RESEARCH ARTICLE

Trends of Smokeless Tobacco use among Adults (Aged 15-49 Years) in Bangladesh, India and Nepal

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Abstract

Background: Smokeless tobacco (SLT) has long been realized as an important component of the fight for global tobacco control. It still remains a major problem in countries like India, Bangladesh and Nepal. The objective of this study was to estimate the trends of SLT use in three countries of the SEARO WHO office. Materials and Methods: We used data from national surveys in three countries (Bangladesh, India and Nepal) to estimate trends in prevalence of current SLT use. All available nationally representative data sources were used. Estimates were weighted, age standardized and given along with 95% confidence intervals. Significance of linear trend in prevalence over time was tested using the Cochrane-Armitage test for trend. A p value of less than 0.05 was considered statistically significant. Results: We identified three surveys for Bangladesh, three for India and four for Nepal that met the selection criteria (such as Demographic and Health Surveys, WHO-STEPwise approach to Surveillance and Global Adult Tobacco Surveys). A significantly increasing trend was noticed in the prevalence of current SLT use among Bangladeshi men (20.2% to 23%, p=0.03). In India, a similar significantly increasing trend was seen among men (27.1% to 33.4%, p<0.001) and women (10.1% to 15.7%, p<0.001). In Nepal, there was a no significant trend among both men (39.1% to 31.6%, p=0.11) and women (5.6% to 4.7%, p=0.49). Conclusions: In the study countries SLT use has remained at alarmingly high levels. Usage trends do not show any signs of decline in spite of control efforts. Tobacco control measures should focus more on controlling SLT use.

Keywords: National surveys - smokeless tobacco - South-East Asia - trend - prevalence

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Introduction

It has been predicted that if the current trends of tobacco use are unchecked the number of tobacco related deaths will reach eight million by 2030, with approximately 70% of these deaths occurring in developing countries. (WHO, 2008) Smokeless Tobacco (SLT) use affects nearly 300 million people worldwide and about 90% of the world's users reside in the South-East Asia Region (SEAR) of the WHO. (NCI, 2014) SLT use is so prevalent in this region that in certain countries like India it exceeds the prevalence of smoking.

Although SLT has been recognized as an important component of the tobacco control efforts there has been no palpable decline in the South-East Asian countries. (WHO, 2011; Ansara et al., 2013; Bhawna, 2013) Similar to tobacco smoking, SLT use has been known to cause several health problems, mainly upper aero-digestive tract cancer, pancreatic cancer, lung cancer, ischemic heart disease, stroke, adverse reproductive outcomes, addiction and others. (USDHHS, 1986; IARC, 2007; EC, 2008; Piano et al., 2010; (Ng et al., 2014) examined trends in smoking prevalence for 187 countries between 1980 and 2012 and found that the age-standardized prevalence of daily tobacco smoking declined by 25% globally with an initial rapid decline followed by a much slower decline after 2006. They also found a steady decline of prevalence for both sexes in developing countries between 1980 and 2012. (Ng et al., 2014) A similar synthesis of SLT use data over time is essential to judge the appropriateness of control measures and the need for further action. It has also been shown that interventions for SLT use cessation have not been unequivocal, highlighting the need for prevention rather than cessation. (Severson, 2003; Carr and Ebbert, 2007; Ebbert et al., 2007).

In keeping with this, our present objective was to describe the secular trends of smokeless tobacco use among adults in selected countries of the WHO-SEARO.

Materials and Methods

The major indicator selected for this study was gender-

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wise prevalence of current Smokeless Tobacco (SLT) use. Three countries of WHO-SEARO, India, Bangladesh and Nepal, that contributed to more than 90% of the volume of SLT use and had at least three nationally representative surveys on SLT prevalence were included in the analysis.

Selection criteria for inclusion of a data source

The survey should provide information for current Smokeless Tobacco (SLT) use for at least one gender or both genders combined. The study population should be members of the general population aged 15 to 49 years. They should be a nationally representative survey. All surveys carried before December 2014 were included in the review with no limit on earliest year. Data which were not nationally representative, not weighted or did not include smokeless tobacco use were excluded from the present investigation. Aggregate data from published reports were also excluded.

Data sources

We searched for raw datasets that provided nationally representative data on smokeless tobacco use. We obtained the raw data from the agency that conduced the survey or the study authors. The '*current Smokeless Tobacco (SLT) use*' variable included only those individuals, who reported using any form smokeless tobacco product such as snuff, pan masala, gutkha and any chewable tobacco.

