



Original article

Estimating the quantity of smokeless tobacco consumption among older adults in India

Lucky Singh^a, Pallavi Sinha^b, Arpit Singh^b, Prashant Kumar Singh^{b,*}, Shalini Singh^b

^a ICMR-National Institute of Medical Statistics, Ansari Nagar, New Delhi, India

^b Division of Preventive Oncology & Population Health, WHO FCTC Knowledge Hub on Smokeless Tobacco, ICMR-National Institute of Cancer Prevention and Research, Noida, Uttar Pradesh, India

ARTICLE INFO

Keywords:

Tobacco
Smokeless tobacco
Older population
India

ABSTRACT

Problem considered: Globally, smokeless tobacco (SLT) users are highest in India. Whilst, studies examined prevalence and determinants of SLT use, no evidence exists which examined the quantity of SLT consumed.

Methods: Study utilized national representative data from the Longitudinal Aging Study in India (LASI) which adopted a multistage stratified area probability cluster sampling design. First, we computed the average SLT consumption per day (in grams) from the LASI data. Consecutively, we further utilized the projected population approximations from the 26th round of the official United Nations population estimates and prevalence rate of current SLT use from the Global Adult Tobacco Survey (GATS-2) and LASI Survey, separately to estimate SLT use pattern for the entire Indian population aged 45 or above.

Results: The prevalence of current SLT use among older adults was 17.2% wherein the SLT use is higher among men (20.8%). On average, an older adult consumes 1.01 g of SLT on a daily basis. The range of SLT quantity consumed by users' according to the LASI and GATS-2 prevalence, varies from 65,000 kg to 85,000 kg per day whereas, annual consumption ranges from 23 million kilograms to 32 million kilograms, respectively.

Conclusion: The development of SLT cessation services examining the quantitative aspects of SLT use would be beneficial in tackling the high SLT burden in India and improving the rates of intention to quit.

1. Introduction

Globally, 350 million smokeless tobacco (SLT) users are from 127 countries, whereas 95% of SLT users live in Southeast Asia Region, where India's contribution is highest.¹ Along with the mass production and availability of varied SLT products in India, SLT products have also yielded popularity owing to the social and cultural acceptability compared to tobacco smoking.² In addition, SLT is also used as a 'harm reduction' method to reduce and/or quit tobacco smoking which elucidates the persistent high SLT use in many countries, including India.³

In India, alike many low-income and middle-income countries, data related to current use, frequency of SLT consumption, type of products, SLT use initiation and cessation, is primary by obtained from the Global Adult Tobacco Survey (GATS). However, no information related to the quantity of SLT consumption is obtained from the users in the GATS. While, the extant literature has well-documented the prevalence, determinants and frequency of SLT use, no evidence exists which

accentuate on the quantity of SLT consumed. This study examines the amount of SLT being consumed by users aged 45 and older using a nationally representative survey.

The research evidence on SLT use elucidates that high-level addiction and habit of consuming SLT increases with age especially among the late middle-aged adults posing catastrophic health threats to adult users who are at higher risk of multi-morbidity and mortality as compared to young SLT users.⁴ SLT products contain highly addictive substances such as nicotine and more than 30 carcinogenic elements leading to high-level addiction, periodontal diseases, respiratory and lung impairment, cardiovascular diseases, pre-cancers, cancers (oral, pharyngeal and oesophageal cancers), myocardial infarction, stroke, erectile dysfunction and adverse pregnancy outcomes such as stillbirth and low-birth weight, logged as major harmful effects of SLT use globally.^{5,6} Consequently, SLT users are at higher risk of communicable disease namely, novel coronavirus (COVID-19) disease because users use their hands every single time to put the chewing tobacco inside their

* Corresponding author.

E-mail addresses: lucky.5bhu@gmail.com (L. Singh), pallavi.zeus@gmail.com (P. Sinha), singh.arpit.lko@gmail.com (A. Singh), prashants.geo@gmail.com (P.K. Singh), shalinisingh.icmr@gmail.com (S. Singh).

