the annual dental examination, including advice to quit SLT use and referral to local tobacco cessation programmes. At 6 months, the cessation rate of SLT use was 30.3% in the behavioural intervention arm and 15.3% in the usual-care arm (RR, 1.98; 95% CI, 1.5–2.61; Ebbert et al., 2015). [Results were not confirmed biochemically.]

A recent meta-analysis (Nethan et al., 2020) reported efficacy of behavioural interventions for SLT cessation in adults (RR, 1.63; 95% CI, 1.32–1.94) in both developed countries (RR, 1.39; 95% CI, 1.16–1.63) and developing countries (RR, 2.79; 95% CI, 2.32–3.25). Of the 16 studies included in the meta-analysis, 8 studies (Gupta et al., 1992; Stevens et al., 1995; Severson et al., 1998, 2007, 2008, 2009; Walsh et al., 1999; Virtanen et al., 2015) are summarized above.

In addition, in a study conducted in Minnesota (USA) among 210 adult male users of spit tobacco, group behavioural interventions alone provided a higher long-term abstinence rate than the use of nicotine gum with minimal contact (Hatsukami et al., 1996; for details, see Section 3.3.3).

(b) Behavioural interventions in youth

Interventions for cessation of SLT use in youth are different from those in adults, because the related health risks are not a major concern for this age group. A total of 5 studies (4 RCTs and 1 cohort study) were found that assessed behavioural interventions for SLT cessation in youth. The 4 RCTs were conducted in the USA in schools and colleges, in baseball and football players and other athletes (Gansky et al., 2002, 2005; Walsh et al., 2010; Danaher et al., 2013). The cohort study was conducted in India (Stigler et al., 2007) (Table 3.10).

Walsh et al. (2010) conducted an SLT cessation intervention study in 246 male baseball players aged 14–18 years in rural high schools in the USA who used SLT, and showed a significant effect at 12 months of follow-up. The intervention involved peer-led educational sessions, an oral examination, brief advice to quit SLT use, a self-help guide, a follow-up oral examination, and group cessation counselling sessions led by the school nurse. In SLT users who were non-smokers at baseline, at 12 months of follow-up the cessation rate of SLT use was 62% in the intervention arm and 36% in the control arm [RR, 1.70; 95% CI, 1.50–1.86]. [Results were not confirmed biochemically.] In this study, the male students who used SLT only were more likely to quit SLT use than those who also smoked (i.e. dual users).

Gansky et al. (2005) conducted a study in 637 collegiate baseball athletes aged 17–20 years who used spit tobacco at 52 colleges in California (USA). The participants in the intervention arm received oral cancer screening with feedback and brief counselling during the pre-season health screenings, support from a certified athletic trainer for SLT cessation, and a peer-led educational team meeting. The participants in the control arm received the usual anti-tobacco education, and the intervention materials were distributed only after the study ended. At 12 months, the cessation rate of SLT use in the intervention group (36%) was not significantly different from that in the control group (37%) (RR, 0.98; 95% CI, 0.80–1.20; Ebbert et al., 2015). In a larger cohort of 948 students from the same colleges, a significant positive effect of the intervention on the prevention of initiation of SLT use was observed (RR, 0.58; 95% CI, 0.35–0.99). [Results were not confirmed biochemically.]

Danaher et al. (2013) assessed a web-based intervention for SLT cessation, called the MyLastDip programme, in SLT users aged 14–25 years in the USA; 857 SLT users were randomly assigned to receive the enhanced website-based tailored intervention, and 859 SLT

Table 3.10 Behavioural interventions for cessation of smokeless tobacco and/or areca nut use in youth

Reference Location	Study design Study population	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Gansky et al. (2002) USA	RCT Males High school baseball athletes Spit tobacco[a] 24-month follow-up	355 141 users of spit tobacco Oral examination by dentist, brief counselling, peer-led component (video, graphic slides, group discussion)	375 166 users of spit tobacco No intervention	At 24 months, quit rate: I: 23% C: 13% RR (95% CI): 2.03 (0.89–4.60)	Strength: long-term follow-up Limitation: results were not confirmed biochemically RR calculated by Carr and Ebbert (2012) Initiation of SLT use: 27% in intervention group, 28% in control group (RR, 1.03; 95% CI, 0.75–1.41)
Gansky et al. (2005) USA	Cluster RCT Males, aged 17–20 years Collegiate baseball athletes Spit tobacco[a] 12-month follow-up	883 (27 colleges) 285 SLT users Dental component: oral cancer screening examination by dentist and/or DH, brief advice to quit SLT use, self-help guide tailored to baseball athletes, brief counselling by DH, follow-up by certified athletic trainer (group sessions), referral to tobacco-cessation counsellors on campus or in the community (for athletes wanting more intensive support and problem-solving) Peer-led component: videos (one tailored to baseball athletes), slide presentation, discussion	702 (25 colleges) 352 SLT users Usual anti-tobacco education offered at their colleges; all intervention materials were distributed at the end of the study	At 12 months, quit rate: I: 36% C: 37% RR (95% CI): 0.98 (0.80–1.20)	Strength: long-term follow-up Limitation: results were not confirmed biochemically RR calculated by Ebbert et al. (2015) Initiation of SLT use: 5.1% in intervention colleges, 8.4% in control colleges (RR, 0.58; 95% CI, 0.35–0.99) Of the SLT-only users at baseline, 4% reported at follow-up that they had stopped SLT use but had initiated smoking Of the dual users at baseline, 14% reported at follow-up that they had quit SLT use but continued to smoke
Stigler et al. (2007) India	Cohort study (Project MYTRI) Male and female students, aged 10–16 years School students in grade 6–9 Chewing tobacco[a,b] 12-month follow-up	4009 (16 schools) Classroom activities (curriculum), school posters, parent postcards, peer-led health activism	4360 (16 schools) Delayed intervention	At 12 months, quit rate: I: 1.1% C: 0.9% [RR (95% CI): 1.23 (0.88–1.72)]	Strength: long-term follow-up Limitation: results were not confirmed biochemically

Table 3.10 (continued)

Reference Location	Study design Study population	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Walsh et al. (2010) USA	Cluster RCT Males, aged 14–18 years Baseball players SLT[a] 12-month follow-up	2270 123 SLT users Peer-led educational session (video, slide presentation, discussion), oral examination with feedback, brief advice to quit SLT use, self-help guide, follow-up oral examination by nurse, nurse-led group cessation counselling sessions	2461 123 SLT users No intervention	At 12 months, quit rate in baseline non-smokers: I: 62% C: 36% [RR (95% CI): 1.70 (1.50–1.86)[c]]	Strength: long-term follow-up Limitations: results were not confirmed biochemically; confounded by smoking in some participants Prevalence of SLT initiation in baseline non-SLT users: Overall: 3% in intervention group, 3% in control group (OR, 0.78; 95% CI, 0.49–1.23) In baseline non-smokers: 2% in intervention group, 3% in control group (OR, 0.63; 95% CI, 0.36–1.13) In baseline smokers: 9% in intervention group, 7% in control group (OR, 0.88; 95% CI, 0.51–1.51) SLT-only users at baseline (i.e. baseline non-smokers) reported a significantly higher percentage of smoking at follow-up (19.4%)
Danaher et al. (2013) USA	RCT (MyLastDip programme) Males (majority) and females, aged 14–25 years SLT[a] 6-month follow-up	857 Enhanced condition: personalized best-practices SLT cessation programme with interactive and multimedia features, resource section with informational materials	859 Basic condition: online version of a self-help guide, resource section with informational materials, links to websites with content on SLT cessation and relaxation strategies	At 6 months, quit rate: I: 22.6% C: 21.9% RR (95% CI): 1.07 (0.87–1.31)	Limitation: results were not confirmed biochemically RR calculated by Ebbert et al. (2015)

AN, areca nut; C, control; CI, confidence interval; DH, dental hygienist; GEE, generalized estimating equation; I, intervention; MYTRI, Mobilizing Youth for Tobacco-Related Initiatives in India; OR, odds ratio; RCT, randomized controlled trial; RR, relative risk; SLT, smokeless tobacco.

[a] SLT only.

[b] AN with tobacco.

[c] The calculation did not adjust for the fact that the OR reported by the authors comes from a GEE model that adjusted for clustering at schools.

users (controls) used the simple website, which provided guidelines in static text. At 6 months, in the intention-to-treat analysis, the cessation rate of SLT use was 22.6% in the intervention group and 21.9% in the control group (RR, 1.07; 95% CI, 0.87–1.31; Ebbert et al., 2015). [Results were not confirmed biochemically.]

A 2-year school-based, multicomponent tobacco intervention, called Project MYTRI: Mobilizing Youth for Tobacco-Related Initiatives in India, was conducted in two large cities (Delhi and Chennai) at 32 schools (16 schools in the intervention arm and 16 in the control arm) with two cohorts of students who were in grades 6 and 8, aged 10–16 years, when the study began (Stigler et al., 2007). Three surveys were conducted: the first at baseline in 2004, the second at the midpoint in 2005, and the third at the end of the intervention in 2006. The intervention was carried out by trained field staff, teachers, and peer leaders and consisted of four primary components: (i) behavioural, (ii) awareness generation with classroom activities and posters, (iii) parental involvement, and (iv) peer leadership in health activism. The controls received a delayed intervention. At 12 months, the cessation rate of SLT use was 1.1% in the intervention arm and 0.9% in the control arm [RR, 1.23; 95% CI, 0.88–1.72]. [Results were not confirmed biochemically, and RR with 95% CI and intention-to-treat analysis were not provided by the authors. The Working Group noted that in this study the term "SLT" may include products with SLT only and products with areca nut and tobacco, because both are predominant in India.]

In the recent meta-analysis by Nethan et al. (2020), behavioural interventions for SLT cessation did not prove effective in youth overall (RR, 1.07; 95% CI, 0.73–1.41), in developed countries (RR, 1.39; 95% CI, 0.58–2.21), or in developing countries (RR, 0.87; 95% CI, 0.68–1.07). Of the 3 studies included in the meta-analysis, 2 studies (Stigler et al., 2007; Walsh et al., 2010) are summarized above.

3.3.2 Pharmacological interventions

This section reviews studies assessing the effectiveness of pharmacological interventions alone for cessation of SLT or areca nut use. Nicotine replacement therapy, such as nicotine gums, lozenges, patches, and inhalers, and non-nicotine agents such as bupropion and varenicline are used as pharmacological interventions for tobacco cessation (Aubin et al., 2014). A total of 3 RCTs were considered; one was conducted in India (Raja et al., 2016), one in the USA (Severson et al., 2015), and one in Taiwan (China) (Hung et al., 2020) (Table 3.11).

(a) Nicotine replacement therapy

A worksite-based RCT in India evaluated and compared the effectiveness of nicotine gum (2 mg strength) and oral health education in 40 male users of SLT and areca nut (Raja et al., 2016). The tobacco abstinence rate (biochemically confirmed by cotinine levels in urine) at 3 months was higher in the nicotine gum group than in the group that received oral health education, but the difference was not statistically significant [RR, 1.33; 95% CI, 0.70–2.56]. [Limitations of this study are the small sample size, the short follow-up period, no mention of nicotine gum treatment period or frequency of gum intake, and the presence of one bidi smoker in the nicotine gum group.]