Statistical analyses

Descriptive analyses were performed and prevalence was calculated. All proportions were weighted to account for the complex survey design and age standardization was done for all countries using the WHO 2000-2025 standard population proportions to provide comparable estimates across countries. (Ahmad et al., 2001) All proportions were given along with 95% Confidence Intervals (CI) and restricted to the age groups 15 to 49 years. If only a specific gender was reported that information alone was taken into calculation. Relative change from baseline prevalence was calculated to see the increase increase or decrease with respect to subsequent time point. In order to test whether the prevalence showed any significant linear trend (increasing or decreasing) over time, the Cochran-

Table 1. Methodological Details of the Data Sources Included in the Study with Regard to Smokeless Tobacco Use Data

Name of the survey	Data collection	Sample design	Marital status	Age group	Sampled men	Sampled women	Coverage	Response rate
Bangladesh								
DHS	2004	Multi-stage stratified	All men	15-54	4,297	-	>99%	95.70%
DHS	2007	Multi-stage stratified	Ever married men	15-49	3,771	-	>99%	92.60%
GATS	2009	Multi-stage stratified	All men and women	15+	4,468	5,161	95.50%	95.80%
India								
NFHS 2	1998-99	Multi-stage stratified	All men and women	15+	263,273	254,106	>99%	95.50%
NFHS 3	2005-06	Multi-stage stratified	All men and women	15-54 (M) 15-49 (W)	74,369	124,385	99%	87.1% (M) 94.5% (W)
GATS	2009-10	Multi-stage stratified	All men and women	15+	33,767	35,529	99.90%	94.80%
Nepal								
DHS	2006	Multi-stage stratified	All men and women	15-54 (M) 15-49 (W)	4,397	10,793	96%	96.0% (M) 98.4% (W)
STEPS	2007	Multi-stage stratified	All men and women	15-64	1,907	2,421	24%	98.3% (M) 98.4% (W)
DHS	2011	Multi-stage stratified	All men and women	15-49	4,121	12,674	96%	95.3% (M) 98.1% (W)
STEPS	2013	Multi-stage stratified	All men and women	15-69	1,336	2,807	>90%	98.60%

*Note: DHS – Demographic and Health Surveys, NFHS – National Family Health Survey, STEPS – WHO STEPwise approach to Surveillance, GATS - Global Adult Tobacco Surveys, M – Men, W - Women

Armitage trend test was used. A p value of less than 0.05 was considered statistically significant. All analyses were conducted in Stata 11.

Ethical clearance

Since the study was only a secondary data analysis of anonymized surveillance data no ethical clearance was sought.

Results

Data sources

Based on the pre-specified selection criteria a number of surveys were identified for trend analysis. (Table 1) For Bangladesh we identified six surveys that were conducted between 2004 and 2013. Out of these The '*Impact of tobacco related illnesses in Bangladesh*' study was not included due to non-availability of raw data and STEPS 2010 and STEPS 2013 were not included due to lack of sample weighting information and also because the study population's age range was >25 years. Therefore, Bangladesh had only three surveys that could be used for men and only survey i.e., GATS that had data for women.

Table 2. Un-weighted Sample Size Used in the Analysis of the Various Surveys by Country and Gender

Country	Survey	Marital status	Age group	Men	Women	Overall
Bangladesh						
	2004 DHS	All men	15-49	4,069	-	-
	2007 DHS	Ever married men	15-49	3,231	-	-
	2009 GATS	All men	15-49	3,450	-	-
India						
	1998 NFHS	All men and women	15-49	131,932	131,271	263,203
	2005 NFHS	All men and women	15-49	69,834	124,385	194,219
	2010 GATS	All men and women	15-49	26,145	28,482	54,627
Nepal			15-49			
	2006 DHS	All men and women	15-49	3,842	10,793	14,635
	2007 STEPS	All men and women	15-49	1,431	1,938	3,369
	2011 DHS	All men and women	15-49	4,121	12,674	16,795
	2013 STEPS	All men and women	15-49	850	2,094	2,944

Table 3. Age Standardized Weighted Prevalence of Smokeless Tobacco Use among Adults Aged 15-49 Years in 3 Countries of WHO-SEARO