<https://doi.org/10.1016/j.cegh.2022.101150>

Received 28 June 2022; Received in revised form 11 August 2022; Accepted 15 September 2022

Available online 20 September 2022

2213-3984/© 2022 The Author(s). Published by Elsevier B.V. on behalf of INDIACLEN. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

mouth or cheeks.⁷

In comparison to the combustible tobacco products, the nicotine content in the SLT products is significantly higher which varies between 0.8 and 50.0 mg per gram in India.⁸ The sustained use of SLT products which contain high nicotine with addictive properties, results in the early development of nicotine dependence.⁸ Approximately, 16.3% males and 6.7% females were highly dependent on SLT use, additionally, high physiological dependence and psychological dependence was observed among users with mean age of 50 years and 56 years respectively.⁹ Although, majority of SLT users who desire to quit fail at the preparation stage of tobacco cessation recording the high rates of relapse, explicating the physical dependence and ingrained habit of SLT consumption among the elderly population, leads to hindrance in deliverance of SLT cessation support.¹⁰ Therefore, this study aims to examine the quantity of SLT consumed in India by the adult users aged 45 or above during the year 2017-18 utilizing a nationally representative dataset.

2. Methods

2.1. Design and settings

This study analysed the data from the Longitudinal Aging Study in India (LASI), a national representative survey exhibiting the information on health, economic and social well-being of the elderly population of India aged 45 and older based on internationally comparable research design and tools such as Health and Retirement Study (HRS) in the United States and others.¹¹ The first wave of LASI conducted in the year 2017-18 provided information about 72,250 individuals, from 36 states and union territories of India.¹¹

In order to attain eventual units of observation *older adults aged 45 years and above* in 36 states and union territories (UTs) of India, a multistage stratified area probability cluster sampling design was adopted in this survey. A three-stage and four-stage sampling design was adopted for the rural and urban areas respectively for each selected state. The first stage consists of Primary Sampling Unit (PSUs) namely Tehsils/Talukas (sub-districts) of each state, whereas the second stage involves the selection of villages and wards from rural and urban areas respectively within the selected PSUs. In the third stage, households were selected from the predetermined villages from both the rural and urban areas of the chosen state. In the case of urban areas, one Census Enumeration Block (CEB) were randomly selected, consecutively the fourth stage of household selection was commenced for the selected CEBs.

The selection of sub-districts (first stage), villages and wards (second stage) were considered in accordance to Census 2011. The sampling frame of the third stage consists CEBs of each selected ward. Additionally, to obtain the sampling frame for the selection of households from secondary sampling units (SSUs), mapping and listing of household for the each sampled SSUs (i.e. villages in rural areas and CEBs in urban areas) was conducted. Total number of listed households in selected villages/CEBs (SSUs) formed the sampling frame for the selection of households. Additionally, detailed description related to LASI First Wave methodology is publicly available online at https://www.iipsindia.ac.in/sites/default/files/LASI_India_Report_2020_compressed.pdf.

The individual survey schedule which was available in both English and local language was administered to each consenting respondent age 45 and above and their spouses (irrespective of age) in the sampled households. All eligible participants were provided with information brochures explaining the purpose of the survey, ways of protecting their privacy, and the safety of the health assessments as part of the ethics protocols.

2.2. Measures

LASI is the first national-level data which provided the information

on the quantity of SLT (in grams) consumed daily or weekly by a current user. In order to enquire about the individual current use of SLT, they were asked: “Do you currently consume any smokeless tobacco products such as chewing tobacco, gutkha, or pan masala?” Those responded in “yes” were considered to be current SLT users. Estimation of the quantity of SLT consumed by an individual was based on the respondents’ answer to the survey question, “Please tell me approximately how many grams of smokeless tobacco you normally consume per day? If it is easier, you can tell me how many grams per week”. The response for the SLT consumed in grams was collected for ‘per day’ or ‘per week’ consumption in accordance to the participant recollection.

2.3. Statistical analysis

In order to calculate the SLT consumption of the study population, we first computed the average SLT consumption per day (in grams) from the LASI data. However, to extrapolate the SLT use pattern for the entire Indian population (aged 45 years and above) for daily, weekly, monthly and yearly consumption, we utilized the projected population approximations from the 26th round of the official United Nations population estimates¹² and prevalence rate of current SLT use from Global Adult Tobacco Survey (2016–17) and LASI Survey, separately. To obtain the total quantity of SLT consumption (in grams) for the Indian population (45 years and above), we calculated the average SLT consumption (per kilogram) using the equation mentioned below:

$$\text{Avg. SLT Consumption(per kilogram)} = \frac{((P_{st} \times P_a) \times P_{sc})}{1,000,000}$$

where, ‘Avg. SLT consumption’ represents average SLT consumption, followed by P_{st} and P_a which denotes prevalence of current SLT usage and projected population of India respectively, further, P_{sc} signifies average SLT consumption (in grams) by an individual, information mentioned in the LASI data. All the statistical analysis was conducted using the STATA version 15 software.¹³

3. Results

About half of the study population (52.0%) belonged to the age group 45–59 and 53.5% were women (Table 1). 47.0% older population was illiterate and majority lived in rural areas (64.7%). Representation of sample was highest from south region (23.9%), followed by north (18.2%) and east (17.7%) region.

