

# Smokeless Tobacco Warnings in Indian Mass Media: Intention and Attempts to Quit

## Abstract

**Introduction:** In India, over 200 million people use smokeless tobacco (SLT), which increases the risk of cancers. Studies have demonstrated mass media campaigns effectively reduce smoking tobacco prevalence, but few have assessed their impact on SLT cessation. **Objectives:** This study used data from the Global Adult Tobacco Surveys (GATS) in 2009–2010 and 2016–2017 to examine associations between SLT health warnings in mass media, and intention and attempts to quit using SLT. We also compared the proportion of SLT users who noticed mass media warnings between 2009–2010 and 2016–2017. **Materials and Methods:** Over 16,000 and 15,000 current SLT users from the GATS-1 and GATS-2, respectively, were used for analysis. Weighted logistic regression models were used to analyze associations between noticed health warnings on SLT packages, newspapers/magazines, television, radio, billboards, cinemas, internet, vehicles, and walls, and intention and attempts to quit SLT. **Results:** In final models, the odds of intention and attempts to quit were highest among those who noticed warnings in newspapers/magazines (adjusted odds ratio [AOR]: 1.50; 95% confidence interval [CI]: 1.30–1.74) and the internet (AOR: 1.60; 95% CI: 1.12–2.29), respectively. Warnings on SLT packages, television, billboards, radio, vehicles, and walls were also associated with increased cessation behavior. More noticed warnings on SLT packages, television, billboards, and newspapers/magazines in GATS-2 than GATS-1, but fewer heard radio warnings. **Conclusions:** Among Indian SLT users, we found evidence that SLT warnings in mass media may promote cessation behavior. Health warnings in mass media could play an important role in the overall strategy to reduce the morbidity and mortality associated with SLT use.

**Keywords:** *Attempts to quit, cessation behavior, Indian adults, intention to quit, mass media, smokeless tobacco*

## Introduction

India is the world's second-largest consumer and third largest producer of tobacco. There are over 300 million smokeless tobacco (SLT) users worldwide, of which 206 million (68.7%) live in India.<sup>[1]</sup> In India, the prevalence of SLT use among adults is 21.4% with the highest use among men, those in rural areas, and of lower socioeconomic status (SES) and educational attainment.<sup>[2]</sup>

Popular SLT products in India include *khaini*, *gutkha*, *paan* with tobacco, *mishri*, *gul*, *bajjar*, and *gudakhu*, which contain some combination of dried tobacco leaves, slaked lime, areca nut, and catechu.<sup>[3]</sup> They are often placed in the mandibular or labial groove and sucked slowly for 10–15 min, occasionally overnight. Many people use SLT as a dentifrice, believing SLT has a

germicidal chemical that cleans teeth.<sup>[1,3]</sup> SLT products contain 28 carcinogens, including nitrosamines, heavy metals, polycyclic aromatic hydrocarbons, and aldehydes. The placement of quid in the mouth between cheeks and gums increases the risk of tumors of the gingiva, oropharynx, esophagus, and stomach. SLT may also cause leukoplakia, tooth abrasion/attrition, dental caries, gingivitis, periodontitis, cardiovascular disease, and stroke.<sup>[1]</sup> India has one of the world's highest oral cancer rates with >50% attributable to SLT. India accounts for three quarters of global deaths attributed to SLT and global disability-adjusted life years. Direct medical expenses of treating SLT-related illnesses in India exceed \$285 million annually. All tobacco-related deaths in India may exceed 1.5 million annually by 2020.<sup>[1]</sup>

To address the use and consequences of tobacco products, India initiated the National Tobacco Control Programme

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in 2007–2009 in 21 states.<sup>[2]</sup> The program oversees the implementation of tobacco laws, promoting educational campaigns, establishing cessation centers, and disseminating anti-tobacco messaging in the media.<sup>[2]</sup> By 2013, the program was expanded to all 29 states, and efforts were made for a National Level Public Awareness Campaign.

Many studies have demonstrated mass media campaigns effectively inform the public of the dangers of smoking tobacco and promote quitting.<sup>[4,5]</sup> Campaign reach, intensity, and duration influence program success. Fewer studies have examined the impact of mass media campaigns of SLT health consequences on SLT usage. One study in 2009 demonstrated mass media campaigns of the harms of SLT successfully increased knowledge and negative attitudes toward SLT.<sup>[6]</sup> However, it is unclear whether these media campaigns promoted SLT cessation behavior. This study uses cross-sectional nationwide data from 2009–2010 to 2016–2017 Global Adult Tobacco Surveys (GATS) in India to examine associations between exposure to SLT health warnings in mass media (SLT packages, newspapers/magazines, television, radio, billboards, cinemas, internet, public transportation vehicles, and public walls), and intention and attempts to quit using SLT. A secondary objective was to ascertain whether the proportion of SLT users who noticed health warnings in mass media changed between 2009–2010 and 2016–2017.