Year	Bangladesh	India			Nepal		
	% (95% CI)	% (95% CI)			% (95% CI)		
	Men	Men	Women	Overall	Men	Women	Overall
1998		27.1	10.1	18.7			
		(26.6, 27.7)	(9.7, 10.5)	(18.3, 19.1)			
2004	20.2						
	(18.6, 21.9)						
2005		37.2	9.8	19.7			
		(36.5, 38.0)	(9.3, 10.2)	(19.2, 20.1)			
2006					39.1	5.6	14.4
					(37.2, 41.1)	(4.7, 6.6)	(13.0, 15.9)
2007	16.9				32.3	4.6	18.2
	(14.5, 19.7)				(26.3, 39.0)	(2.8, 7.6)	(14.7, 22.4)
2009	23						
	(21.3, 24.9)						
2010		33.4	15.7	24.8			
		(32.5, 34.4)	(15.0, 16.3)	(24.3, 25.4)			
2011					38	5.5	13.4
					(35.7, 40.4)	(4.5, 6.7)	(12.4, 14.6)
2013					31.6	4.7	17.5
					(27.5, 35.7)	(3.5, 5.9)	(15.4, 19.6)

Table 4. Relative Change In Prevalence of SLT Use Over Time and Significance Tests for Linear Trend by Country and Gender

Year	Bangladesh		India						Nepal					
	Men		Men		Women		Overall		Men		Women		Overall	
	%	Relative change	%	Relative change	%	Relative change	%	Relative change	%	Relative change	%	Relative change	%	Relative change
1998			27.1	0.37[@]	10.1	-0.03[@]	18.7	0.05[@]						
2004	20.2	-0.16[@]		0.23[#]		0.55[#]		0.33[#]						
2005		0.14[#]	37.2	-0.10[$]	9.8	0.60[$]	19.7	0.26[$]						
2006		0.36[$]							39.1	-0.17[@]	5.6	-0.18[@]	14.4	0.26[@]
2007	16.9								32.3	-0.03[#]	4.6	-0.02[#]	18.2	-0.07[#]
2009	23									-0.19[~]		-0.16[~]		0.22[~]
2010			33.4		15.7		24.8			0.18[$]		0.20[$]		-0.26[$]
2011									38	-0.02[&]	5.5	0.02[&]	13.4	-0.04[&]
2013									31.6	-0.17**	4.7	-0.15**	17.5	0.31**
p value*	0.03		<0.001		<0.001		<0.001		0.11		0.49		0.22	

*Cochran-Armitage test for trend, Relative change between: [@]first and second point; [#]first and third point; [~]first and fourth point; $second and third point; [&]second and fourth point; **third and fourth point

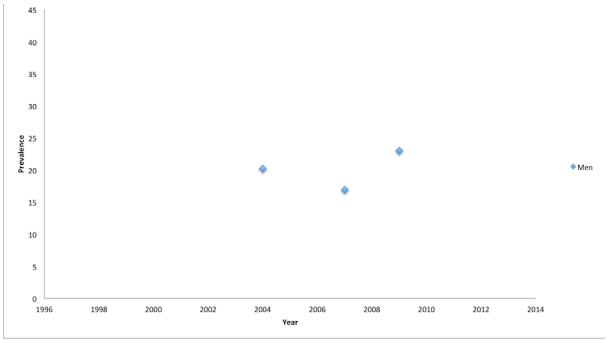

Figure 1. Trends in Smokeless Tobacco Use among Adult Men in Bangladesh

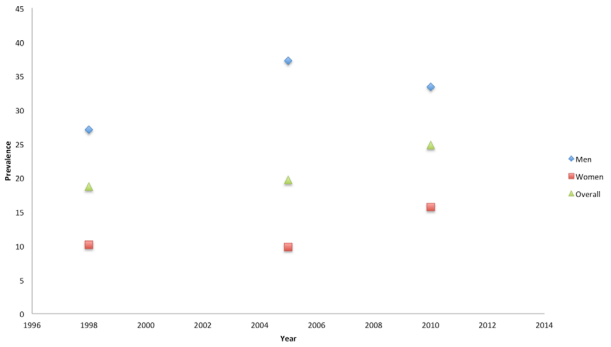

Figure 2. Trends in Smokeless Tobacco Use among Adults in India

Since there was only one data point for women it was not analyzed further. India had three surveys and Nepal had four surveys and all of them met the selection criteria. The identified surveys were Demographic and Health Surveys (DHS), WHO-STEPwise approach to Surveillance (STEPS) and Global Adult Tobacco Surveys (GATS). The surveys were nationally representative, i.e. their sampling frame covered more than 90% of the country's population, and all followed a multistage, stratified, cluster and population proportional to size sampling strategy.