A web-based study (Severson et al., 2015), conducted in 1067 users of SLT in the USA, assessed the effectiveness of three separate interventions for SLT cessation: (a) nicotine lozenge (4 mg for 12 weeks) together with telephone counselling for 3 weeks (intervention arm), (b) nicotine lozenge (4 mg for 12 weeks) alone, and (c) telephone counselling only. In the study, groups (b) and (c) were considered as two control arms. [The Working Group assessed the results of the lozenge-only arm (b), taking the telephone counselling-only arm (c) as the control arm. There was no significant difference between the

Table 3.11 Pharmacological interventions for cessation of smokeless tobacco and/or areca nut use

Reference Location	Study design Study population Recruitment	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Nicotine replacement therapy					
Severson et al. (2015) USA	RCT Male (98%) users of SLT[a] only who were ready to quit Web-based 3-month and 6-month follow-up	(a) Nicotine lozenge (4 mg for 12 weeks) plus 3 coaching calls[d] (for 3 weeks) (n = 357) (b) Nicotine lozenge (4 mg for 12 weeks) (n = 356)	(c) 3 coaching calls[d] (for 3 weeks) (n = 354)	7-day repeated PP all-tobacco abstinence rate at 3-month and 6-month assessments (ITT) (self-reported): (a) 43.1% (b) 32.6% (c) 31.6% Lozenge alone (b) versus coaching calls alone (c): [RR (95% CI): 1.02 (0.87–1.19)]	Strength: large sample size (> 100 for each arm) Limitations: unstated allocation concealment; no biochemical validation test Note: In this study, the two groups (b) nicotine lozenge-only group and (c) telephone counselling-only group were considered as two control arms. Based on the abstinence rates, the Working Group could estimate the effectiveness of the lozenge-only intervention, by comparing (b) versus (c)
Raja et al. (2016) India	Parallel RCT Male users of *khaini*[a] and *paan masala*[c] Worksite-based 3-month follow-up	NRT group: nicotine gum (2 mg, depending on frequency of tobacco intake) (n = 20)	Oral health education group (n = 20)	Tobacco abstinence rate at 3 months (urinary cotinine): [I: 25% C: 15%] [RR (95% CI): 1.33 (0.70–2.56)]	Limitations: small sample size; no mention of NRT treatment period or frequency of gum intake; no information on mean age of study participants; 1 smoker (bidi) was included in the NRT group; loss to follow-up was treated as non-abstinent

Table 3.11 (continued)

Reference Location	Study design Study population Recruitment	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Non-nicotine replacement therapy					
Hung et al. (2020) Taiwan (China)	Double-blind RCT Male users of AN (e.g. BQ)[c] with cigarette smoking habits (except for 2 participants assigned to moclobemide group) Health-care setting-based	Escitalopram (SSRI, 10 mg/day for 8 weeks) (n = 38) Moclobemide (reversible MAOI, 150 mg/day for 8 weeks) (n = 36)	Placebo (identical-appearing) (n = 37)	Continuous abstinence rate (ITT) for ≥ 6 weeks after 8-week treatment (urinary arecoline): Escitalopram: 34.2% Moclobemide: 33.3% Placebo: 5.4% Escitalopram versus placebo: Adjusted proportion ratio: 6.3 (95% CI, 1.5–26.1) [RR (95% CI): 6.33 (1.53–26.14)] Moclobemide versus placebo: Adjusted proportion ratio: 6.8 (95% CI, 1.6–28.0) [RR (95% CI): 6.17 (1.48–25.64)]	Strength: this is a novel study of prescribing antidepressants for cessation of AN use Limitations: the outcomes were confounded by the cigarette smoking habits; an assignment of behavioural therapy group as a control arm is lacking

AN, areca nut; BQ, betel quid; CI, confidence interval; ITT, intention-to-treat analysis; MAOI, monoamine oxidase inhibitor; NRT, nicotine replacement therapy; PP, point prevalence; RCT, randomized controlled trial; RR, relative risk; SLT, smokeless tobacco; SSRI, selective serotonin reuptake inhibitor.

[a] SLT alone.

[b] AN with SLT.

[c] AN alone.

[d] Three planned proactive telephone counselling calls: 1 week after randomization for initial call, 2–3 days after the quit date, and 14–21 days after the second call.

two groups in the all-tobacco abstinence rate at the 3-month and 6-month assessments of self-reported 7-day repeated point prevalence (RR, 1.02; 95% CI, 0.87–1.19). The main strength of this study is the large sample size. Limitations of this study are unstated allocation concealment and no biochemical validation test.]

(b) Non-nicotine replacement therapy

In Taiwan (China), areca nut (including betel quid) products are consumed without tobacco (Lee et al., 2011). A double-blind RCT was conducted in 111 male users of areca nut and betel quid, to assess the effectiveness of the antidepressants escitalopram (a selective serotonin reuptake inhibitor; 10 mg/day for 8 weeks) and moclobemide (a reversible monoamine oxidase inhibitor; 150 mg/day for 8 weeks) in treating areca nut or betel quid use disorder or areca nut addiction (Lee et al., 2018; Hung et al., 2020). Follow-up was every 2 weeks for the 8-week trial. The primary outcome was cessation of areca nut chewing, which was defined as patients who had quit use of areca nut products continuously for ≥ 6 weeks. After 8 weeks of treatment, 34.2% of participants in the escitalopram group, 33.3% in the moclobemide group, and 5.4% in the placebo group quit use of areca nut products continuously for ≥ 6 weeks. The adjusted proportion ratio for areca nut chewing cessation (adjusted for age, education level, cigarette smoking, and the level of betel quid use disorder) was 6.3 (95% CI, 1.5–26.1) for escitalopram [RR, 6.33; 95% CI, 1.53–26.14] and 6.8 (95% CI, 1.6–28.0) for moclobemide [RR, 6.17; 95% CI, 1.48–25.64], compared with the placebo group. [This is an innovative study prescribing antidepressants for cessation of use of areca nut or betel quid, but it has limitations such as being confounded by cigarette smoking and lack of behavioural therapy in the control arm.]

3.3.3 Combined pharmacological and behavioural interventions

This section reviews studies assessing the effectiveness of pharmacological interventions in combination with behavioural interventions for cessation of SLT or areca nut use. In addition to the study selection criteria mentioned earlier, the review excluded studies on a pharmacological intervention alone and studies with no placebo or behavioural intervention in the control group.

A total of 16 RCTs were evaluated (Table 3.12), of which 2 were on nicotine gum (Boyle, 1992; Hatsukami et al., 1996), 4 on nicotine patch (Howard-Pitney et al., 1999; Hatsukami et al., 2000; Stotts et al., 2003; Ebbert et al., 2013), 4 on nicotine lozenge (Ebbert et al., 2009, 2010; Danaher et al., 2015; Severson et al., 2015), 3 on bupropion (Glover et al., 2002; Dale et al., 2002, 2007), and 3 on varenicline (Fagerström et al., 2010; Ebbert et al., 2011; Jain et al., 2014). Most of the studies were conducted in the USA (Boyle, 1992; Hatsukami et al., 1996, 2000; Howard-Pitney et al., 1999; Dale et al., 2002, 2007; Glover et al., 2002; Stotts et al., 2003; Ebbert et al., 2009, 2010, 2011, 2013; Danaher et al., 2015; Severson et al., 2015); one study was in Norway and Sweden (Fagerström et al., 2010), and one study was in India (Jain et al., 2014). One study was conducted specifically in adolescents aged 14–19 years (Stotts et al., 2003). [The Working Group noted that in all the studies the same behavioural intervention was given in both the intervention arm and the control arm, which may limit the evaluation of the combined effect of pharmacological and behavioural interventions compared with no intervention.]

(a) Nicotine replacement therapy

(i) Nicotine gum

Boyle (1992) conducted the first RCT for SLT cessation using nicotine replacement therapy in 100 users of moist snuff in the USA. The study investigated the effectiveness for SLT cessation

Table 3.12 Combined pharmacological and behavioural interventions for cessation of smokeless tobacco and/or areca nut use

Reference Location	Study design Study population Recruitment	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Nicotine replacement therapy: nicotine gum					
Boyle (1992) USA	RCT Male users of SLT* only Mass/social media-based *Moist snuff and chewing tobacco 6-week follow-up	Nicotine gum (2 mg, 12 pieces/day) for 6 weeks with group meeting and group social support for behavioural skills training (20–60 minutes/week) for 4 weeks (n = 50)	Placebo gum with group meeting and group social support for behavioural skills training (20–60 minutes/week) for 4 weeks (n = 50)	Continuous all-tobacco abstinence rate at 6 weeks (CO and tobacco alkaloids): Nicotine gum: 50% Placebo gum: 40% [RR (95% CI): 1.25 (0.81–1.94)]	Loss to follow-up was treated as non-abstinent Different validation tests were used at baseline and during follow-up Limitations: control arm also received the behavioural intervention; in biochemical validation tests at baseline, saliva cotinine levels were significantly higher in the active gum group; short follow-up
Hatsukami et al. (1996) USA	RCT Male users of SLT* only who were motivated to quit (not regular users of other forms of tobacco products) Mass/social media-based *Spit tobacco 12-month follow-up	(a) 2 mg of nicotine gum (at least 6 pieces/day initially, then decrease) with group behavioural therapy** for 8 weeks (n = 55) (c) 2 mg of nicotine gum with minimal contact*** for 8 weeks (n = 51) **Group behavioural therapy: 8 sessions (45–60 minutes each over 10 weeks) ***Minimal contact: 4 brief sessions by nurse, self-help booklet	(b) Placebo gum with group behavioural therapy** (n = 50) (d) Placebo gum with minimal contact*** (n = 54)	7-day PP SLT abstinence rate at 12-month follow-up (salivary cotinine): (a) 34.5% (b) 26% (c) 17.6% (d) 27.8% Nicotine gum (a) versus placebo gum (b) with group behavioural therapy: [RR (95% CI): 1.20 (0.83–1.74)] Nicotine gum (c) versus placebo gum (d) with minimal contact: [RR (95% CI): 0.72 (0.41–1.26)]	Loss to follow-up was treated as non-abstinent Limitations: control arms also received the behavioural interventions; not enough description of the approach of group allocation of participants, although it was mentioned that they were randomized

Table 3.12 (continued)

Reference Location	Study design Study population Recruitment	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Nicotine replacement therapy: nicotine patch					
Howard-Pitney et al. (1999) USA	Double-blind RCT Male users of SLT* only (98% non-smokers) who were motivated to quit Mass/social media-based *Chewing tobacco 6-month follow-up	15 mg nicotine patch for 6 weeks plus minimal-contact behavioural therapy** for 6 weeks (n = 206) **2 pharmacy visits (with trained pharmacist), 2 support calls (48 hours and 10 days after the quit date), self-help materials	Placebo patch plus minimal-contact behavioural therapy** for 6 weeks (n = 204)	7-day PP SLT abstinence rate at 6 months after treatment (salivary cotinine): Active patch: 38% Placebo patch: 34% [RR (95% CI): 1.09 (0.90–1.33)]	Loss to follow-up was treated as non-abstinent Strength: large sample size (≥ 100 in each arm) Limitations: control arm also received the behavioural intervention; high relapse rate in both groups; at the 6-month follow-up, the response rate was low (74%) and the distribution by group was not described
Hatsukami et al. (2000) USA	Double-blind RCT Male users of SLT* only who were ready to quit (not regular users of other forms of tobacco products) Mass/social media-based *Spit tobacco 62-week follow-up	(a) Active nicotine patch (including tapering period of 21 mg for 6 weeks, 14 mg for 2 weeks, and 7 mg for 2 weeks) plus mint snuff for 10 weeks (n = 100) (b) Active nicotine patch (including tapering period, same as group a) and no mint snuff for 10 weeks (n = 100) Individual brief behavioural interventions (10 minutes) with self-help manual were given for all groups at 8 visits	(c) Placebo patch plus mint snuff for 10 weeks (n = 101) (d) Placebo patch and no mint snuff for 10 weeks (n = 101)	Continuous all-tobacco abstinence rate at 62-week assessment (saliva cotinine): (a) 33% (b) 29% (c) 21% (d) 28% Active patch (b) versus placebo patch (d): [RR (95% CI): 1.03 (0.76–1.39)]	Loss to follow-up was treated as non-abstinent No evidence of the effect of mint snuff, and no interaction with nicotine patch (a versus b) Strength: large sample size (≥ 100 in each arm) Limitations: control arms also received the behavioural intervention; not enough description of the approach of group allocation of participants, although it was mentioned that they were randomized

Table 3.12 (continued)

Reference Location	Study design Study population Recruitment	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Stotts et al. (2003) USA	RCT Adolescent male users of SLT* only who were motivated to quit Youth-targeted (ages 14–19 years) *Spit tobacco (snuff and/or chewing tobacco) 12-month follow-up	(a) Nicotine patch with 50 minutes of behavioural intervention** for 6 weeks (n = 98) **Based on National Cancer Institute educational materials, and invited for a free oral screening	(b) Placebo patch with 50 minutes of behavioural intervention** for 6 weeks (n = 100) (c) Usual care: 5–10-minute counselling with follow-up telephone call 2 weeks later (n = 105)	7-day PP spit tobacco abstinence rate (ITT) at 12 months (salivary cotinine): (a) 17.3% (b) 25.0% (c) 11.4% Active patch (a) versus placebo (b): [RR (95% CI): 0.69 (0.40–1.20)] Active patch (a) versus usual care (c): [RR (95% CI): 1.52 (0.77–3.01)]	Limitations: high dropout rate in the control group as a result of knowing that they had no chance of receiving NRT; a few participants also smoked
Ebbert et al. (2013) USA	Phase II RCT Male heavy users of SLT only (aged 18–55 years) who use ≥ 3 cans or pouches per week and no other tobacco products Mass/social media-based 6-month follow-up	Nicotine patch (two 21 mg patches/day for 6 weeks and one 21 mg patch/day for 2 weeks) with behavioural intervention* (n = 25) *Individualized sessions (4 study visits during the medication phase) with self-help manual, minimum of 10 minutes, delivered by trained research staff	Identical-appearing placebo patch for 8 weeks with behavioural intervention* (n = 27)	Prolonged all-tobacco abstinence rate at 6 months (urinary anabasine): Nicotine patch: 32% Placebo patch: 19% [RR (95% CI): 1.41 (0.81–2.47)]	Loss to follow-up was treated as non-abstinent Limitations: control arm also received the behavioural intervention; the dropout rate was higher in the placebo group