The prevalence of current SLT use among adults aged 45 and older was 17.2% (Table 1). Not much variation evident across age groups but 20.8% men consume SLT as against 14.0% among women. SLT use among widowed/divorced/separated women was highest (18.1%), while it was lowest among never married individuals (15.0%). Only 6.2% older population who had completed post-graduate and above level of education consume SLT, while the corresponding percentage was three times (18.3%) and four times (21.7%) higher among illiterate and individuals with below primary school education. Rural residents consume SLT considerably higher (20.1%) as against 11.9% by their urban counterpart. SLT use was highest reported in east region (30.7%), followed by northeast (24.8%) and central region (21%). On an average, older adults consume 1.01 g (Standard Deviation (SD) 1.21) of SLT on daily basis. It varies 1.11 g (SD 2.64) in central region to 0.96 g (SD 0.15) in northeast region.

We estimated that older adults aged 45 and above consume nearly 65,592 kg of SLT products every day (Table 2). On weekly basis this figure of SLT consumption increased to 4,59,144 kg, and further 19,67,760 kg in a month and 2,39,41,074 kg in a year. Men consume considerably higher quantity of SLT products as compared to women. For instance, SLT consumption was 44,662 kg/day among men, while the corresponding figure was 22,802 kg/per day among women.

We found the estimated quantity of SLT products consumption

Table 1
Summary statistics of older adults (aged 45 years and above) covered in the Longitudinal Ageing Study in India (LASI), 2017-18.

Background characteristics	Sample distribution		Prevalence of smokeless tobacco		Smokeless tobacco quantity consumed per day (in grams)	
	n	%	n	%	Mean	SD
Age group						
45-49	13182	20.1	2212	16.8	0.99	0.09
50-54	10911	16.6	1858	17.0	1.05	1.77
55-59	10005	15.3	1737	17.4	1.01	0.68
60-64	10134	15.5	1780	17.6	1.04	2.02
65-69	8845	13.5	1533	17.3	1.00	0.07
70-74	5746	8.8	1025	17.8	0.99	0.10
75-79	3362	5.1	574	17.1	1.07	2.01
80+	3390	5.2	558	16.5	0.98	0.12
Sex						
Male	30487	46.5	6353	20.8	1.02	1.16
Female	35088	53.5	4924	14.0	1.00	1.29
Current marital status						
Currently married	49169	75.0	8341	17.0	1.02	1.40
Widowed/separated/divorced	15573	23.7	2811	18.1	0.99	0.09
Never Married	825	1.3	124	15.0	0.99	0.08
Education						
Illiterate	30824	47.0	5649	18.3	1.02	1.47
Less than primary	7480	11.4	1625	21.7	0.99	0.08
Completed primary	8618	13.1	1477	17.1	1.02	1.23
Completed secondary	12128	18.5	1833	15.1	1.02	1.11
Completed high school	2805	4.3	377	13.4	0.98	0.11
Completed college/university	2542	3.9	243	9.6	0.97	0.13
Completed post-graduation & above	1176	1.8	73	6.2	0.99	0.06
Residence						
Rural	42430	64.7	8521	20.1	1.02	1.33
Urban	23145	35.3	2756	11.9	1.00	0.73
Region						
North region	11966	18.2	553	4.6	1.00	0.05
Central region	8907	13.6	1871	21.0	1.11	2.64
East region	11582	17.7	3557	30.7	0.99	0.08
Northeast region	8514	13.0	2112	24.8	0.96	0.15
West region	8902	13.6	1728	19.4	1.04	1.34
South region	15704	23.9	1456	9.3	1.00	0.03
Total	65575		11277	17.2	1.02	1.21

increased when considered prevalence of SLT use based on GATS-2 prevalence among adults aged 45 and above years (Table 2). For instances, nearly 89,190 kg/per day SLT products was consumed among adults 45 and above at national level. This estimates were 6,24,328/

Table 2
Estimated quantity of smokeless tobacco use among population 45 and above, India.