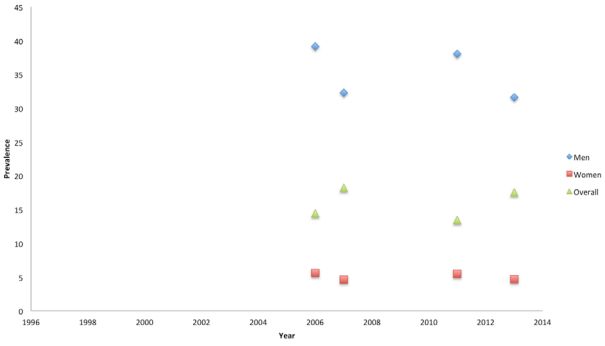

Figure 3. Trends in Smokeless Tobacco Use among Adults in Nepal

Although most surveys included both sexes, some did not collect information on tobacco use among women, for e.g., DHS 2004 and DHS 2007 in Bangladesh. The lower age limit in all surveys was 15 years and upper age limit varied widely between surveys. Most surveys had a very high response rate of >90%. Bangladesh had three data points for men and none for women or overall prevalence. India had three data points and Nepal had four data points each for men, women and overall prevalence. Among the surveys, the largest sample sizes were seen in Indian surveys followed by Nepal and Bangladesh. (Table 2) It has to be noted that all proportions were age standardized and therefore do not represent actual prevalence in the respective countries.

Prevalence and trends in Bangladesh

There was rising trend in current SLT use among men (20.2% to 23%). (Table 3) The increasing trend was statistically significant (p=0.03). (Table 4) Trend estimation could not be made for women and consequently for both sexes combined due to lack of adequate data.

Prevalence and trends in India

The prevalence among men was higher (27% to 37%) as compared to that in women (10% to 15%). There was

Table 5. Trends in Age Specific Standardized Prevalence of Smokeless Tobacco (SLT) Use in Bangladesh

	2004	2007	2009
Age (years)	% (95% CI)	% (95% CI)	% (95% CI)
Men			
15-19	4.3 (2.8, 6.3)	9.6 (2.3, 32.7)	4.3 (2.5, 7.3)
20-24	10.3 (7.8, 13.5)	10.2 (6.6, 15.6)	14.9 (10.6, 20.5)
25-29	19.8 (15.7, 24.8)	16.3 (13.0, 20.2)	17.5 (13.7, 21.9)
30-34	21.6 (18.2, 25.5)	15.1 (11.7, 19.2)	27.7 (23.0, 33.0)
35-39	24.0 (20.1, 28.3)	19.6 (16.0, 23.7)	29.4 (25.2, 34.1)
40-44	35.5 (30.5, 40.9)	24.6 (20.7, 28.9)	36.5 (31.1, 42.2)
45-49	33.6 (28.4, 39.1)	27.9 (23.7, 32.6)	39.6 (33.0, 46.6)
Total	20.2 (18.6, 21.9)	16.9 (14.5, 19.7)	23.0 (21.3, 24.9)

Table 6. Trends in Age Specific Standardized Prevalence of Smokeless Tobacco (SLT) Use in India

	1998	2005	2010
Age (years)	% (95% CI)	% (95% CI)	% (95% CI)
Both sexes			
15-19	5.7 (5.4, 6.1)	9.6 (9.1, 10.2)	11.4 (10.2, 12.8)
20-24	11.8 (11.3, 12.3)	16.6 (16.0, 17.3)	20.5 (18.9, 22.0)
25-29	17.2 (16.7, 17.8)	19.9 (19.2, 20.6)	25.2 (23.7, 26.7)
30-34	21.5 (20.8, 22.1)	22.3 (21.5, 23.1)	29.2 (27.6, 30.9)
35-39	25.0 (24.3, 25.7)	24.1 (23.2, 24.9)	31.0 (29.4, 32.5)
40-44	27.1 (26.3, 27.9)	23.8 (22.9, 24.7)	30.7 (28.9, 32.4)
45-49	27.9 (27.0, 28.8)	24.5 (23.5, 25.5)	30.0 (28.2, 31.9)
Total	18.7 (18.3, 19.1)	19.7 (19.2, 20.1)	24.8 (24.3, 25.4)
Men			
15-19	9.4 (8.8, 9.9)	22.1 (20.9, 23.3)	15.4 (13.5, 17.6)
20-24	20.3 (19.5, 21.1)	38.7 (37.3, 40.1)	30.6 (28.1, 33.2)
25-29	27.8 (26.9, 28.7)	42.4 (40.9, 43.9)	37.7 (35.2, 40.3)
30-34	32.4 (31.5, 33.4)	42.7 (41.2, 44.2)	40.7 (38.2, 43.2)
35-39	35.3 (34.3, 36.3)	41.3 (39.7, 42.8)	40.9 (38.6, 43.2)
40-44	35.6 (34.5, 36.7)	38.4 (36.8, 40.0)	37.8 (35.3, 40.3)
45-49	35.0 (33.8, 36.3)	36.7 (35.0, 38.5)	34.3 (31.6, 37.1)
Total	27.1 (26.6, 27.7)	37.2 (36.5, 38.0)	33.4 (32.5, 34.4)
Women			
15-19	2.0 (1.8, 2.3)	3.1 (2.8, 3.5)	6.9 (5.7, 8.4)
20-24	4.2 (3.8, 4.5)	5.0 (4.6, 5.5)	9.4 (8.2, 10.8)
25-29	7.6 (7.1, 8.2)	7.9 (7.3, 8.5)	13.3 (11.9, 14.8)
30-34	10.7 (10.0, 11.4)	11.0 (10.3, 11.8)	16.8 (15.1, 18.5)
35-39	13.8 (13.0, 14.6)	14.0 (13.1, 14.9)	20.5 (18.7, 22.4)
40-44	17.3 (16.4, 18.3)	14.8 (13.9, 15.8)	22.0 (19.8, 24.3)
45-49	19.8 (18.8, 20.8)	16.0 (15.0, 17.2)	25.6 (23.2, 28.1)
Total	10.1 (9.7, 10.5)	9.8 (9.3, 10.2)	15.7 (15.0, 16.3)