## Materials and Methods

### Study design

Launched in 2007 by the World Health Organization (WHO), GATS collects tobacco control indicators among 25 low- and middle-income countries (LMICs) where most tobacco users reside.<sup>[7]</sup> The first GATS survey in India (GATS-1) was administered by the Ministry of Health and Family Welfare (MoHFW), Government of India, with support from the Centers for Disease Control and Prevention, WHO, and Research Triangle Institute International.<sup>[8]</sup> GATS-1 was a cross-sectional household survey conducted in 2009–2010 to monitor adult tobacco use, track tobacco control indicators, and assess the impact of tobacco control efforts, including the Cigarettes and Other Tobacco Products Act of 2003.<sup>[8]</sup>

The second GATS survey (GATS-2) was launched in 2016–2017 by MoHFW and Tata Institute of Social Science (TISS) to measure the impact of tobacco control legislation since GATS-1.<sup>[2]</sup> Both surveys covered 99.9% of the population and were nationally representative of India's six geographic regions.<sup>[2,8]</sup> Both surveys used pretested questionnaires, which were translated into 19 Indian languages for the administration in different states and included information on background characteristics, tobacco smoking, SLT, cessation, secondhand smoke, economics, media, knowledge, attitudes, and perceptions.<sup>[2,8]</sup>

### Study population

GATS-1 and GATS-2 used a multistage cluster sampling design, stratified by population density.<sup>[2,8]</sup> In urban areas, there were three selection stages: city wards selected with probability proportional-to-size, census enumeration blocks, and households. In rural areas, there were two selection stages: villages stratified by geographical regions selected with probability proportional-to-size and households. During the last stage, one individual was randomly picked from each household.<sup>[2,8]</sup>

Both surveys included noninstitutionalized male and female residents aged 15 years and older.<sup>[2,8]</sup> Individuals living in student dorms, hospitals, prisons, barracks, or extremely remote or unsafe areas were excluded. Further details of the household sampling design, interview, and data compilation process are available elsewhere.<sup>[2,8]</sup>

GATS-1 and GATS-2 sampled a total of 79,690 and 84,047 households, respectively.<sup>[8]</sup> GATS-1 and GATS-2 had respective household response rates of 96.8% and 96.7% and individual level response rates of 94.8% and 96%. GATS-1 completed 69,296 interviews: 27,471 urban and 41,825 in rural areas.<sup>[8]</sup> GATS-2 completed 74,037 interviews: 26,488 urban and 47,549 in rural areas.<sup>[2]</sup>

### Ethics statement

This study is based on secondary analysis of India GATS-1 and GATS-2 data. Study protocols and survey materials for GATS-1 were approved by the Ethics Review Committee, Institutional Review Board (IRB) of International Institute for Population Sciences.<sup>[8]</sup> Study materials for GATS-2 were approved by the IRB of TISS.<sup>[2]</sup> Consent was obtained from all participants. Parent or guardian consent was required for interviews of minors ages 15–17 years.

### Variables

Outcome variables were intention (yes, no) and attempt to quit using SLT (yes, no). "Intention to quit" included "within the next month," "next 12 months," and "someday, but not the next 12 months."

The exposures of interest were noticed health warnings about SLT on SLT product packages, newspapers/magazines, television, radio, billboards/hoardings, cinemas, internet, public transportation vehicles/stations, and public walls (yes, no).

Covariates included age; sex (female, male); residence (urban, rural); national region (North, Central, East, West, South, Northeast); highest level of education (<primary, completed primary, completed secondary, completed college); employment (employed, homemaker, unemployed); visited a doctor within the past 12 months (yes, no); noticed advertisements/signs promoting SLT products in the past 30 days (yes, no); believe SLT use causes serious illness (yes, no); and rules about smoking at home (allowed, not allowed). "Allowed" also included "not allowed,

but exceptions,” “no rules,” and “don’t know.” Principal components analysis was used to create an SES index from ten variables from GATS-2: has electricity, flush toilet, fixed telephone, cellphone, television, radio, refrigerator, car, motorcycle, and washing machine (yes, no). One component was drawn, which included all ten variables and accounted for 28.4% of the variability in the data [Supplementary Table 1]. These variables were weighted against their eigenvector coefficients. The same component representing SES in GATS-2 was used to represent SES in GATS-1. Scores ranged from 0 to 3, with higher scores indicating greater SES index.