Population (aged 45 years and above)	Male	SD	Female	SD	Total	SD
Average SLT consumed (grams per day) - LASI 2017-18	1.022	1.159	1.004	1.285	1.015	1.211
Current SLT Prevalence (in%) - LASI 2017-18	27.46		14.45		20.43	
Current SLT Prevalence (in%) - GATS 2016-17	33.3		22.3		27.8	
UN Projected Population of India (2016-17)	159142500		157170000		316312500	
Estimates based on LASI prevalence						
Average SLT consumed by current user (in kg) per day	44662		22802		65592	
Average SLT consumed by current user (in kg) per week	312634		159613		459144	
Average SLT consumed by current user (in kg) per month	1339858		684057		1967760	
Average SLT consumed by current user (in kg) per year	16301609		8322697		23941074	
Estimates based on GATS prevalence						
Average SLT consumed by current user (in kg) per day	54095		35126		89190	
Average SLT consumed by current user (in kg) per week	378667		245882		624328	
Average SLT consumed by current user (in kg) per month	1622858		1053780		2675691	
Average SLT consumed by current SLT user (in kg) per year	19744775		12820985		32554236	

week and nearly 3,25,54,236/per year at national level among users.

4. Discussion

This study for the first time provides robust estimates on the SLT quantity consumed by the users aged 45 years and older. To the best of our knowledge, there are no extant literature available which explored the quantitative aspects of SLT consumption. In correspondence to the findings, the range of SLT quantity consumed by users (45 years or above) in accordance to the LASI and GATS-2 prevalence, varies from 65.5 thousand kilograms to 89 thousand kilograms for a quotidian use whereas, annual consumption ranges from 23 million kilograms to 32 million kilograms respectively.

Our findings have several implications. First, the reported notable quantity of SLT consumption by the elderly population aged 45 years or older will result in high nicotine dependency,⁸ increasing the frequency of SLT use and rendering their intention to quit. In addition, this cohort will be more prone to the adverse health effects such as oral leukoplasias,¹⁴ cancers¹⁵ and metabolic syndrome.¹⁶

Second, the older population is projected to increase in future¹⁷ will intensify the burden of SLT related diseases, exerting enormous pressure on the overburdened healthcare system of India. The annual economic burden of direct medical cost (129320 INR million) and indirect morbidity and mortality cost (334874 INR million) attributable due to SLT use will proliferate¹⁸ affecting users well-being and will also lead to loss in the productivity and economy.

Third, the widely applied Fagerström Test for Nicotine Dependence (FTND) to determine nicotine dependence among SLT users does not record information related to quantity consumed¹⁹ like smoking,²⁰ which misapprehend users' nicotine addiction, if their SLT consumption is overall high in a day as compared to their first chew. Hence, this study would enhance the SLT cessation services, providing attention to the quantitative aspect as the timings and frequency of SLT use. In addition, the SLT cessation services in India are dominated by the male users,² that must prioritize and focus on the female users' by developing gender-specific strategies to tackle the high SLT burden among females presented in the study.

This study has certain limitations. First, we cannot rule out the possibility of SLT use underreporting by older women due to social desirability. Second, the SLT users could have reported the reduced SLT quantities owing to the social desirability, thus difficult to verify. Third, the recorded SLT quantity was based on users' recollection, so there could be a recall bias. Fourth, there could be many indigenous SLT products that may not be reported in the study owing to the lack of knowledge from both users as well as field investigator side. Fifth, inaccuracy in recording SLT quantities by the field investigators, hence subjected to content errors which cannot be addressed.

5. Conclusion

Consumption of SLT products among the older adults will result in high dependency, lower intention to quit tobacco and lower use of existing cessation support. This will adversely impact health of older adults and pose enormous pressure on the overburdened healthcare system. The first-time robust estimates on the SLT quantity consumed by the older adults provided by this study successively creates an opportunity to strengthen and modify the current SLT tobacco cessation services and record the information about the SLT quantity consumed by the users to accurately determine the user's nicotine dependence and improve the chances of SLT-quit attempts.

Ethics approval

This study used a LASI Wave 1 data available in the public domain for use by researchers, thus no ethical clearance is required for this study.

Funding

No funding was received from any funding agencies in the public, commercial, or not-for-profit sectors to assist with the preparation of this manuscript.

Patient consent for publication

Not applicable as no patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Declaration of competing interest

None declared.