a significantly increasing trend among men (27.1% to 33.4%, $p<0.001$) and women (10.1% to 15.7%, $p<0.001$). The overall trend in both sexes combined also showed an increasing trend (18.7% to 24.8%, $p\leq0.001$). (Table 3,4)

Prevalence and trends in Nepal

Prevalence among men was much higher than among women (31% to 39% *vs*. 5% to 6%). There was a declining trend in both men (39.1% to 31.6%) and women (5.6% to 4.7%). However, this was not statistically significant implying a relatively stable trend for Nepal.

In summary; among men, Bangladesh and India

Table 7. Trends in Age Specific Standardized Prevalence of Smokeless Tobacco (SLT) Use in Nepal

	2006	2007	2011	2013
Age (years)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Both sexes				
15-19	4.3 (3.0, 6.1)	4.2 (1.3, 12.9)	2.4 (1.7, 3.3)	6.9 (3.8, 12.3)
20-24	10.3 (8.4, 12.5)	20.1 (14.2, 27.8)	6.5 (5.5, 7.8)	10.9 (7.1, 16.4)
25-29	13.4 (11.5, 15.7)	14.4 (7.9, 24.8)	13.5 (12.0, 15.2)	15.4 (11.0, 21.3)
30-34	17.8 (15.1, 20.9)	20.0(11.1, 33.5)	15.5 (13.5, 17.8)	21.0 (16.1, 26.9)
35-39	19.6 (16.9, 22.7)	23.9 (14.9, 36.1)	18.9 (16.6, 21.5)	22.5 (18.1, 27.6)
40-44	19.5 (16.9, 22.4)	20.1 (11.6, 32.4)	21.0 (18.6, 23.6)	23.0 (18.5, 28.1)
45-49	19.6 (16.8, 22.7)	29.3 (17.8, 44.2)	21.2 (18.5, 24.2)	27.8 (22.7, 33.5)
Total	14.4 (13.0, 15.9)	18.2 (14.7, 22.4)	13.5 (12.4, 14.6)	17.5 (15.5, 19.7)
Men				
15-19	12.5 (8.6, 18.0)	7.3 (2.3, 21.1)	7.2 (5.0, 10.2)	12.3 (6.6, 21.8)
20-24	32.7 (27.7, 38.1)	42.0 (31.1, 53.8)	23.7 (19.9, 27.8)	20.7 (12.9, 31.4)
25-29	42.6 (37.9, 47.5)	21.7 (11.1, 38.1)	46.2 (40.5, 52.0)	31.2 (22.0, 42.3)
30-34	49.2 (43.0, 55.4)	38.3 (21.4, 58.6)	49.4 (43.5, 55.4)	37.9 (28.0, 48.9)
35-39	48.4 (41.3, 55.6)	39.2 (22.7, 58.6)	52.2 (46.9, 57.4)	42.3 (32.9, 52.3)
40-44	49.4 (43.5, 55.2)	38.3 (20.6, 59.8)	50.2 (44.8, 55.7)	39.4 (31.5, 47.9)
45-49	45.8 (39.6, 52.1)	46.0 (27.2, 65.9)	46.4 (40.4, 52.5)	44.8 (35.8, 54.1)
Total	39.1 (37.2, 41.1)	32.3 (26.3, 39.0)	38.1 (35.8, 40.5)	31.6 (27.6, 35.8)
Women				
15-19	1.1 (0.7, 1.8)	-	0.7 (0.3, 1.4)	-
20-24	3.2 (2.2, 4.7)	0.6 (0.1, 4.9)	1.4 (0.9, 2.2)	2.0 (0.8, 5.4)
25-29	4.8 (3.5, 6.5)	3.2 (1.1, 8.8)	4.5 (3.4, 5.9)	1.6 (0.6, 4.4)
30-34	6.1 (4.3, 8.5)	2.0 (0.5, 6.9)	5.8 (4.3, 7.7)	5.9 (3.4, 10.2)
35-39	9.1 (6.5, 12.6)	8.0 (2.6, 22.2)	7.3 (5.7, 9.3)	6.9 (4.7, 10.2)
40-44	8.4 (6.4, 11.0)	5.1 (2.4, 10.5)	11.0 (8.5, 14.1)	5.5 (3.4, 8.8)
45-49	8.1 (6.1, 10.7)	17.4 (7.0, 37.3)	10.6 (8.1, 13.7)	13.8 (9.1, 20.4)
Total	5.6 (4.7, 6.6)	4.6 (2.8, 7.6)	5.5 (4.5, 6.7)	4.7 (3.6, 6.0)