Table 3.12 (continued)

Reference Location	Study design Study population Recruitment	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Nicotine replacement therapy: nicotine lozenge					
Ebbert et al. (2009) USA	RCT pilot study Adult (97% male) users of SLT* only who were ready to quit Mass/social media-based *Snuff 6-month follow-up	Nicotine lozenge (4 mg for 12 weeks) with brief behavioural counselling** at each visit (n = 136) **Including best-practice topics (10 minutes long, at week 2, 4, 6, and 12), tailored to participant quitting status	Placebo lozenge (for 12 weeks) with brief behavioural counselling** at each visit (n = 134)	Prolonged SLT abstinence rate at week 24 (no verification by urinary cotinine): Nicotine lozenge: 30.2% Placebo lozenge: 23.1% [RR (95% CI): 1.19 (0.93–1.52)]	Loss to follow-up was treated as non-abstinent Strength: large sample size (≥ 100 in each arm) Limitations: control arm also received the behavioural intervention; a higher percentage of the active group (18.3%) had biochemical disconfirmation of the self-reporting compared with the placebo group (5.1%) in week 12 (end of medication)
Ebbert et al. (2010) USA	RCT pilot study Adult (97% male) users of SLT* only who wanted to quit Mass/social media-based *Snuff 6-month follow-up	Nicotine lozenge (4 mg for 12 weeks) with assisted self-help intervention** (n = 30) **Assisted self-help by a self-help quitting guide, telephone support (5–15 minutes) by trained study assistants	Placebo lozenge (for 12 weeks) with assisted self-help intervention** (n = 30)	Prolonged SLT abstinence rate (self-reported) at 6 months: Nicotine lozenge: 27% Placebo lozenge: 38% [RR (95% CI): 0.79 (0.43–1.43)]	Loss to follow-up was treated as non-abstinent Limitations: control arm also received the behavioural intervention; small sample size; no biochemically confirmed abstinence; unstated randomization method
Danaher et al. (2015) USA	RCT Adult (98% male) users of SLT only who wanted to quit Web-based 6-month follow-up	Interactive web-based intervention* plus lozenge (4 mg) for 12 weeks (n = 205) *Automated email reminders encouraged engagement with the programme before and after the quit date (supportive emails sent 2 days, 1 week, and 2 weeks after the quit date)	Web-based intervention* only (n = 202)	7-day repeated PP SLT abstinence rate (ITT) at 6 months (self-reported) (primary outcome): Intervention arm: 45.9% Control arm: 39.1% [RR (95% CI): 1.15 (0.95–1.39)]	Strength: large sample size (≥ 100 in each arm) Limitations: no placebo lozenge was given to control arm; control arm also received the behavioural intervention; unstated allocation concealment; no biochemical validation test

Table 3.12 (continued)

Reference Location	Study design Study population Recruitment	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Severson et al. (2015) USA	RCT Adult (98% male) users of SLT only who were ready to quit Web-based 3-month and 6-month follow-up	(a) Nicotine lozenge (4 mg for 12 weeks) plus 3 coaching calls* (for 3 weeks) (n = 357) *3 planned proactive telephone counselling calls: 1 week after randomization for initial call, 2–3 days after the quit date, and 14–21 days after the second call	(b) Nicotine lozenge (4 mg for 12 weeks) (n = 356) (c) 3 coaching calls* (for 3 weeks) (n = 354)	7-day repeated PP all-tobacco abstinence rate at 3-month and 6-month assessments (ITT) (self-reported): (a) 43.1% (b) 32.6% (c) 31.6% (a) versus (b): [RR (95% CI): 1.24 (1.08–1.44)] (a) versus (c): [RR (95% CI): 1.27 (1.10–1.47)]	Strengths: large sample size (≥ 100 in each arm) Limitations: unstated allocation concealment; no biochemical validation test
Non-nicotine replacement therapy: bupropion SR					
Glover et al. (2002) USA	Double-blind RCT Male users of SLT* only who were motivated to quit (smokers excluded) Mass/social media-based *Moist snuff 12-week follow-up	Bupropion SR 150 mg (for 7 weeks: 150 mg once a day for 3 days, 150 mg twice a day for days 4–49) and brief counselling** (n = 35) **Trained clinician encouraged participants via telephone (3 days after the quit date and during the follow-up phase), nurse or qualified staff provided brief individual counselling (< 5 minutes) at each visit during the treatment phase	Placebo (for 7 weeks: 1 tablet once a day for 3 days, 1 tablet twice a day for days 4–49) and brief counselling** (n = 35)	7-day PP SLT abstinence rate at 12 weeks after treatment (CO, cotinine, and NicCheck): Intervention arm: 40% Control arm: 26% [RR (95% CI): 1.36 (0.86–2.15)]	Loss to follow-up was treated as non-abstinent Limitations: control arm also received the behavioural intervention; small sample size; short follow-up; no mention of dropout or loss to follow-up

Table 3.12 (continued)

Reference Location	Study design Study population Recruitment	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Dale et al. (2002) USA	Double-blind pilot RCT Male users of SLT* only who were interested in quitting Mass/social media-based *Snuff and/or chewing tobacco 6-month follow-up	Bupropion SR 150 mg (for 12 weeks: 150 mg once a day for 3 days, 150 mg twice a day from day 4 onwards) with behavioural intervention** (n = 34) **10-minute behavioural intervention at each study visit	Placebo (identical-appearing, same dosage schedule) for 12 weeks with behavioural intervention** (n = 34)	Continuous all-tobacco abstinence rate at 24 weeks (biochemically confirmed): Intervention arm: 12% Control arm: 12% [RR (95% CI): 1.00 (0.48–2.09)]	Loss to follow-up was treated as non-abstinent Limitations: control arm also received the behavioural intervention; small sample size; nearly half of the participants (31 of 68) withdrew or were lost to follow-up; unstated randomization and double-blinding method
Dale et al. (2007) USA	Multicentre double-blind RCT Male users of SLT* only who wanted to quit Mass/social media-based *Snuff and/or chewing tobacco 12-month follow-up	Bupropion 150 mg twice a day for 12 weeks plus behavioural intervention** (n = 113) **All participants received an oral examination by a periodontist and behavioural intervention with a manual during the treatment and follow-up phases	Placebo for 12 weeks plus behavioural intervention** (n = 112)	Continuous all-tobacco abstinence rate at week 52 (urinary cotinine): Intervention arm: 18.6% Control arm: 21.4% [RR (95% CI): 0.91 (0.65–1.29)]	Loss to follow-up was treated as non-abstinent Strengths: long follow-up; large sample size (≥ 100 in each arm) Limitation: control arm also received the behavioural intervention
Non-nicotine replacement therapy: varenicline					
Fagerström et al. (2010) Norway and Sweden	Multicentre, double-blind, placebo-controlled, parallel-group RCT Adult (90% male) users of SLT* only Mass/social media-based *Swedish *snus* 26-week follow-up	Varenicline 1 mg twice a day (titrated up during the first week) for 12 weeks with brief behavioural counselling* (n = 213) *Simple advice and helpful tips at the discretion of the investigator	Placebo for 12 weeks with brief behavioural counselling* (n = 218)	Continuous SLT abstinence rate at weeks 9–26 (salivary cotinine): Intervention arm: 45% Control arm: 34% RR (95% CI): 1.42 (1.08–1.79)	Loss to follow-up was treated as non-abstinent Strength: large sample size (≥ 100 in each arm) Limitation: control arm also received the behavioural intervention

Table 3.12 (continued)

Reference Location	Study design Study population Recruitment	Intervention arm	Control arm	Efficacy of intervention	Comments/interpretation
Ebbert et al. (2011) USA	Double-blind, placebo-controlled, phase II RCT Male users of SLT only Mass/social media-based 6-month follow-up	Varenicline (0.5 mg once a day for 3 days, then 0.5 mg twice a day for days 4–7, then 1.0 mg twice a day for a total of 12 weeks) with brief behavioural counselling** (*n* = 38) **Individualized programme containing 4 sessions of counselling (10 minutes long) with an intervention manual	Matching placebo with brief behavioural counselling** (*n* = 38)	Prolonged SLT abstinence rate at 6 months (urinary cotinine): Intervention arm: 44.7% Control arm: 31.6% [RR (95% CI): 1.31 (0.84–2.04)]	Loss to follow-up was treated as non-abstinent Limitations: control arm also received the behavioural intervention; small sample size
Jain et al. (2014) India	Double-blind RCT Adult (97% male) SLT users (specific products used not mentioned) Population/community based 12-week follow-up	Varenicline (1 mg twice a day for 12 weeks) with behavioural counselling* (*n* = 119) *6-session counselling with manual-based intervention	Matching placebo with behavioural counselling* (*n* = 118)	7-day PP SLT abstinence rate at 12 weeks (urinary cotinine and CO) (ITT): Intervention arm: 25.2% Control arm: 19.5% [RR (95% CI): 1.18 (0.89–1.56)]	Strength: large sample size (≥ 100 in each arm) Limitations: no mention of the type of SLT products and whether they were with or without areca nut; the study did not observe a long-term effect of the treatment; adherence to varenicline use was low; unstated randomization and double-blinding method; control arm also received the behavioural intervention

CI, confidence interval; CO, carbon monoxide; ITT, intention-to-treat analysis; NRT, nicotine replacement therapy; PP, point prevalence; RCT, randomized controlled trial; RR, relative risk; SLT, smokeless tobacco; SR, sustained release.

of nicotine gum prescribed for 6 weeks along with behavioural support in the form of 4 weekly group meetings and group social support (Boyle, 1992). At the end of the 6-week study, there was no significant difference between the nicotine gum arm and the placebo arm in the continuous abstinence rate (verified by carbon monoxide and tobacco alkaloid metabolites analysis) for use of any tobacco (including SLT) [RR, 1.25; 95% CI, 0.81–1.94]. [Limitations of this study are the short follow-up period and that levels of salivary cotinine were significantly higher at baseline in the active nicotine gum group.]

In a study conducted in Minnesota (USA), 210 adult male users of spit tobacco were randomized to determine the effectiveness of nicotine gum and behavioural therapy (Hatsukami et al.,1996). The participants were randomly assigned to the following groups: (a) group behavioural therapy and nicotine gum, (b) group behavioural therapy and placebo gum, (c) minimal contact and nicotine gum, or (d) minimal contact and placebo gum. At 12 months, there were no significant differences in 7-day point-prevalence SLT abstinence rates between group a and group b [RR, 1.20; 95% CI, 0.83–1.74] or between group c and group d [RR, 0.72; 95% CI, 0.41–1.26]. [A limitation of this study is not enough description of the approach of group allocation of participants, although it was mentioned that they were randomized.]

In a systematic review of interventions for SLT cessation (Ebbert et al., 2015), based on these two trials (Boyle et al., 1992; Hatsukami et al., 1996), nicotine gum use did not increase abstinence compared with placebo (RR, 0.99; 95% CI, 0.68–1.43).

(ii) Nicotine patch

In a large double-blind RCT (Howard-Pitney et al., 1999), 410 adult users of chewing tobacco (SLT) (99% men) received either a nicotine patch (15 mg) or a placebo patch treatment for 6 weeks combined with minimal-contact behavioural intervention. At 6 months after the treatment, the biochemically confirmed 7-day point-prevalence SLT abstinence rate was slightly higher in the nicotine patch group than in the placebo patch group, but the difference was not statistically significant [RR, 1.09; 95% CI, 0.90–1.33]. [A limitation of this study is that at the 6-month follow-up, the response rate was low and the distribution by group was not described.]

In another large trial, conducted in Minnesota (USA) (Hatsukami et al., 2000), 402 adult participants (99% men) were randomly assigned to the following treatment groups for 10 weeks: (a) nicotine patch plus mint snuff, (b) nicotine patch and no mint snuff, (c) placebo patch plus mint snuff, or (d) placebo patch and no mint snuff. The participants were also given a self-help manual, and individual brief behavioural interventions were conducted (10 minutes) at 8 visits. At the 62-week assessment (12 months after treatment), the continuous abstinence rate was higher in the nicotine patch group (b) than in the placebo patch group (d), but the difference was not statistically significant [RR, 1.03; 95% CI, 0.76–1.39]. [A limitation of this study is not enough description of the approach of group allocation of participants, although it was mentioned that they were randomized.]