References

- 1 Sinha DN, Suliankatchi RA, Gupta PC, et al. Global burden of all-cause and cause-specific mortality due to smokeless tobacco use: systematic review and meta-analysis. *Tobac Control*. 2018;27(1):35–42.
- 2 Singh S, Jain P, Singh PK, Reddy KS, Bhargava B. White paper on smokeless tobacco & women's health in India. *Indian J Med Res*. 2020;151(6):513.
- 3 Suliankatchi RA, Sinha DN, Rath R, et al. Smokeless tobacco use is "replacing" the smoking epidemic in the South-East Asia region. *Nicotine Tob Res*. 2019. <https://doi.org/10.1093/ntr/ntx272>.
- 4 Thakur JS, Paika R. Determinants of smokeless tobacco use in India. *Indian J Med Res Suppl*. 2018. https://doi.org/10.4103/ijmr.IJMR_27_18.
- 5 Siddiqi K, Husain S, Vidyasagaran A, Readshaw A, Mishu MP, Sheikh A. Global burden of disease due to smokeless tobacco consumption in adults: an updated analysis of data from 127 countries. *BMC Med*. 2020. <https://doi.org/10.1186/s12916-020-01677-9>.
- 6 Kakde S, Bhopal RS, Jones CM. A systematic review on the social context of smokeless tobacco use in the South Asian population: implications for public health. *Publ Health*. 2012. <https://doi.org/10.1016/j.puhe.2012.05.002>.
- 7 Kaur J, Rinkoo AV. Public health perspectives of smokeless tobacco and areca nut use in the COVID-19 era. *Nicotine Tob Res*. 2020. <https://doi.org/10.1093/ntr/ntaa081>.
- 8 Gupta A, Mehrotra R. Alarming High Levels of Nicotine and Carcinogenic Nitrosamines in Smokeless Tobacco Products Sold Worldwide. doi:10.1093/ntr/ntaa184/5909170.
- 9 Deolia S, Agarwal S, Chhabra KG, Daphle G, Sen S, Jaiswal A. Physical and psychological dependence of smokeless and smoked tobacco. *J Clin Diagn Res*. 2018. <https://doi.org/10.7860/JCDR/2018/28583.11233>.
- 10 Thomas JL, Ebbert JO, Patten CA, Dale LC, Bronars CA, Schroeder DR. Measuring nicotine dependence among smokeless tobacco users. *Addict Behav*. 2006;31(9):1511–1521. <https://doi.org/10.1016/j.addbeh.2005.11.005>.
- 11 International Institute for Population Sciences (IIPS). *NP for, Health Care of Elderly (NPHCE), MoHFW HTHCS of, (USC) PH (HSPH) and the U of SC. Longitudinal Ageing Study in India (LASI) Wave 1, 2017-18, India Report*. 2020.
- 12 Economic and Social Affairs D, United nations population division. *World Population Prospects 2019: Methodology of the United Nations Population Estimates and Projections*. 2019.
- 13 StataCorp. *Stata Statistical Software*. 2017. <https://doi.org/10.2307/2234838>. Release 15. 2017.
- 14 Critchley JA, Unal B. Health effects associated with smokeless tobacco: a systematic review. *Thorax*. 2003;58(5):435–443. <https://doi.org/10.1136/thorax.58.5.435>.
- 15 Sinha DN, Abdulkader RS, Gupta PC. Smokeless tobacco-associated cancers: a systematic review and meta-analysis of Indian studies. *Int J Cancer*. 2016. <https://doi.org/10.1002/ijc.29884>.
- 16 Gupta R, Gupta N, Khedar RS. Smokeless tobacco and cardiovascular disease in low and middle income countries. *Indian Heart J*. 2013. <https://doi.org/10.1016/j.ihj.2013.06.005>.
- 17 United Nations. *World Population Ageing. World Population Ageing 2020; 2019:2020*.
- 18 John RM, Sinha P, Munish VG, Tullu FT. Economic costs of diseases and deaths attributable to tobacco use in India, 2017-2018. *Nicotine Tob Res*. 2021;23(2):294–301. <https://doi.org/10.1093/ntr/ntaa154>.
- 19 Ebbert JO, Patten CA, Schroeder DR. The Fagerström test for nicotine dependence-smokeless tobacco (FTND-ST). *Addict Behav*. 2006. <https://doi.org/10.1016/j.addbeh.2005.12.015>.
- 20 Kandel DB, Chen K. *Extent of Smoking and Nicotine Dependence in the United States: 1991-1993*. *Nicotine Tob Res*; 2000. <https://doi.org/10.1080/14622200050147538>.