showed a similar rising trend (Indian men at a much higher level) and on the contrary Nepali men showed a stable trend. Among women, India showed a rising trend and on the contrary Nepali women showed a stable trend. The burden of SLT use was increasing among men in Bangladesh, in India it was largely propelled by men (with women showing an increasing trend), and in Nepal the problem was mainly contributed by men and the trend was relatively stable in both sexes.

Discussion

It is evident that SLT use is major problem, sometimes even exceeding tobacco smoking in the study countries. Some of the worrisome findings include increasing prevalence among women in India, very high levels of usage in men in all countries and a stable trend in Nepal. In India, a number of studies have been previously carried out on the harmful effects and control policies for smokeless tobacco (Panda et al., 2013; Thakur et al., 2013; Danawala et al., 2014; Mini et al., 2014; Gajalakshmi and Kanimozhi, 2015) but this study is the first instance of trend analysis for SLT use.

Previous studies have examined SLT trends in adolescents due to availability of periodically repeated surveys such as Global Youth Tobacco Study and Global Health Profession Students Survey. It was seen that among 13 to 15 years old school children, the prevalence of SLT use did not change in Bangladesh and India whereas it increased significantly in Nepal. (Sinha et al., 2014) An increasing trend was also noted in the United States between 2000 to 2010 among adults aged 18 to 44 years especially in snus use.(Bhattacharyya, 2012) A similar rising trend in snus use was seen among the Swedish, especially among women although at a lower level than men. (Norberg et al., 2011) These findings were similar to the current study.

Compared to more developed countries, the SLT issue in the SEAR is much more complex. This is because of several reasons such as wide range of products with varying components, unregulated and unorganized market forces, and production and sale in informal settings. (IARC, 2007; WHO, 2011; Eriksen et al., 2012) Aggressive clamping down on tobacco smoking has forced

the tobacco industries to look for alternative markets such as smokeless tobacco, which are advertised and promoted as less harmful and socially more desirable than smoking. The products are cheap and provide the same nicotine kicks leading to addiction.(Dave and Saffer, 2013; Nargis et al., 2014; Rout and Arora, 2014)

Bangladesh enacted its national tobacco control law early in 2005 but only in 2013 SLT products were brought under its purview. Similarly, India, which enacted its national anti-tobacco law in 2005, banned the sale of gutka and pan masala under its national law only in 2013. Finally, Nepal enacted its law only in 2011 and is in its early stages of implementation.(Mahato, 2012; ITCP, 2013; ITCP, 2014) Thus countries have made a late realization and acted late to bring the SLT under the purview of their respective national tobacco control laws, leading to increasing prevalence of SLT use among the public.

Strengths & limitations: To the best of our knowledge this is first study that has examined a secular trend of SLT use in these selected countries of the WHO-SEAR. All figures were age standardized and weighted to take into account the different age structures of the study countries and the complex sampling design of the surveys ensuring comparability across surveys.

One of the major limitations of this analysis is the restriction placed on age groups. This was imposed in order to provide comparability across time and countries and also because only a few surveys had included persons aged >49 years (e.g., GATS). It is known that the prevalence of tobacco use has a strong association with age. We found some evidence that SLT use reaches a peak in the middle age groups and declines thereafter in men whereas in women it continues to increase with age and that this relationship is variable in different countries. (Tables 5-7) But we did not explore this relationship beyond 49 years.