An RCT was conducted in adolescent male users of SLT in the USA to test the efficacy of nicotine patches in combination with behavioural intervention compared with the usual care (Stotts et al., 2003). About 303 participants (aged 14–19 years) were recruited from 41 high schools in Arkansas. Participants were provided with either a nicotine patch (group a) or a placebo patch (group b) for 6 weeks along with a behavioural intervention and were also invited for a free oral screening, or were provided usual care (group c). At the 1-year follow-up, no significant difference was noted between the nicotine patch group and the placebo patch group [RR, 0.69; 95% CI, 0.40–1.20] or between the nicotine patch group and the usual-care group [RR, 1.52;

95% CI, 0.77–3.01]. [A limitation of this study is a high dropout rate in the control group as a result of knowing that they had no chance of receiving nicotine replacement therapy; a few participants also smoked. The study was conducted in adolescents.]

Ebbert et al. (2013) conducted a phase II RCT in adult male heavy users of SLT (who used ≥ 3 cans or pouches per week). The intervention consisted of a 42 mg/day nicotine patch (for 6 weeks) followed by a 21 mg/day nicotine patch (for 2 weeks) along with behavioural counselling for SLT cessation. At 6 months, the continuous all-tobacco abstinence rate was higher in the nicotine patch group than in the placebo patch group, but the difference was not statistically significant [RR, 1.41; 95% CI, 0.81–2.47]. [A limitation of this study is that the dropout rate was higher in the placebo group. The low power of the test may be due to the small sample size.]

The systematic review by Ebbert et al. (2015) also did not report significantly increased abstinence with nicotine patch use (5 trials; RR, 1.13; 95% CI, 0.93–1.37). Of the 5 trials included in the systematic review, 4 trials (Howard-Pitney et al., 1999; Hatsukami et al., 2000; Stotts et al., 2003; Ebbert et al., 2013) are summarized above.

(iii) Nicotine lozenge

Two randomized pilot studies were conducted in adult (mostly male) snuff users to assess the effect of nicotine lozenge use (for 12 weeks) on SLT cessation (Ebbert et al., 2009, 2010; Table 3.12). Participants were randomly allocated to either a nicotine lozenge group or a placebo lozenge group, combined with behavioural intervention (i.e. brief behavioural counselling) (Ebbert et al., 2009) or a self-help quitting guide and telephone support (Ebbert et al., 2010). At 6 months, neither of the studies showed significant differences in prolonged SLT abstinence rates: [RR, 1.19; 95% CI, 0.93–1.52] (Ebbert et al., 2009) and [RR, 0.79; 95% CI, 0.43–1.43] (Ebbert et al., 2010).

A large, web-based intervention (the MyLastDip programme) was conducted in 407 adult (98% male) SLT users in the USA to evaluate the benefits of the website and nicotine lozenge (for 12 weeks) on SLT cessation (Danaher et al., 2015; Table 3.12). At 6 months, the 7-day repeated point-prevalence SLT abstinence rate for the website plus lozenge group was not significantly higher than that for the website-only group [RR, 1.15; 95% CI, 0.95–1.39]. [Limitations of this study are that no placebo lozenge was given to the control arm, unstated allocation concealment, and no biochemical validation test.]

Severson et al. (2015) conducted a large RCT in the USA using nicotine lozenge plus telephone counselling for SLT cessation in 1067 adult (98% male) participants recruited through an online marketing campaign. Participants were allocated to one of three groups: (a) nicotine lozenge (4 mg for 12 weeks) plus coaching calls (telephone counselling), (b) nicotine lozenge (4 mg for 12 weeks) alone, or (c) coaching calls alone. For the telephone counselling, three planned proactive calls were made: 1 week after randomization for the initial call, 2–3 days after the quit date, and 14–21 days after the second call. At the 3-month and 6-month assessments, the 7-day repeated point-prevalence all-tobacco abstinence rate was higher for nicotine lozenge plus coaching calls (43.1%) than for nicotine lozenge alone (32.6%) or coaching calls alone (31.6%). The differences were statistically significant for lozenge plus coaching calls versus lozenge only [RR, 1.24; 95% CI, 1.08–1.44] and for lozenge plus coaching calls versus coaching calls only [1.27; 95% CI, 1.10–1.47]. Overall, the all-tobacco abstinence rates were relatively high in all three groups. [A strength of this study is the large sample size. Limitations are unstated allocation concealment and no biochemical validation test.]

In the meta-analysis by Ebbert et al. (2015), nicotine lozenge intervention was effective in helping people quit SLT use (5 trials; RR, 1.36; 95% CI, 1.17–1.59), but the quality of the evidence

was rated as low. Of the 5 studies included in the systematic review, 4 trials (Ebbert et al., 2009, 2010; Danaher et al., 2015; Severson et al., 2015) are summarized above.

(b) Non-nicotine replacement therapy

(i) Bupropion

Bupropion is a monocyclic antidepressant that acts as a norepinephrine and dopamine reuptake inhibitor (Cooper et al., 1980). Sustained-release bupropion has been used to treat nicotine dependence and for cessation in cigarette smokers (Hurt et al., 1997; Jorenby et al., 1999; Cahill et al., 2013).

A double-blind RCT was conducted in 70 adult male users of moist snuff in the USA, using sustained-release bupropion (150–300 mg/day for 7 weeks) or placebo, combined with brief counselling (< 5 minutes) (Glover et al., 2002). At 12 weeks, the 7-day point-prevalence SLT abstinence rate was higher in the sustained-release bupropion plus brief counselling group than in the placebo plus brief counselling group, but the difference was not statistically significant [RR, 1.36; 95% CI, 0.86–2.15]. [Limitations of this study are the small sample size and no mention of dropout or loss to follow-up rates.]

A double-blind pilot RCT (Dale et al., 2002) and a double-blind multicentre RCT (Dale et al., 2007) were conducted in adult male SLT users in the USA to assess the effectiveness of bupropion 150 mg or placebo along with behavioural intervention over a period of 12 weeks, with long-term follow-up (at 6 months and 12 months, respectively). Neither of the studies found significant differences in the continuous all-tobacco abstinence rates between the two groups. [A strength of the Dale et al. (2007) study is the large sample size.]

In the meta-analysis by Ebbert et al. (2015), based on two trials, bupropion did not show a benefit in SLT cessation (RR, 0.89; 95% CI, 0.54–1.44). Both of these trials (Dale et al., 2002, 2007) are summarized above.

(ii) Varenicline

Varenicline, a partial agonist of the α4β2 nicotinic receptor (Coe et al., 2005), has been used for smoking cessation (Gonzales et al., 2006; Jorenby et al., 2006; Wu et al., 2006; Cahill et al., 2012). Varenicline inhibits the activation of dopaminergic activity caused by smoking while providing relief from the craving and withdrawal symptoms associated with smoking cessation attempts (Coe et al., 2005).

A large, multicentre, double-blind, placebo-controlled, parallel-group RCT was conducted in Norway and Sweden to evaluate the efficacy of varenicline for cessation of SLT (Swedish *snus*) use in 431 adult (mostly male) users (Fagerström et al., 2010). Participants were recruited through newspaper advertisements and were given either varenicline (1 mg) twice daily (titrated during the first week) with brief behavioural counselling, or placebo with brief behavioural counselling, for 12 weeks with follow-up to 14 weeks after treatment. All participants received brief advice and helpful tips at the discretion of the investigator, together with discussion of any topics or concerns they raised. The continuous SLT abstinence rate at weeks 9–26 was significantly higher in the varenicline plus behavioural counselling group than in the placebo plus behavioural counselling group (RR, 1.42; 95% CI, 1.08–1.79). [A strength of this study is the large sample size.]

Another double-blind, placebo-controlled, phase II RCT was conducted in the USA, using varenicline (for 12 weeks) with brief behavioural counselling for the treatment of SLT use (Ebbert et al., 2011). At 6 months, the prolonged SLT abstinence rate was not significantly higher in the varenicline plus behavioural counselling group than in the placebo plus behavioural counselling group [RR, 1.31; 95% CI, 0.84–2.04]. [A limitation of this study is the small sample size.]

Another large double-blind RCT was conducted in 237 adult (mostly male) users of SLT in India, using varenicline (1 mg twice per day for 12 weeks) with behavioural counselling as the intervention (Jain et al., 2014). The end-of-treatment 7-day point-prevalence SLT abstinence rate was higher in the varenicline group than in the placebo group, but the difference was not statistically significant [RR, 1.18; 95% CI, 0.89–1.56]. [A strength of this study is the large sample size. Limitations are that there was no mention of the type of SLT products and whether they were with or without areca nut, that the study did not observe a long-term effect of the treatment, and that adherence to varenicline use was low.]

In the meta-analysis by Ebbert et al. (2015), pooled results from two trials of varenicline reported a benefit in SLT cessation (RR, 1.34; 95% CI, 1.08–1.68). Both of these trials (Fagerström et al., 2010; Ebbert et al., 2011) are summarized above.

3.4 Policies and their impacts

3.4.1 Control policies for smokeless tobacco

(a) Introduction

The burden and the health effects of SLT use have shown that it poses a global public health challenge, like tobacco smoking (NCI and CDC, 2014). The WHO Framework Convention on Tobacco Control (FCTC) aims to reduce consumption of all forms of tobacco (as stated in Article 4.4) (WHO, 2003). The sixth session of the Conference of the Parties to the WHO FCTC reviewed the challenges related to SLT products and recommended that the countries apply relevant policy interventions for SLT products with the same rigour as those for smoked tobacco products (WHO FCTC, 2014).

However, it is difficult to have globally uniform regulations and guidelines pertaining to SLT products, because of the wide variations in the use, type of products, tobacco markets, and distribution patterns in different geographical regions. Other factors that make SLT control challenging include manufacturing, storage, and consumption patterns, inadequate regulatory processes, and illegal trade routes, but SLT control is an indispensable component of tobacco control efforts (Sinha et al., 2018b).

The WHO FCTC has been acceded to by 182 Parties as of May 2020 (WHO FCTC, 2021), and progress in its implementation is at an early intermediate stage for SLT (WHO, 2008). Table 3.13 gives the number of countries in which the individual policies have been implemented for SLT control (Mehrotra et al., 2019; WHO, 2021b).

The WHO MPOWER package for tobacco control (WHO, 2008) includes six evidence-based measures: monitoring tobacco use and prevention policies (M); protecting people from tobacco smoke (P); offering help to quit tobacco use (O); warning people about the harms of tobacco (W); enforcing bans on tobacco advertising, promotion, and sponsorship (E); and raising taxes on tobacco (R). Two thirds of the countries monitor SLT use. Just less than half of the countries offer help to quit SLT use, and more than one third have a quitline. Most countries have required the placement of pictorial health warnings on SLT packages, but many of these are small relative to the package size. At least half of the countries enforce bans on advertising and promotion of SLT products. Very few countries have provided data on raising taxes on SLT (Mehrotra et al., 2019; WHO, 2021b).