## Analysis

Descriptive statistics were reported for exposures and covariates stratified by survey year. Means and standard deviations were reported for continuous variables (age, SES index) and frequency distributions for categorical variables (sex; education; employment; residence; region; visited doctor; noticed SLT warnings on SLT packages, television, radio, billboards, newspapers/magazines, cinemas, internet, vehicles, walls; noticed signs promoting SLT; home smoking rules; and believe SLT causes illness). *T*-tests and Chi-square tests were used to assess differences between survey years for continuous and categorical variables, respectively.

Logistic regression models were used to analyze unadjusted (Model 1) and adjusted (Model 2) associations between exposures of interest (noticed health warnings on SLT packages, newspapers/magazines, television, radio, billboards, cinemas, internet, vehicles, and walls) and outcomes (intention and attempts to quit SLT) for both surveys. Model 2 adjusted for confounders identified *a priori* from the literature: age,<sup>[9,10]</sup> sex,<sup>[9]</sup> education,<sup>[9,10]</sup> employment,<sup>[9,10]</sup> SES index,<sup>[11]</sup> region,<sup>[9]</sup> urban/rural residence,<sup>[9]</sup> visited a doctor,<sup>[12]</sup> home smoking rules,<sup>[13,14]</sup> noticed SLT advertisements,<sup>[15]</sup> and believed SLT causes illness.<sup>[16]</sup> Tolerance values were used to assess collinearity among all independent variables. Statistical significance, defined as  $P < 0.05$ , was evaluated through the Chi-square test. Because of the complex sampling design involving clustering and stratification, sample weights, cluster, and strata factors were included during analysis to obtain accurate estimates that reflect SLT use patterns in the total India population. Odds ratios, 95% confidence interval (CI), and *P* values were reported. We used SAS V.9.4 (SAS Institute, Inc., Cary, North Carolina, USA) for all analyses.

## Results

### Sample characteristics

There were 16,812 current SLT users in GATS-1 and 15,235 in GATS-2, which after accounting for cluster, strata, and weight factors, represented 25.9% and 21.4% of the population, respectively.

The average participant age for GATS-2 was 42.3 years and 70.8% were male [Table 1]. In GATS-1 and GATS-2, 71.8% and 82.1% of SLT users noticed SLT health warnings in the previous month on SLT packages, newspapers/magazines, television, radio, or billboards, respectively. More participants noticed SLT warnings on SLT packages, television, billboards, and newspapers/magazines in GATS-2 than GATS-1, but fewer heard warnings on the

**Table 1: Descriptive statistics of smokeless tobacco users, 2009-2010 and 2016-2017 India Global Adult Tobacco Surveys**

Characteristic	2009-2010	2016-2017	<i>P</i> <sup>b</sup>
Categorical variables (percentage and SE) <sup>a</sup>			
Noticed SLT warnings on/in			
SLT packages	62.9 (0.9)	71.6 (0.7)	<0.01
Television	24.0 (0.8)	52.0 (0.9)	<0.01
The radio	15.0 (0.6)	8.6 (0.5)	<0.01
Billboards	14.7 (0.6)	26.8 (0.7)	<0.01
Newspapers or magazines	17.3 (0.6)	28.7 (0.8)	<0.01
Cinemas	-	20.3 (0.7)	
The internet	-	3.3 (0.3)	
Public transportation vehicles	-	30.5 (0.8)	
Public walls	-	20.3 (0.7)	
Noticed signs promoting SLT	21.2 (0.8)	20.8 (0.8)	0.72
Never allowed smoking at home	27.4 (0.8)	39.2 (0.9)	<0.01
Believe SLT causes illness	86.3 (0.5)	94.0 (0.3)	<0.01
Male sex	65.7 (0.7)	70.8 (0.7)	<0.01
Education			
College completed	4.0 (0.3)	3.8 (0.3)	<0.01
Secondary school completed	11.9 (0.5)	15.4 (0.6)	
Primary school completed	28.1 (0.7)	31.8 (0.6)	
< Primary	56.0 (0.8)	49.0 (0.7)	
Employment			
Employed	69.1 (0.7)	74.2 (0.7)	<0.01
Homemaker	21.0 (0.6)	16.6 (0.5)	
Unemployed	9.8 (0.4)	9.2 (0.4)	
Urban residence	19.9 (0.8)	24.6 (1.0)	<0.01
Region			
North	1.4 (0.1)	3.0 (0.2)	<0.01
Central	36.7 (1.9)	36.4 (1.0)	
East	30.7 (1.8)	27.2 (0.8)	
West	14.6 (1.1)	15.8 (0.9)	
South	11.8 (1.0)	10.6 (0.6)	
Northeast	4.8 (0.3)	7.0 (0.2)	
Visited a doctor in past year	36.3 (0.7)	39.2 (0.7)	<0.01
Continuous variables (mean and SE)			
Age	39.5 (0.2)	42.3 (0.3)	<0.01
SES index <sup>c</sup>	0.8 (0.1)	1.1 (0.1)	<0.01