A few issues prevented absolute comparability between surveys. For Bangladesh, the DHS 2004 surveyed men irrespective of martial status whereas the DHS 2007 surveyed only ever-married men. The definition of indicators was largely similar across surveys but there were some differences in type of products asked. There were certain variations in the ways in which tobacco related questions were put to people in different surveys that may affect responses from the same person. (CDC, 2011) Although DHS were implemented using standard methodology in different countries, minor variations at the country level due to variations in local language translation might have occurred. DHS did not specify a time limit to the '*current user*' definition and therefore there was a probability of misclassification errors creeping in. No distinction has been made between daily and non-daily current users. None of the surveys included institutionalized persons such as those in dormitories, hostels, army barracks, other organizations and hospitals. It has been pointed out that persons in institutions may have a higher prevalence of tobacco use and this might lead to underestimation of the overall population indictors. (Wang and Ma, 2012) Also, we did not analyze other indicators like consumption density and types of products.

The face-to-face interview technique adopted by these surveys was likely to be affected by the social desirability bias, especially in conservative societies where tobacco use (especially smoking but not as much for SLT) may be considered immoral and socially detestable. (Palipudi et al., 2012)

Conclusions: It can be concluded that SLT use is a major public health issue in the study countries. The harmful health effects of SLT use are as grievous as that of tobacco smoking and hence the same level of importance should be accorded to its control. The loopholes in national anti-tobacco laws should be taken care of to prevent market forces using them to push newer, cheaper and attractive tobacco products to unaware consumers. Awareness generation among the public regarding the harms of SLT use should also be reinforced.

Recommendations: There is a need to monitor the trends of SLT use for effective control as the burden of tobacco smoking becomes less and less prevalent and its place being taken up by SLT. Major hurdles for this effort include the lack of sufficient data on SLT use over a longer period of time and issues relating to sharing of data in a transparent manner. Enough data should be collected on SLT use so that a more robust estimate of the trend could be estimated using modeling techniques. There is much greater social acceptability of smokeless tobacco use compared to smoking among family members and by women in these countries. The society should be made aware of the harms of SLT use using the same level of enthusiasm used for anti-smoking campaigns. Certain reports suggest that a shift from tobacco smoking to SLT use may be occurring due to a perceived lesser harm from SLT use and in turn being responsible for the overall increase in tobacco use in these countries. (Zaman et al., 2014). It is important to note that reduction of prevalence of any tobacco use by 30% by 2025 is one the important indicators for WHO Global Monitoring Framework on NCDs. (WHO, 2013) The SLT market should be brought under tight regulation and the product compositions standardized. A closer examination of changes in population preferences of product type can provide valuable insight into the dynamic tobacco market and strategize controls efforts accordingly. Surveillance systems should adopt a uniform set of standardized questions such as the Tobacco Questions for Surveys (TQS) or any other standard that can be agreed upon by all agencies conducting such surveys. (CDC, 2011) Using these trend information countries can suitably modify existing control strategies and/or implement newer strategies for better control of tobacco epidemic.

References

Ahmad OB, Boschi-Pinto C, Lopez AD, et al (2001). Age standardization of rates: a new WHO standard (WHO). GPE discussion paper series: No.31. World Health Organization. Geneva.

Ansara DL, Arnold F, Kishor S, Hsia J, Kaufmann R (2013). Tobacco use by men and women in 49 countries with demographic and health surveys. DHS comparative reports no. 31. calverton, Maryland, USA: ICF international.