This section presents studies on the impact of the above-mentioned policies in terms of reduction in prevalence of SLT use, increased cessation of SLT use, thinking about quitting SLT use, reduction in frequency of SLT use, decrease in initiation of SLT use, or decrease in sales of SLT to youth, mainly as reported in successive national surveys (after 2011) for countries with a medium to high prevalence of SLT use (i.e. Bangladesh, India, the Sudan, Thailand, and the USA), or from a few other resources. The

Table 3.13 Tobacco control policies applicable to smokeless tobacco, and number of countries where they have been implemented

WHO FCTC policies applicable to SLT	Specific policy	Data year	Number of countries (%)[a]	Reference
Article 6: Price and tax measures on SLT	Data on price and taxation of SLT products	2018	34 (19%)	Mehrotra et al. (2019)
	Two-point data on SLT taxation	2018	11 (6%)	Mehrotra et al. (2019)
	Data on price elasticity and affordability of SLT	2018	2 (1%)	Mehrotra et al. (2019)
Article 9: Regulation of contents of SLT products Article 10: Regulation of disclosures of contents of SLT product	Ban on the display of quantitative information on relevant constituents or emissions of SLT	2021	43 (22%)	WHO (2021b)
	Mandate the display of qualitative information on relevant constituents or emissions of SLT	2021	26 (13%)	WHO (2021b)
	Data on pH and free nicotine in different SLT tobacco products	2018	6 (3%)	Mehrotra et al. (2019)
Article 11: Packaging and labelling of SLT products	Pictorial health warnings on SLT products	2020	47 (24%)	WHO (2021b)
	Pictorial health warnings ≥ 50% of package size	2020	41 (21%)	WHO (2021b)
	Text warnings ≥ 50% of package size	2020	23 (12%)	WHO (2021b)
Article 12: Education, communication, training, and public awareness on SLT	Anti-tobacco mass media campaign	2018	65 (36%)	Mehrotra et al. (2019)
	Data on adults who believe that using SLT causes serious illness	2018	19 (11%)	Mehrotra et al. (2019)
	Data on adults who noticed information about the dangers of using SLT	2018	1 (1%)	Mehrotra et al. (2019)
	Data on SLT users who noticed health warnings on SLT packages	2018	1 (1%)	Mehrotra et al. (2019)
	Tobacco use prevention is included in the school curriculum	2018	30 (17%)	Mehrotra et al. (2019)
	Training to prevent tobacco use in young people	2018	30 (17%)	Mehrotra et al. (2019)
	Non-classroom programmes or activities to teach tobacco use prevention to students	2018	29 (16%)	Mehrotra et al. (2019)
	Access to teaching and learning materials about preventing tobacco use in young people	2018	28 (16%)	Mehrotra et al. (2019)
Article 13: Ban on SLT advertising, promotion, and sponsorship (TAPS)	Ban on promotion on national television and radio	2020	166 (85%)	WHO (2021b)
	Ban on promotion in local magazines and newspapers	2020	155 (80%)	WHO (2021b)
	Ban on billboard and outdoor advertising	2020	158 (81%)	WHO (2021b)
	Ban on advertising at point of sale	2020	111 (57%)	WHO (2021b)
	Ban on free distribution in mail or through other means	2020	134 (69%)	WHO (2021b)
	Ban on promotional discounts	2020	126 (65%)	WHO (2021b)
	Ban on tobacco brands (product placement) on television or in films	2020	130 (67%)	WHO (2021b)
	Ban on tobacco products on television or in films	2020	49 (25%)	WHO (2021b)
	Complete ban on sponsorship	2020	66 (34%)	WHO (2021b)
	Fines for violations of bans on promotion and sponsorship	2020	151 (77%)	WHO (2021b)

Table 3.13 (continued)

WHO FCTC policies applicable to SLT	Specific policy	Data year	Number of countries (%)[a]	Reference
Article 14: Demand reduction measures concerning SLT dependence and cessation	Quitline available	2020	72 (37%)	WHO (2021b)
	Nicotine replacement therapy available	2020	117 (60%)	WHO (2021b)
	Nicotine replacement therapy available as essential medicine	2020	47 (24%)	WHO (2021b)
	Nicotine replacement therapy available (cost covered)	2020	57 (29%)	WHO (2021b)
	Cessation support available in health facilities and/or in hospitals	2020	125 (64%)	WHO (2021b)
	Cessation support available in offices of health professionals	2020	78 (40%)	WHO (2021b)
	Cessation support available in the community	2020	80 (41%)	WHO (2021b)
Article 16: Access to and availability of SLT to minors	Warning signboards at point of sale	2018	75 (42%)	Mehrotra et al. (2019)
	Ban on display of tobacco products at point of sale	2020	50 (26%)	WHO (2021b)
	Ban on tobacco products in the form of sweets, toys, candies, etc.	2020	103 (52%)	WHO (2021b)
	Prohibition of vending machines that contain tobacco products	2020	113 (58%)	WHO (2021b)
	Ban on free distribution of tobacco products to minors	2018	72 (40%)	Mehrotra et al. (2019)
	Ban on sale of loose SLT products	2018	18 (10%)	Mehrotra et al. (2019)
	Penalty against sellers for violations	2018	113 (63%)	Mehrotra et al. (2019)
Article 20: Research, surveillance, and exchange of information on SLT	Data on SLT use in adults	2020	125 (64%)	WHO (2021b)
	Data on recent SLT use in adults	2018	55 (31%)	Mehrotra et al. (2019)
	Data on SLT use in adolescents	2020	117 (60%)	WHO (2021b)
	Data on recent SLT use in adolescents	2018	70 (39%)	Mehrotra et al. (2019)
	Prevalence of SLT use > 10% in adults	2020	14 (7%)	WHO (2021b)
	Prevalence of SLT use > 10% in adolescents	2020	16 (8%)	WHO (2021b)
	Data on SLT-attributable major diseases risk factors	2018	10 (6%)	Mehrotra et al. (2019)

SLT, smokeless tobacco; WHO FCTC, World Health Organization Framework Convention on Tobacco Control.

[a] 180 countries for Mehrotra et al. (2019); 195 countries for WHO (2021b).

studies are described in the order of relevance to the WHO FCTC articles for which considerable progress has been shown (Articles 4–6, 11–14, 16, and 20, and bans on SLT products).

(b) Articles 4 and 5: Prevention of initiation of smokeless tobacco use in youth

The Global School Personnel Survey (GSPS) conducted in 2000 in the state of Bihar in India reported that nearly 78% of school personnel, including teachers, used tobacco (Sinha et al., 2002; Sorensen et al., 2005).

In the GYTS conducted in students in grades 8, 9, and 10 (generally aged 13–15 years) in 50 state government schools and 50 federal (central government) schools in Bihar, a significantly higher prevalence of ever and current tobacco use (for both smoking and SLT use) was found in students in state government schools without tobacco-free policies than in students in federal schools with tobacco-free policies. Classroom teaching about the harmfulness of tobacco use to health was also much more common in federal schools. Students in state schools were much more likely to have friends who used tobacco compared with students in federal schools (Sinha et al., 2004a). When the school personnel were surveyed (Sinha et al., 2004b), a significantly higher prevalence of smoking and SLT use was found in state schools than in federal schools. More than half of the personnel in the federal schools knew about the policy prohibiting tobacco use by personnel and students and about the means of enforcement. Teaching about the health consequences of tobacco use was carried out to some extent in the federal schools but not in the state schools, and the federal schools had some access to teaching materials on this topic. More than 90% of all personnel in both types of schools supported a policy prohibiting tobacco use in schools.

An RCT was conducted in teachers and staff of grades 8–10 in 72 state government schools in Bihar, in 2009–2010 and 2010–2011, to inform teachers of the dangers of tobacco use, to assist them to quit tobacco use (Sorensen et al., 2013), and to assess the implementation of the tobacco control polices (Mathur et al., 2016). The intervention, called the Tobacco-Free Teachers/ Tobacco-Free Society Program, focused on tobacco control policies, educational efforts, and cessation support. The control group received delayed intervention. At baseline, about one third of teachers and staff used SLT and 7% were smokers. At 30 days after the intervention, the self-reported adjusted cessation rate of SLT use was 49.6% in the intervention cohort and 15.4% in the control cohort ($P < 0.05$), whereas at 6 months, the adjusted cessation rate was 18.5% in the intervention cohort and 7.3% in the control cohort ($P = 0.06$). When the analysis was restricted to teachers who were employed at the school for the entire intervention period, the adjusted 6-month cessation rate was 20% in the intervention cohort and 6% in the control cohort ($P = 0.04$) (Sorensen et al., 2013). About 97% of the intervention schools posted "no tobacco" signboards. Also, 84.5% of the intervention schools adopted the recommended tobacco control policy; this percentage was much higher than that in the control schools (odds ratio [OR], 7.54; 95% CI, 4.92–11.60). The percentage of schools where tobacco was sold within 100 yards [~91 m] of the school decreased from 32.0% to 24.9% in the intervention schools and increased from 26.2% to 28.4% in the control schools (OR, 0.77; 95% CI, 0.54–1.11) (Mathur et al., 2016).

(c) Article 6: Price and tax measures on smokeless tobacco

Price increases and/or increased taxation on SLT products have caused a decrease in the prevalence of SLT consumption, just like for smoked tobacco products (Table 3.14).

A study conducted in the USA (Huang and Chaloupka, 2012) assessed the impact of the 2009 federal tobacco excise tax increase (effective on 1 April 2009, causing a price increase of 12%)

Table 3.14 Article 6: Effect of taxation and price increases on price elasticity for use of smokeless tobacco products with or without areca nut

Reference Location Policy	Data source (dates)	Estimated price elasticity
John (2008) India Price increase	55th round of the National Sample Survey (1999–2000)	For leaf tobacco consumption and expenditure for purchase: In rural areas: −0.871 (0.02)[a] In urban areas: −0.874 (0.03)[a]
Huang and Chaloupka (2012) USA Taxation and price increase	Monitoring the Future Surveys (2008 and 2009)	For smokeless tobacco: −1.2 to −1.8
Joseph and Chaloupka (2014) India Taxation and price increase	Global Youth Tobacco Survey, India (1999–2004)	For *gutka*: −0.58
Nargis et al. (2014) Bangladesh	International Tobacco Control-Bangladesh Wave 3 Survey (2011–2012)	For *zarda*: Lower-priced brands: −0.64 Higher-priced brands: −0.39 Cross-price elasticity with cigarettes: 0.35
Selvaraj et al. (2015) India Price increase	Consumer Expenditure Survey (2011–2012)	For leaf tobacco, by income group: Lowest income: −0.557 Middle income: −0.4537 Highest income: −0.0507

[a] Values in parentheses are bootstrapped standard errors (bidis are complements for leaf tobacco; users of one tend to also use the other).

on the use of SLT products in youth, by using two different models. The prevalence of SLT use in youth decreased from 6.06% before the tax increase to 4.22% 30 days after the tax increase – a relative decrease of 30.37% – in the first econometric model, which did not control for the other study variables. In the second model, which controlled for all the variables (such as individual, family, and school-level characteristics, state-level tobacco control measures, and state tobacco control funding), SLT use in youth decreased by 16–24%. The study also reported a price elasticity of between −1.2 and −1.8 for the prevalence of SLT use; this implies that an increase of 10% in the price of SLT products would reduce the prevalence of SLT use in youth by about 12–18% (Huang and Chaloupka, 2012).

A study on tobacco taxation and price in India (Joseph and Chaloupka, 2014), which used the GYTS data for 1999–2004 in 73 356 students aged 13–15 years, estimated the price elasticity of *gutka* as −0.58. This implies that a 10% increase in the price of a pouch of *gutka* would reduce the likelihood of someone becoming a *gutka* chewer by 5.8%.

John (2008) estimated the price elasticity for tobacco products for urban and rural households in India separately, using data from the 55th round of the National Sample Survey, conducted in 1999–2000 in 120 309 households in 10 140 villages, on tobacco consumption and expenditure incurred during the past 30 days. For both urban and rural households, the values are close to 1; this implies that a change in price (e.g. an increase due to taxation) would have a large downward effect on demand.

Another study in India (Selvaraj et al., 2015) examined the pattern of price elasticity of three major tobacco products (bidi, cigarettes, and leaf tobacco) based on household monthly per capita

consumption expenditure using data from the nationally representative Consumer Expenditure Survey of 2011–2012 in 101 662 households. The price elasticity for leaf tobacco, estimated using a simulation model, was highest in the lowest income group (−0.557), followed by the middle income group (−0.4537) and the highest income group (−0.0507). This implies that a 10% increase in tax would reduce the consumption by about 5% in the lowest income group, by about 4% in the middle income group, and by 0.5% in the highest income group (Selvaraj et al., 2015).

Nargis et al. (2014) used data from the third wave of the International Tobacco Control Survey in Bangladesh in 2011–2012 to estimate the price elasticity of the most commonly used SLT product in Bangladesh, *zarda*, and the cross-price elasticity for *zarda* with respect to cigarettes. The estimated price elasticity was −0.64 for lower-priced brands and −0.39 for higher-priced brands. This implies that a 10% increase in the price would cause a reduction in the prevalence of *zarda* use by about 6% for the lower-priced brands and by 4% for the higher-priced brands. The estimated cross-price elasticity for *zarda* with respect to the price of cigarettes was 0.35. This implies that a 10% increase in the price of cigarettes with the price of *zarda* remaining unchanged would result in an increase of about 3.5% in the consumption of *zarda*. Taken together, these estimates signify that only if the prices of both cigarettes and *zarda* were increased by 10%, a reduction of 2.5% (−6% + 3.5%) would be seen in the consumption of *zarda*.

An evaluation of the effect of the goods and services tax in India on the affordability of tobacco products revealed that all tobacco products, including SLT products, had become increasingly affordable over the previous 10 years and that the goods and services tax had accentuated the increase in the affordability of SLT products (John and Dauchy, 2021).