<sup>a</sup>Estimates include sample weights, cluster, and stratification factors;

<sup>b</sup>Categorical variables: *P* value from Chi-square test; continuous variables: *P* value from *t*-test; <sup>c</sup>SES index was derived from principal components analysis and included: Electricity, a flush toilet, fixed telephone, cellphone, television, radio, refrigerator, car, motorcycle, and washing machine. Score range: 0-3. SLT – Smokeless tobacco; SE – Standard error; SES – Socioeconomic status

radio ( $P < 0.01$ ). In GATS-2, 49.5% of SLT users intended to quit using SLT, and 32.0% attempted to quit. Tolerance values for all independent variables were  $\geq 0.66$  for both surveys, so there was no evidence of collinearity.

### Intention to quit

For both surveys, unadjusted analyses demonstrated associations between intention to quit SLT and noticed warnings on SLT packages, newspapers/magazines, television, radio, and billboards ( $P < 0.001$ ) [Table 2]. In GATS-2, unadjusted analyses also revealed associations between intention to quit SLT and noticed SLT warnings on the internet, vehicles, walls, and cinemas ( $P < 0.001$ ).

In GATS-2, intention to quit SLT was associated with noticed warnings on SLT packages (adjusted odds ratio [AOR]: 1.19; 95% CI: 1.04–1.36), newspapers/magazines (AOR: 1.50; 95% CI: 1.30–1.74), billboards (AOR: 1.21; 95% CI: 1.04–1.40), cinemas (AOR: 1.40; 95% CI: 1.21–1.62),

public transportation vehicles (AOR: 1.21; 95% CI: 1.04–1.40), and public walls (AOR: 1.26; 95% CI: 1.08–1.47), after adjusting for age, sex, education, employment, SES index, region, residence, visited a doctor, home smoking rules, noticed SLT advertisements, and believed SLT causes illness. Results from GATS-1 were similar, but the intention to quit SLT was also associated with noticed warnings on television (AOR: 1.18; 95% CI: 1.03–1.36) and the radio (AOR: 1.44; 95% CI: 1.24–1.68).

### Attempted to quit

For both surveys, unadjusted analyses demonstrated associations between attempted to quit SLT and noticed warnings on SLT packages, newspapers/magazines, television, radio, and billboards ( $P < 0.001$ ) [Table 3]. In GATS-2, attempted to quit SLT was also associated with noticed SLT warnings on the internet, vehicles, walls, and cinemas ( $P < 0.001$ ).

**Table 2: Unadjusted and adjusted<sup>a</sup> associations<sup>b</sup> between noticed smokeless tobacco health warnings in the media and intention to quit using smokeless tobacco, 2009-2010 and 2016-2017 India Global Adult Tobacco Surveys**