Bhattacharyya N (2012). Trends in the use of smokeless tobacco

in united states, 2000-2010. *Laryngoscope*, **122**, 2175-8.
Bhawna G (2013). Burden of smoked and smokeless tobacco consumption in India - results from the global adult tobacco survey India (GATS-India)- 2009-201. *Asian Pac J Cancer Prev*, **14**, 3323-9.
Carr AB and Ebbert JO (2007). Interventions for tobacco cessation in the dental setting. A systematic review. *Community Dent Health*, **24**, 70-4.
Centers for Disease Control and Prevention (CDC) (2011). Global adult tobacco survey collaborative group. tobacco questions for surveys: a subset of key questions from the global adult tobacco survey (GATS), 2nd Edition. Atlanta, GA.
Danawala SA, Arora M, and Stigler MH (2014). Analysis of motivating factors for smokeless tobacco use in two Indian states. *Asian Pac J Cancer Prev*, **15**, 6553-8.
Dave D and Saffer H (2013). Demand for smokeless tobacco: role of advertising. *J Health Econ*, **32**, 682-7.
Ebbert JO, Montori V, Vickers KS, et al. (2007). Interventions for smokeless tobacco use cessation. *Cochrane Database Syst Rev*, 4306.
Eriksen M, Mackay J and Ross H (2012). The tobacco atlas. 4th ed. Atlanta: American Cancer Society; New York.
European Commission (EC) (2008). Scientific committee on emerging and newly identified health risks. Health effects of smokeless tobacco products. Brussels.
Gajalakshmi V, and Kanimozhi V (2015). Tobacco chewing and adult mortality: a case-control analysis of 22,000 cases and 429,000 controls, never smoking tobacco and never drinking alcohol, in South India. *Asian Pac J Cancer Prev*, **16**, 1201-6.
International Agency for Research on Cancer (IARC) (2007). Smokeless tobacco and some tobacco-specific N-nitrosamines. IARC monographs on the evaluation of carcinogenic risks to humans. Vol. 89. Lyon, France.
ITC Project (ITCP) (2013). TCP India National Report. Findings from the Wave 1 Survey (2010-2011). University of waterloo, waterloo, ontario, canada; healis-sekhsaria institute for public health, Navi Mumbai, India.
ITC Project (ITCP) (2014). Tobacco price and taxation policies in bangladesh: evidence of effectiveness and implications for action. University of Waterloo, Waterloo, Ontario, Canada.
Mahato P (2012). Current tobacco control practices in Nepal: existing gaps and way forward. *JHAS*, **2**, 70-3.
Mini GK, Sarma PS, and Thankappan KR (2014). Pattern of tobacco use and its correlates among older adults in India. *Asian Pac J Cancer Prev*, **15**, 6195-8.
Nargis N, Hussain AKMG and Fong GT (2014). Smokeless tobacco product prices and taxation in Bangladesh: findings from the international tobacco control survey. *Indian J Cancer*, **51**, 33-8.
National Cancer Institute (NCI) and Centers for Disease Control and Prevention (CDC) (2014). Smokeless tobacco and public health: a global perspective. Bethesda, MD: U.S. department of health and human services, centers for disease control and prevention and national institutes of health, national cancer institute. NIH Publication No. 14-7983.
Ng M, Freeman MK, Fleming TD, et al. (2014). Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. *JAMA*, **311**, 183-2.
Norberg M, Malmberg G, Ng N, and Brostrom G (2011). Who is using snus? - Time trends, socioeconomic and geographic characteristics of snus users in the ageing Swedish population. *BMC Public Health*, **11**, 929.
Palipudi KM, Sinha DN, Choudhury S, et al (2012). Predictors of tobacco smoking and smokeless tobacco use among adults in Bangladesh. *Indian J Cancer*, **49**, 387-2.
Panda R, Persai D, Mathur M, and Sarkar BK (2013). Perception and practices of physicians in addressing the smokeless tobacco epidemic: findings from two States in India. *Asian Pac J Cancer Prev*, **14**, 7237-1.
Piano MR, Benowitz NL, Fitzgerald GA, et al (2010). Impact of smokeless tobacco products on cardiovascular disease: implications for policy, prevention, and treatment: a policy statement from the American heart association. *Circulation*, **122**, 1520-4.
Rout SK, and Arora M (2014). Taxation of smokeless tobacco in India. *Indian J Cancer*, **51**, 8-2.
Severson HH (2003). What have we learned from 20 years of research on smokeless tobacco cessation? *Am J Med Sci*, **326**, 206-1.
Sinha DN, Palipudi KM, Jones CK, et al (2014). Levels and trends of smokeless tobacco use among youth in countries of the World Health Organization South-East Asia Region. *Indian J Cancer*, **51**, 50-3.
Thakur JS, Prinja S, Bhatnagar N, Rana S, and Sinha, DN (2013). Socioeconomic inequality in the prevalence of smoking and smokeless tobacco use in India. *Asian Pac J Cancer Prev*, **14**, 6965-9.
U.S. Department of Health and Human Services (USDHHS) (1986). The health consequences of using smokeless tobacco: a report of the advisory committee to the surgeon general. NIH publication no. 86-2674. Bethesda, MD.
Wang Z and Ma J (2012). Prevalence and patterns of tobacco use in Asia. *Lancet*, **380**, 1905-6.
World Health Organization (WHO) (2011). WHO report on the global tobacco epidemic, 2011. Geneva.
World Health Organization (WHO) (2013). Global action plan for the prevention and control of noncommunicable diseases 2013-2020. Geneva.
Zaman MM, Bhuiyan,MR, Huq SM, et al (2014). Dual use of tobacco among Bangladeshi men. *Indian J Cancer*, **51**, 46-9.