A meta-analysis of 17 studies on the price elasticity of demand for SLT products in 5 countries showed that a 10% price increase would reduce the demand for SLT by 2.1%. The price elasticity estimates for SLT products in high-income countries and low- and middle-income countries were similar (coefficient, −0.2) (Jawad et al., 2018). Of the 17 studies included in the meta-analysis, 2 studies (Joseph and Chaloupka, 2014; Nargis et al., 2014) are summarized above.

(d) Article 11: Packaging and labelling of smokeless tobacco products

A study in the USA (Adkison et al., 2014) evaluated the association of three elements of SLT packaging (health warning labels, descriptive characteristics, and corporate branding) with knowledge of health risks and perceptions of novelty and appeal, by using a web-based survey in 1000 individuals. Perception of health risks was higher with a graphic or pictorial health warning than with a text warning on SLT packaging for both adults and young respondents (Table 3.15).

In India, pictorial health warnings have changed substantially in content, size, and coverage during the past decade. The first pictorial health warning on SLT packages (a symbol of a scorpion), which covered < 30% of the front of the package, was released in May 2009, just before the GATS-1 (in 2009–2010) in India (MOHFW and IIPS, 2010). In a study analysing the GATS-1 India data, SLT users who thought about quitting after seeing a health warning in the past 30 days were significantly more likely to make attempts to quit compared with those who did not see a health warning (OR, 3.41; 95% CI, 3.12–3.73) (Singh et al., 2018). In 2011, the pictorial health warnings consisted of photographs of patients with oral cancer, which covered 40% of the front of all SLT packages; by 2016, these were enlarged to cover 85% of the front and the back of the package. As a result, the percentage of SLT users who noticed these health warnings increased from 62.9% in the GATS-1 to 71.6% in the GATS-2 (in 2016–2017), and the percentage

Table 3.15 Effects of text and graphic or pictorial health warning labels on smokeless tobacco packaging on perceptions of health risks

Reference Location	Study description	Perceptions of health risks (%)		
Adkison et al. (2014) USA	Cross-sectional web survey Participants (n = 1000): Youth: 14–17 yr Young adults: 18–25 yr Older adults: 26–65 yr		Text HWL	Graphic HWL
		Reduce health risks	23.2	10.8
		Consider health risks	5.4	63.6
		Most dangerous to health	4.8	28.3
		Deliver dangerous chemicals	3.9	31.8
Gravely et al. (2016) India	Tobacco Control Project India Survey from 4 states Adult SLT users (n = 4733) Policy assessed: change of HWLs from symbol to graphic images on SLT packages in 2011 Respondents who noticed HWLs (n = 2154)		Wave 1 (2010–2011) Symbolic HWL % (95% CI)	Wave 2 (2012–2013) Graphic HWL % (95% CI)
		Among all respondents (n = 4733):		
		Aware that SLT packages contain HWLs	72.7 (67.1–77.7)	73.0 (67.3–78.1)
		Noticed HWLs at least once in a while	34.3 (28.5–40.6)	28.1 (21.8–35.4)
		Among respondents who noticed HWLs (n = 2154):		
		Read HWLs at least once in a while	49.4 (42.0–56.9)	50.1 (40.4–59.9)
		HWLs made you think about risks of SLT at least a little	15.0 (11.9–18.8)	17.5 (12.1–24.6)
		HWLs made you think about quitting SLT at least a little	16.8 (13.0–21.4)	19.3 (13.6–26.6)
		Avoided looking at HWLs	8.1 (5.5–11.8)	11.6 (7.8–17.0)
		Gave up SLT use at least once because of HWLs	31.3 (24.3–39.3)	36.7 (27.2–47.5)
		Have any intentions to quit SLT use	19.8 (14.6–26.4)	20.5 (15.2–27.0)
MOHFW and IIPS (2010); TISS and MOHFW (2017) India	Cross-sectional national survey: Global Adult Tobacco Survey		GATS-1 (2009–2010) Photograph warning covering 40% of front of package	GATS-2 (2016–2017) Photograph warning covering 85% of front and back of package
		Noticed HWLs	62.9	71.6
		Thought of quitting because of the HWLs	33.8	46.2

CI, confidence interval; GATS, Global Adult Tobacco Survey; HWL, health warning label; SLT, smokeless tobacco; yr, year or years.

of SLT users who thought of quitting also increased, from 33.8% in the GATS-1 to 46.2% in the GATS-2 (TISS and MOHFW, 2017).

Gravely et al. (2016) evaluated the impact of the change in the health warning labels on SLT packaging from a single symbol (a scorpion) in 2009 to four new graphic images in 2011, using data from the Tobacco Control Project India Survey (wave 1 in 2010–2011 and wave 2 in 2012–2013) from 4 states (Bihar, West Bengal, Madhya Pradesh, and Maharashtra) in 4733 individuals aged ≥ 15 years. The change from a symbol to graphic images did not significantly increase any of the health warning label indicators or intentions to quit SLT use. However, people who quit using SLT were significantly more aware of health warning labels compared with people who continued to use SLT.

A study in 99 tobacco users (smokers and SLT users) in Chennai, India, assessed the impact of the pictorial health warnings (photographs of throat cancer on cigarette packages and of oral cancer on SLT packages, covering 85% of the front and back of the package) on the motivation of tobacco users to quit. Most (84.8%) of the tobacco users noticed the health warning labels (including the text warning); 21.2% of SLT users were able to identify the picture correctly, and 55.5% of tobacco users could relate the pictures to health problems. Including pictorial health warnings made 52.5% of users think about quitting, and 72.7% said that these warnings would motivate them to quit tobacco use. Because the text warning was only in English, not everyone could read it, but those who could not read the text understood the pictorial warning (Bincy et al., 2018).

(e) Article 12: Education, communication, training, and public awareness on smokeless tobacco

In a study analysing the GATS-1 India data, SLT users who noticed anti-SLT messages were significantly more likely to make attempts to quit compared with those who did not notice these messages (OR, 1.42; 95% CI, 1.30–1.56) (Singh et al., 2018).

In 2009, a national mass media communication campaign on the dangers of SLT use, called the Surgeon campaign, aired on television and radio in India for 6 weeks (Murukutla et al., 2012) in three languages (Hindi, English, and Sindhi) (Vital Strategies, 2010). A nationally representative survey was subsequently conducted to evaluate the impact of the campaign in SLT users aged 16–50 years who had access to television or radio during the previous 2 months. The survey was administered to 2108 users of SLT only and 790 SLT users who also smoked (dual users). Of these, 1323 users of SLT only (62.8%) and 565 dual users (71.5%), or a total of 1888 users (65.1%), were aware of the campaign. Of the respondents who were aware of the campaign, 62% recalled the campaign on television only, 21% on both television and radio, and 16% on radio only. Of the campaign-aware respondents, 72% said that the campaign made them stop and think. Almost 75% of the users of SLT only and 77% of the dual users said that the campaign made them feel concerned about the effects of using SLT on their health. In a logistic regression analysis, users of SLT only who were aware of the campaign were 2.4 times as likely to say that SLT causes mouth cancer ($P < 0.001$) compared with those who were not aware of the campaign, and they were more likely to agree that quitting SLT use would improve their health. Dual users who were aware of the campaign were 2.3 times as likely to say that SLT causes throat cancer ($P < 0.001$). When respondents were asked about non-campaign-relevant statements (e.g. "SLT use by pregnant women causes low-birth-weight babies"), there was little or no difference in the responses between those who were aware of the campaign and those who were not. Users of SLT only who were aware of the campaign were more likely to have seriously considered quitting SLT use in the previous 2 months (OR, 1.6; $P < 0.001$)

and were more likely to have attempted to quit in the previous 2 months (OR, 1.9; $P < 0.001$) compared with those who were not aware of the campaign.

After the Surgeon campaign, a new campaign was developed based on the story of Mukesh, a young patient (age 24 years) who died of oral cancer. The campaign consisted of a 30-second video message of Mukesh speaking to the public from his hospital bed, after an introduction by the surgeon. Subtitles were used in different languages. The video was aired for 4 weeks in 2011 by the Government of India. Apart from public awareness, the Mukesh campaign also provided a face and a story for advocacy and policy efforts about the harms of SLT use (including the request for a ban on *gutka*, as part of the Voice of Tobacco Victims campaign spearheaded by surgeons from Tata Memorial Hospital in Mumbai, India). The Mukesh campaign was evaluated using street intercept interviews of tobacco users in 5 states representing 5 zones of India. The findings showed that 71% of SLT users recalled the campaign, 80% rated it as believable, 79% found it personally relevant, and 77% said it made them feel concerned about the health effects of their own SLT use (Vital Strategies, 2011; Gupta et al., 2016a).

In 2016, a mass communication campaign, called the People Behind the Packs campaign, was started in Bangladesh, in Bengali and English, to support the introduction of pack-based graphic warning labels and persuade tobacco users (including SLT users) to heed the warnings in order to avoid the depicted tobacco-related diseases. Two of the messages from the communication campaign aired on 13 national television stations, and all 4 messages were portrayed on billboards and community health centre posters. A cross-sectional face-to-face survey was conducted within 14 days of the television campaign in 1796 adult tobacco users (including SLT users) aged 16–55 years. The results showed that 66.5% of users were aware of at least one People Behind the Packs campaign message, 83.6% had seen the new graphic warning labels on tobacco packaging, and 38.1% had made an attempt to quit. Attempts to quit were significantly associated with having seen the new graphic warning labels on tobacco packaging ($P < 0.001$), recalling at least one People Behind the Packs campaign message ($P < 0.001$), and recalling a greater number of adverse effects of using tobacco products ($P < 0.001$). However, attempts to quit were less likely in users of SLT only ($P < 0.001$) and in dual users ($P < 0.01$) than in smokers (Turk et al., 2018).

(f) Article 13: Ban on smokeless tobacco advertising, promotion, and sponsorship (TAPS)

There is a dearth of studies on the impact of policies to prohibit advertising and sponsorship of SLT on quitting or attempts to quit SLT use.

A cross-sectional study in Mumbai, India, in 1373 high school students and 436 tobacco vendors close to their schools reported a lower risk of current SLT use in students at schools in areas with higher compliance by vendors with tobacco point-of-sale policies (OR, 0.40; 95% CI, 0.21–0.77) compared with students at schools in areas with lower compliance, when controlling for student-level and community-level tobacco use risk factors (Mistry et al., 2019).

A cross-sectional study in 1670 students aged 13–15 years was conducted in 28 randomly selected schools in 7 areas of Khartoum in the Sudan. The students completed a questionnaire about their exposure to *toombak* advertisements at point of sale, the social acceptability of *toombak* use, the perceived accessibility of *toombak*, susceptibility to *toombak*, and *toombak* use. Despite a legal ban on advertisement at point of sale, 41.8% of students reported exposure to *toombak* advertisements at point of sale. Exposure to such advertisements was associated with male sex, older age, ever use, more social

acceptability, and direct accessibility of *toombak* (Almahdi et al., 2020).

(g) Article 14: Demand reduction measures concerning smokeless tobacco dependence and cessation

In Oklahoma (USA), a state with a high prevalence of SLT use, a sample of 959 male users of SLT only who had registered with the Oklahoma Tobacco Helpline in 2004–2012 were assessed for factors related to SLT abstinence (Mushtaq et al., 2015). Of the 374 SLT users who completed the 7-month follow-up, 162 (43%) reported 30-day abstinence, representing a 15% cessation rate. SLT users with higher levels of motivation to quit at baseline were twice as likely to be abstinent than those with low or moderate levels of motivation to quit (OR, 2.05; 95% CI, 1.25–3.35), and each additional completed helpline call increased the likelihood of tobacco cessation by 20%.

In Rajasthan, India, a quitline service was initiated in January 2013 as a voluntary activity (Gupta et al., 2016b) and later became a part of the 104 Information Helpline of the Medical and Health Department of the Government of Rajasthan. Of the 1525 callers in 2013, 1105 (72.5%) were SLT users. A self-reported cessation rate of about 20% was observed in the SLT users at the 18-month follow-up. This is > 11 times the cessation rate of 1.6% for former daily users of SLT (and former daily smokers) in Rajasthan reported in the GATS-1.