Characteristic	2009-2010				2016-2017			
	OR (95% CI)	P	AOR (95% CI)	P	OR (95% CI)	P	AOR (95% CI)	P
Noticed SLT warnings (reference: no)								
On SLT packages	1.56 (1.40-1.73)	<0.001	1.21 (1.08-1.37)	0.002	1.59 (1.41-1.80)	<0.001	1.19 (1.04-1.36)	0.010
In newspapers or magazines	1.78 (1.55-2.05)	<0.001	1.43 (1.22-1.66)	<0.001	1.82 (1.60-2.07)	<0.001	1.50 (1.30-1.74)	<0.001
On television	1.31 (1.15-1.50)	<0.001	1.18 (1.03-1.36)	0.021	1.42 (1.27-1.59)	<0.001	1.11 (0.99-1.25)	0.085
On the radio	1.68 (1.45-1.96)	<0.001	1.44 (1.24-1.68)	<0.001	1.37 (1.10-1.70)	0.005	1.17 (0.94-1.46)	0.158
On billboards	1.58 (1.35-1.84)	<0.001	1.34 (1.13-1.57)	<0.001	1.52 (1.33-1.74)	<0.001	1.21 (1.04-1.40)	0.015
In cinemas	-	-	-	-	1.74 (1.51-2.00)	<0.001	1.40 (1.21-1.62)	<0.001
On the internet	-	-	-	-	2.10 (1.44-3.06)	<0.001	1.48 (0.99-2.23)	0.057
On public transportation vehicles	-	-	-	-	1.56 (1.37-1.78)	<0.001	1.21 (1.04-1.40)	0.015
On public walls	-	-	-	-	1.59 (1.38-1.83)	<0.001	1.26 (1.08-1.47)	0.004

<sup>a</sup>Adjusted for age, sex, education, employment, SES index, region, urban/rural residence, visited a doctor, home smoking rules, noticed SLT advertisements, and believed SLT causes illness. SES index was derived from principal components analysis and included: electricity, a flushed toilet, fixed telephone, cellphone, television, radio, refrigerator, car, motorcycle, and washing machine; <sup>b</sup>Sample weights, cluster, and stratification factors. SLT – Smokeless tobacco; CI – Confidence interval; OR – Odds ratio; AOR – Adjusted OR; SES – Socioeconomic status

**Table 3: Unadjusted and adjusted<sup>a</sup> associations<sup>b</sup> between noticed smokeless tobacco health warnings in the media and attempted to quit using smokeless tobacco, 2009-2010 and 2016-2017 India Global Adult Tobacco Surveys**

Characteristic	2009-2010				2016-2017			
	OR (95% CI)	P	AOR (95% CI)	P	OR (95% CI)	P	AOR (95% CI)	P
Noticed SLT warnings (reference: no)								
On SLT packages	1.73 (1.53-1.96)	<0.001	1.27 (1.11-1.45)	<0.001	1.66 (1.45-1.90)	<0.001	1.26 (1.09-1.46)	0.002
In newspapers or magazines	1.92 (1.68-2.19)	<0.001	1.39 (1.19-1.62)	<0.001	1.67 (1.45-1.92)	<0.001	1.37 (1.18-1.59)	<0.001
On television	1.58 (1.40-1.79)	<0.001	1.33 (1.16-1.53)	<0.001	1.47 (1.28-1.68)	<0.001	1.21 (1.04-1.41)	0.014
On the radio	1.45 (1.24-1.69)	<0.001	1.30 (1.11-1.53)	0.001	1.71 (1.34-2.17)	<0.001	1.41 (1.11-1.79)	0.006
On billboards	1.99 (1.72-2.30)	<0.001	1.48 (1.26-1.74)	<0.001	1.51 (1.30-1.75)	<0.001	1.23 (1.05-1.43)	0.010
In cinemas	-	-	-	-	1.30 (1.12-1.52)	<0.001	1.09 (0.92-1.29)	0.311
On the internet	-	-	-	-	2.03 (1.41-2.93)	<0.001	1.60 (1.12-2.29)	0.009
On public transportation vehicles	-	-	-	-	1.63 (1.42-1.86)	<0.001	1.31 (1.14-1.50)	<0.001
On public walls	-	-	-	-	1.49 (1.30-1.72)	<0.001	1.20 (1.04-1.40)	0.016

<sup>a</sup>Adjusted for age, sex, education, employment, SES index, region, urban/rural residence, visited a doctor, home smoking rules, noticed SLT advertisements, and believed SLT causes illness. SES index was derived from principal components analysis and included: electricity, a flushed toilet, fixed telephone, cellphone, television, radio, refrigerator, car, motorcycle, and washing machine; <sup>b</sup>Sample weights, cluster, and stratification factors. SLT – Smokeless tobacco; CI – Confidence interval; OR – Odds ratio; AOR – Adjusted OR; SES – Socioeconomic status

In GATS-2, attempted to quit SLT was associated with noticed warnings on SLT packages (AOR: 1.26; 95% CI: 1.09–1.46), newspapers/magazines (AOR: 1.37; 95% CI: 1.18–1.59), television (AOR: 1.21; 95% CI: 1.04–1.41), radio (AOR: 1.41; 95% CI: 1.11–1.79), billboards (AOR: 1.23; 95% CI: 1.05–1.43), internet (AOR: 1.60; 95% CI: 1.12–2.29), public transportation vehicles (AOR: 1.31; 95% CI: 1.14–1.50), and public walls (AOR: 1.20; 95% CI: 1.04–1.40), after adjusting for age, sex, education, employment, SES index, region, residence, visited a doctor, home smoking rules, noticed SLT advertisements, and believed SLT causes illness. Results in GATS-1 were similar.