A national tobacco quitline was started in May 2016 in India. Of the 5179 callers who registered during the first year (Kumar et al., 2018), 3169 (61.2%) were SLT users and 644 (12.4%) were dual users. When the dual users were excluded, 41% of SLT users successfully quit (complete abstinence for ≥ 3–4 weeks). After the national quitline number was included on tobacco packages, from September 2018, the percentage of callers who were SLT users increased from 51.1% to 70.7%, the number of tobacco users registering with the quitline increased 3.3-fold, and the number of quitters increased 3.6-fold at 6 months (Kumar et al., 2021).

(h) Article 16: Access to and availability of smokeless tobacco to minors

Although 174 countries have restrictions in place to prevent minors from purchasing tobacco (including SLT products) (WHO, 2021b), no evidence is available about adequate enforcement of this policy or its efficacy (Choi et al., 2014; Khan, 2016; Huque et al., 2017; Nyi Latt et al., 2018; Cho et al., 2020).

In July 1992, the United States Congress enacted the Alcohol, Drug Abuse, and Mental Health Administration Reorganization Act (Public Law 102-321). Through the Synar Amendment to this law, the sale or distribution of any form of tobacco to minors (aged < 18 years) was prohibited. The 2014 Annual Synar Report in 50 states and 8 jurisdictions reported a decrease in the sales of all tobacco to minors (aged < 18 years), from 40.1% in 1997 to 9.6% in 2013 (national weighted averages). Also, the states that fined retailers for selling tobacco to minors had fewer violations of the Synar Amendment (SAMHSA, 2014).

(i) Bans on smokeless tobacco products

This section discusses studies that reported the impact of the prohibition of sale, manufacture, and importation of SLT on its consumption and the quit intentions of users, in some high-burden countries (i.e. those with > 1 million users or a prevalence of ≥ 10% in males or females) (Mehrotra et al., 2017).

Among the high-burden countries, Thailand was the first to impose a ban on the importation of SLT, in 1992, and the country undertook stringent measures for compliance with the ban. The tobacco control programme in Thailand contributed to a decrease in the prevalence of SLT use in adults from 3.9% (1.3% in men and 6.3% in women) in 2009 (WHO Regional Office for South-East Asia, 2009b) to 3.2% (1.1% in men

Table 3.16 Impact of the *gutka* ban on the prevalence of *gutka* use in India[a]

Reference Location	Prevalence of *gutka* use (%)						Relative change in prevalence of use (%)		
	Before the ban: GATS-1[b] (2009–2010)			After the ban: GATS-2[b] (2016–2017)					
	Overall	Men	Women	Overall	Men	Women	Overall	Men	Women
MOHFW and IIPS (2010); TISS and MOHFW (2017) India	8.2	13.1	2.9	6.8	10.8	2.7	–17.1	–17.6	–6.9

GATS, Global Adult Tobacco Survey.
[a] The *gutka* ban was implemented in 2012.
[b] Repeated cross-sectional household survey of individuals aged ≥ 15 years, with a multistage, geographically clustered sample design.

and 5.2% in women) in 2011 (WHO Regional Office for South-East Asia, 2011) and 2.1% in 2017 (National Statistical Office of Thailand, 2017).

In India, a central law in 2011 prohibited tobacco or nicotine from being used in any food products (MOHFW, 2011c), which led to a subsequent statewise ban on the manufacture, storage, and sale of *gutka*. A resultant decrease was observed in the prevalence of *gutka* use, from 8.2% in the GATS-1 to 6.8% in the GATS-2 (Table 3.16). However, *gutka* continued to be available illegally, including near educational institutions (Pimple et al., 2014).

A study conducted in 2014 to assess the impact of the *gutka* ban in the Indian states of Assam, Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha, and Delhi (National Capital Region) revealed that 92% of the population supported the ban and 99% agreed that it was good for the youth of the country (WHO Regional Office for South-East Asia, 2014). Interviews with 1001 current and former users of *gutka* revealed that 49% of current users had reduced their consumption and the remaining 51% had attempted to stop using *gutka* in the previous year. About 41–88% of respondents across the different states reported quitting *gutka* use as a result of the ban.

A study in Maharashtra, India, in 68 *gutka* users (Mishra et al., 2014) found that since the ban, 24% had quit *gutka* use, 56% had reduced their consumption, and 21% had not changed their consumption; none of the participants reported an increase in their use of *gutka*. Some respondents had turned to products that are custom-made by vendors and contain similar ingredients (e.g. *mawa*, betel quid) or to another commercially available SLT product (*khaini*).

A study conducted in Andhra Pradesh, India, in 368 *gutka* users (Reddy et al., 2016) reported that most of the users (81.5%) had tried to quit *gutka* use and 29.9% of the users had turned to other forms of SLT products, most commonly *mawa* (51.8%). Also, 62.2% of the users reported that *gutka* was still available commercially in the form of two separate sachets, one of *paan masala* and the other of tobacco.

In Bhutan, despite a comprehensive ban on the cultivation, manufacture, distribution, and sale of tobacco since 2004, the prevalence of use of tobacco, especially SLT, is high. A cross-sectional analysis of the nationally representative Noncommunicable Disease Risk Factors Surveillance STEPS Survey 2014 in 2820 adults in Bhutan showed a high prevalence of SLT use (19.7%; 95% CI, 16.5–22.9%), especially in males, younger individuals, and people who consumed

alcohol (Gurung et al., 2016). An increase in SLT use in adolescents was also noted in the GYTS in Bhutan, from 18.8% in 2006 to 30.3% in 2013 (WHO Regional Office for South-East Asia, 2015).

Since 1992, there has been a ban on the sale of tobacco for oral use (i.e. *snus*) in the EU except in Sweden (Delhomme, 2019). From 2001, the European Commission reaffirmed that the EU Member States were prohibited from placing tobacco for oral use on the market (Article 8 of Directive 2001/37/EC) (European Parliament, 2001). However, this ban has been evaded through online sale and promotion of *snus* in the EU (Peeters and Gilmore, 2013).

(j) Overall tobacco control policy and Article 20: Research, surveillance, and exchange of information on smokeless tobacco

Standard, nationally representative surveys designed to measure tobacco use and the impact of tobacco control policies in countries in an internationally comparable way were developed jointly by the United States Centers for Disease Control and Prevention and WHO. These surveys include the GYTS, the GSPS, the Global Health Professions Student Survey, and the GATS, which together make up the Global Tobacco Surveillance System.

The GATS is a household survey that is administered in male and female individuals aged ≥ 15 years. A few of the countries with a high SLT burden in the WHO South-East Asia Region, such as Bangladesh, India, and Thailand, have completed two rounds of the GATS since 2009 (WHO Regional Office for South-East Asia, 2009a, b, 2011; MOHFW and IIPS, 2010; TISS and MOHFW, 2017; Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) (Table 3.17). In all three countries, the prevalence of SLT use decreased significantly between the GATS-1 and the GATS-2: in Bangladesh, from 27.2% in 2009 to 20.6% in 2017; in India, from 25.9% in 2009–2010 to 21.4% in 2016–2017; and in Thailand, from 3.9% in 2009 to 3.2% in 2011 (Suliankatchi Abdulkader et al., 2019) (Table 3.17). After the GATS-1 in Bangladesh, pictorial health warnings were introduced that covered 50% of SLT packages, anti-SLT media campaigns were conducted, direct marketing of SLT was prohibited, and taxation of SLT products increased (Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019). In India, the ban on the manufacture and sale of *gutka* was implemented in 2012. In Thailand, since 2009 pictorial health warning labels are also required on packaging of shredded tobacco products (used as SLT) (WHO Regional Office for South-East Asia, 2011).

The GYTS is a school-based survey of students aged 13–15 years. Between 2007 and 2013, the prevalence of current SLT use did not change significantly in Bangladesh, India, or Myanmar, but the prevalence increased significantly in Bhutan and Nepal. During this period, there was either an absence of effective policies focusing on SLT control or a lack of enforcement of policies in these countries. For instance, in India, where the Cigarettes and Other Tobacco Products Act was enacted in 2004, a few court cases by the tobacco industry prevented adequate implementation of the legislation for several years. In Nepal, a tobacco control policy was enacted in 2010, but litigation by the tobacco industry continued until 2014 (Sinha et al., 2014).

From 2010, the Tobacco Control Act of Bhutan (Parliament of Bhutan, 2010) prohibited the cultivation, manufacture, sale, and supply of tobacco products; it remained in effect until 2020 (Wangdi and Gyeltshen, 2020). Awareness programmes on the dangers of tobacco were also undertaken in Bhutan (Tshering et al., 2021). In Sri Lanka, from 2006, the tobacco control law prohibited the sale of tobacco to minors (aged < 21 years) (Sinha et al., 2014). In Nepal, tobacco control laws in 2011 required graphic health warnings covering 75% of both the front and the back of the package for all tobacco products;

Table 3.17 Reduction in prevalence of smokeless tobacco use in adults after policy interventions in selected countries

Reference Location	GATS-1[a]		GATS-2[a]		Reduction in prevalence of SLT use[b] (relative change) (%) Overall (men; women)	Policies and population-level interventions
	Year No. of households surveyed	Prevalence of SLT use[b] (%) Overall (men; women)	Year No. of households surveyed	Prevalence of SLT use[b] (%) Overall (men; women)		
WHO Regional Office for South-East Asia (2009a); Bangladesh Bureau of Statistics and National Tobacco Control Cell (2019) Bangladesh	2009 10 751	27.2 (26.4; 27.9)	2017 14 880	20.6 (16.2; 24.8)	–24.1* (–38.6*; –11.3) * $P < 0.05$	Pictorial health warnings to cover 50% of SLT packages, anti-SLT media campaigns; marketing of SLT prohibited, and increased taxation of SLT products, verified by tax stamp
MOHFW and IIPS (2010); TISS and MOHFW (2017) India	2009–2010 69 296	25.9 (32.9; 18.4)	2016–2017 77 170	21.4 (29.6; 12.8)	–17.4 (–10.0; –30.4) $P < 0.01$	Manufacture and sale of *gutka* and *paan masala* containing tobacco or nicotine banned by nearly all states by 2012 under national law; taxes on SLT increased marginally; public awareness campaigns on SLT in different media; in 2012, tobacco use in films was regulated; in 2016, pictorial health warnings were enlarged to 85% of both principal display areas on packages
WHO Regional Office for South-East Asia (2009b, 2011) Thailand	2009 22 768	3.9 (1.3; 6.3)	2011 20 922	3.2 (1.1; 5.2)	–17.2 (–18.0; –17.0) $P < 0.05$	Pictorial health warnings and text warnings on tobacco packages; taxation

GATS, Global Adult Tobacco Survey; SLT, smokeless tobacco.

[a] Repeated cross-sectional household survey of individuals aged ≥ 15 years, with a multistage, geographically clustered sample design.

[b] SLT use includes use of SLT only and SLT use plus smoking; prevalence of current use includes daily and occasional use.

this was implemented in 2014 (Sinha et al., 2014). In Myanmar, tax rates for tobacco products, including SLT, increased in 2012 and again in 2015 (World Bank Group, 2020), and from 2016 the size of health warnings on SLT and smoked tobacco products was increased to 75% of both the front and the back of the package (Tun et al., 2017; Campaign for Tobacco-Free Kids, 2021),

After 2014, the prevalence of SLT use in youth decreased in four countries with a high SLT burden: in Bhutan, from 21.6% in 2013 (Sinha et al., 2014; WHO Regional Office for South-East Asia, 2015) to 12.5% in 2019 (WHO Regional Office for South-East Asia, 2020); in India, from 14.0% in 2003 to 4.1% in 2019 (MOHFW and IIPS, 2019); in Myanmar, from 9.8% in 2011 (Sinha et al., 2014) to 5.7% in 2016 (Tun et al., 2017); and in Sri Lanka, from 8.5% in 2011 to 2.4% in 2015 (WHO Regional Office for South-East Asia, 2016) (Table 3.18). In Bhutan in the GYTS 2019, 87.1% of current SLT users wanted to stop using it right away. In Bhutan, according to law, tobacco cannot be cultivated and tobacco products cannot be produced. Although tobacco products can be imported for personal consumption, there are limits on the amounts, and importation is prohibited for minors (aged < 18 years). The advertisement, promotion, and sponsorship of tobacco are banned, except for brand stretching (WHO Regional Office for South-East Asia, 2020).

A survey was conducted in two waves, in 2009 and 2010, in 755 school personnel in 72 state government schools in Bihar, India (Gupta et al., 2014a). The reported prevalence of current use of tobacco (mainly SLT) was 35.5% (48.0% in men and 11.3% in women), which was much lower than the prevalence of 77.4% previously reported in the GSPS 2000. Use of *lal dant manjan* (red tooth powder) was considered as use of a tobacco product in the GSPS 2000 but not in this school study, because the inclusion of tobacco in any oral hygiene products was prohibited by a government order. If use of *lal dant manjan* was included as tobacco use in the school survey, the prevalence of tobacco use would increase to 53.9%, which is still substantially lower than the prevalence in the GSPS 2000 (Gupta et al., 2014a).

(k) Modelling the impact of a set of policies using available data

In a study conducted in Minnesota (USA), Levy et al. (2019) estimated the effect of tobacco control policies implemented in 1993–2018 on SLT use using a previous SimSmoke model, updated and extended to incorporate SLT use (both use of SLT only and dual use) (Table 3.19). The SimSmoke model projected that the prevalence of SLT use in men would decrease from 3.9% in 1993 to 2.6% in 2015 and to 2.5% in 2018. In addition, compared with no new policies implemented after 1993, the model projected that the prevalence of SLT use in men would decrease to 2.9% in 2040 (Levy et al., 2019). The Minnesota Adult Tobacco Survey conducted in 2014 reported only a slight decrease in the prevalence of SLT use, to 3.6% (Boyle et al., 2015); this was contradictory to the decrease predicted by the model.

The SimSmoke model was also used to assess the effect of past tobacco control policies and to project the effect of future policies on the prevalence of *snus* use (and smoking) in Sweden (Near et al., 2014; Table 3.20). The model predicted that if all of the policies were implemented, the prevalence of use of *snus* only would decrease from 14.6% in 2010 to 10.4% in 2040 in men and from 3.3% in 2010 to 2.8% in 2040 in women. Overall, the study showed that a combination of the policies would have a greater impact on the prevalence of SLT use than a single policy. According to a survey in 2010, the overall prevalence of SLT use [SLT product not specified] in Sweden was 12.3% (20.7% in men and 3.5% in women) (Leon et al., 2016).

Table 3.18 Reduction in prevalence of smokeless tobacco use in students aged 13–15 years after policy interventions in selected countries

Reference Location	Earlier GYTS[a]		Later GYTS[a]		Reduction in prevalence of SLT use[b] (relative change (%) Overall (boys; girls)	Policies and population-level interventions
	Year	Prevalence of SLT use[b] (%) Overall (boys; girls)	Year	Prevalence of SLT use[b] (%) Overall (boys; girls)		
MOHFW and IIPS (2019) India	2003	14.0 (18.0; 7.9)	2019	4.1	–70.7	Cigarettes and Other Tobacco Products Act (COTPA) in 2004; ban on the manufacture and sale of *gutka* in 2012
Sinha et al. (2014); WHO Regional Office for South-East Asia (2020) Bhutan	2013	21.6 (25.0; 18.9)	2019	12.5 (17.0; 8.1)	–42.1 (–32.0; –57.1)	Tobacco Control Amendment Act of 2012 to the Tobacco Control Act of Bhutan of 2010; Tobacco Control Rules and Regulations 2013. The rules prohibit minors (aged < 18 years) from importing tobacco or tobacco products, even for personal consumption. However, SLT is available and accessible to youth
Sinha et al. (2014); Tun et al. (2017); Campaign for Tobacco-Free Kids (2021) Myanmar	2011	9.8 (15.2; 4.0)	2016	5.7 (11.0; 1.5)	–41.8 (–27.6; –62.5)	From 2016, the size of health warnings on SLT and smoked tobacco products was increased to 75% of the front and back of the package
Sinha et al. (2014); WHO Regional Office for South-East Asia (2016) Sri Lanka	2011	8.5 (13.0; 4.1)	2015	2.4 (4.2; 0.5)	–71.8 (–67.7; –87.8)	The school curriculum has contained lessons on the harmfulness of tobacco use (mainly smoking) for several years, before these surveys

GYTS, Global Youth Tobacco Survey; SLT, smokeless tobacco.

[a] Repeated cross-sectional national school-based, self-administered survey of students aged 13–15 years, with a two-stage sample design.

[b] SLT use includes use of SLT only and SLT use plus smoking; prevalence of current use includes daily and occasional use.

Table 3.19 Modelling projections of the impact of tobacco control policies on prevalence of smokeless tobacco use in men in Minnesota (USA) for 1993–2040

Reference Location	Study design	Tobacco control policies	Prevalence of SLT use in men[a] (%)		
			Actual	Projection Best (lower, upper)[b]	
			1993	2018	2040
Levy et al. (2019) Minnesota (USA)	SimSmoke modelling to estimate the impact of policies on SLT use Period of policies included in model: 1993–2018 Used data from the 1993 Tobacco Use Supplement and information on state policies	Policies remaining at 1993 levels	3.9	3.2 (3.2, 3.2)	2.9 (2.9, 2.9)
		All policies (cumulative)	3.9	2.5 (2.8, 2.2)	2.1 (2.4, 1.8)
		Price policies	3.9	2.8 (2.9, 2.6)	2.5 (2.6, 2.3)
		Smoke-free air policies	3.9	3.2 (3.2, 3.1)	2.8 (2.9, 2.8)
		Tobacco control expenditure by state	3.9	3.1 (3.2, 3.1)	2.8 (2.8, 2.8)
		Cessation treatment	3.9	3.1 (3.1, 3.0)	2.8 (2.8, 2.7)
		Health warnings policies	3.9	3.2 (3.2, 3.1)	2.8 (2.9, 2.8)
		Youth access policies	3.9	3.1 (3.2, 3.1)	2.7 (2.8, 2.6)

SLT, smokeless tobacco.

[a] According to the model, projected prevalence rates for SLT use in women were not affected by the policies.

[b] Estimates are given in terms of the best estimate and the lower and upper bounds based on the policy evaluation literature.

Table 3.20 Modelling projections of the impact of tobacco control policies on prevalence of *snus* use in Sweden

Reference Location	Study design	Tobacco control policies	Prevalence of use of *snus* only (%) Projections for 2010–2040							
			Men				Women			
			2010	2011	2020	2040	2010	2011	2020	2040
Near et al. (2014) Sweden	SimSmoke modelling to estimate the impact of policies on prevalence of use of *snus* only Used data from the Health on Equal Terms of the National Public Health Survey for 2004–2010	Status quo	14.6	14.5	14.4	13.5	3.3	3.3	3.5	3.6
		Newly implemented policies[a]								
		Raise excise taxes to 70% of retail price	14.6	13.4	13.1	11.9	3.3	3.0	3.1	3.1
		Complete smoke-free	14.6	14.5	14.4	13.5	3.3	3.3	3.5	3.6
		Comprehensive marketing ban	14.6	14.4	14.2	13.3	3.3	3.3	3.4	3.5
		High-intensity tobacco control campaign	14.6	14.1	13.8	12.9	3.3	3.2	3.3	3.4
		Strong health warnings	14.6	14.5	14.3	13.4	3.3	3.3	3.4	3.5
		Strong youth access enforcement	14.6	14.5	14.1	12.8	3.3	3.3	3.4	3.4
		Cessation treatment policies	14.6	14.5	14.2	13.3	3.3	3.3	3.4	3.5
		All of the above policies implemented	14.6	12.7	12.0	10.4	3.3	2.9	2.9	2.8

[a] New policies implemented at levels consistent with the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) in 2010 and maintained at the same level until 2040.

3.4.2 Control policies for areca nut products (including betel quid)

Areca nut is cultivated and consumed mainly in South and South-East Asia. In the past few decades (1994–2019), there have been increases in the global production, which is highest in India, followed by Bangladesh, Indonesia, Myanmar, and Taiwan (China), and in areca nut consumption and trade (FAO, 2021). The increase in consumption of areca nut in different forms has led to high incidence rates of oral cancers and oral potentially malignant disorders, especially in India (Gupta et al., 2014b), Hunan (China) (Zhou et al., 2019), Taiwan (China) (Su et al., 2020), Bhutan, Myanmar, Nepal, Papua New Guinea, Pakistan, Sri Lanka, and various South Pacific islands such as Guam (USA) and the Solomon Islands (Gunjal et al., 2020). This, in turn, has led to the adoption in several countries over the past several decades of policies designed to control use of areca nut (Table 3.21).

Areca nut control policies began in Thailand in 1940 with a campaign promoted by the prime minister to discourage betel quid chewing, showing that streets stained with red juice from spitting were dirty and unhygienic, and prohibiting betel quid chewing on government premises (Thai Cultural Encyclopedia Foundation, 1999). Currently, the most common policy to curb areca nut consumption as well as SLT use is a ban on spitting in public places; this has been adopted by several countries, most recently in India during the COVID-19 pandemic (Gunjal et al., 2020; The Economic Times, 2020; Yang et al., 2020). The next most common policy is a ban on betel quid chewing in certain places, such as government offices, schools, and hospitals,

Table 3.21 Major areca nut control policies and where they have been adopted

Policy[a]	Locations
Ban on spitting in public places	Bhutan, Myanmar, Papua New Guinea, India (by the railways only), Taiwan (China), Hangzhou City (China)
Ban on chewing betel quid in certain places	Myanmar (in or near government offices, schools, and hospitals), Sri Lanka, Taiwan (China) (in the military and in some workplaces)
Ban on advertising of areca nut products	Hunan Province (China)
Ban on manufacture and/or sale of certain areca nut products	India, Sindh Province (Pakistan), Xiamen in Fujian Province (China), Myanmar
Text warnings on packages of areca nut products	India
Betel quid cessation programmes	Taiwan (China)
Mass media awareness programmes	Myanmar, Taiwan (China)
Plantation programme	Taiwan (China)
Oral mucosal screening programme	Taiwan (China)

[a] In most countries, betel quid usually also contains tobacco.
Compiled by the Working Group, with data from Vital Strategies (2017); Zhou et al. (2019); Gunjal et al. (2020); The Economic Times (2020); Yang et al. (2020); Zhao and Davey (2020).

in the military, or in certain other workplaces (Gunjal et al., 2020). There have also been mass media awareness programmes about the dangers of betel quid chewing in Taiwan (China) (Yang et al., 2020) and in Myanmar (Vital Strategies, 2017). Currently, Taiwan (China) has the highest number of areca nut control policies, followed by Myanmar and India.

In Taiwan (China), a national areca nut and betel quid cessation programme has been implemented since the late 1990s (Yang et al., 2020). From 1997, 3 December was declared Areca Prevention Day, to raise awareness of the carcinogenicity of areca nut through mass media communication, school programmes, and health-care providers. The government and nongovernmental organizations have created areca nut-free environments to promote healthy behaviour and support a reduction in use of betel quid and areca nut in the community. Beginning in 2014 in Taipei (Hsu, 2014), spitting of betel quid juice in public places has been prohibited under the Waste Disposal Act and enforced by the Environmental Protection Administration (Yang et al., 2020). Support for areca nut cessation has been implemented with culturally sensitive educational materials, especially in high-risk communities and workplaces. An oral mucosal screening programme is available for chewers, former chewers, and smokers (Yang et al., 2020). Also, clothing restrictions have been introduced for the previously scantily clad young women (called "betel quid beauties") who sell areca nut at neon-lit stalls that are frequented by taxi drivers, truck drivers, and other workers (Nylander, 2016). In 2014, the Council of Agriculture introduced a plantation programme that helped areca nut growers change to other cash crops; this led to a reduction of 5% in the area cultivated and of 18% in production. Since the start of such areca nut prevention efforts, the prevalence of betel quid chewing in adults (aged ≥ 18 years) has decreased steadily in all age groups, from about 45% in 2007 to about 5% in 2018. Also, the annual incidence rate of oral cancer has plateaued since 2009 at just more than 42 per 100 000 people,

after increasing for several decades (Yang et al., 2020).

In India, there is a provision under the Food Safety and Standards Act, 2006 (Ministry of Law and Justice, 2006) for the prohibition of the manufacture, storage, distribution, or sale of any article of food product for up to 1 year. This has been used in some states to prohibit *paan masala* (primarily see table containing areca nut). There is also a restriction on the use of anticaking agents, such as magnesium carbonate, in food products (MOHFW, 2011a). This restriction has been used in some states to ban *paan masala*, which invariably contains magnesium carbonate. Also, since 1990, packages of *paan masala* and *supari* have text health warnings (MOHFW, 2011b; NIHFW, 2014). *Gutka*, which consists of areca nut with tobacco, has been banned statewise in India since 2012 (Gunjal et al., 2020).

In China, the first step towards regulating areca nut was a 2019 ban on advertising of areca nut products by companies based in Hunan (Zhou et al., 2019). Also, another city in China (Xiamen, in Fujian Province) adopted a specific anti-areca nut policy that banned the production, sale, and use of areca nut (Zhao and Davey, 2020).

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