## Discussion

In GATS-2, the odds of intention to quit SLT were highest for SLT users who noticed SLT health warnings in newspapers/magazines, cinemas, and public walls, in that order. The odds of attempting to quit SLT were highest for adults who noticed warnings on the internet, radio, and newspapers/magazines. Anti-tobacco messages on SLT packages, television, billboards, public vehicles, and walls were also associated with greater SLT cessation behavior. More SLT users noticed warnings on SLT packages, television, billboards, and newspapers/magazines in GATS-2 than GATS-1, but fewer heard radio warnings.

SLT users who noticed health warning labels (HWLs) on SLT packages were more likely to intend and attempt to quit SLT. At the time of GATS-1, there were mandated pictorial warnings of scorpions and X-rays of lungs that covered 40% of one side of SLT packages.<sup>[17]</sup> These warnings were ineffective at communicating information about the dangers of SLT.<sup>[18–20]</sup> In 2011, those HWLs were replaced with four graphic HWLs that also only covered 40% of one side of packages, which were also ineffective at promoting cessation behavior.<sup>[19]</sup> In 2016, India introduced large graphic HWLs that covered 85% of both sides of SLT packages.<sup>[21]</sup> We found that significantly more SLT users noticed these HWLs on SLT packages in GATS-2 than the HWLs at the time of GATS-1. To the best of our knowledge, our study is the first to use a nationally representative sample of Indian adults to assess the impact of the updated SLT package warnings on SLT cessation behavior. HWLs covering both sides of SLT packages may induce SLT cessation behavior. This is consistent with studies of the impact of HWLs on cigarette packages.<sup>[21,22]</sup> HWLs that elicit fear and include the quitline number may be particularly effective at increasing attempts to quit.<sup>[19,20]</sup>

Over twice as many SLT users noticed SLT health warnings on television in GATS-2 compared to GATS-1, which were associated with attempts to quit using SLT. In addition, adults who noticed SLT warnings in cinemas were more likely to intend to quit. In India, 197 million households own televisions, and from 2016 to 2018, television viewership increased by 12%.<sup>[23]</sup> Although

we are unaware of other studies examining associations between SLT warnings in movies or television and SLT cessation behavior, our results are consistent with previous studies of smoking tobacco, which demonstrated health warnings in television and movies increased attempts to quit smoking.<sup>[14,24]</sup> In 2006, India mandated  $\geq 30$  s anti-tobacco spots, audio disclaimers, and text warnings stating the health consequences of tobacco use be shown at the beginning and middle of all movies and television shows that depict tobacco use.<sup>[2]</sup> We found these warnings may increase SLT cessation behavior.

Approximately half as many SLT users heard SLT health warnings on the radio in GATS-2 as GATS-1, which were associated with greater attempts to quit in GATS-2. From November 2009 to December 2009, India launched a national mass media campaign focusing on the health consequences of SLT, which included over 11,000 radio spot exposures.<sup>[6]</sup> Some studies demonstrate that emotionally evocative radio messages are effective at reducing tobacco use.<sup>[24,25]</sup> Others do not,<sup>[14,26]</sup> citing the lack of visual linkage between the audio messages and health consequences. Over 64% of Indians listen to FM radio every day,<sup>[27]</sup> but less than one-tenth of SLT users heard radio warnings in 2016–2017. Radio advertisements are cheaper than television advertisements and may be one of the most cost-effective methods of motivating tobacco users to quit.<sup>[25]</sup>

Although the odds of attempting to quit using SLT were highest among adults, who noticed SLT health warnings on the internet, only 3% of SLT users noticed internet warnings. In India, 627 million people use the internet, up from 420 million in 2017.<sup>[28]</sup> To the best of our knowledge, no other studies have examined associations between SLT warnings online and SLT cessation behavior, but our results are consistent with a study in Malaysia, which found that internet advertisements were associated with smoking cessation.<sup>[29]</sup> Rapid internet growth highlights the potential of the web as a vehicle of information about the health consequences of SLT use.

The findings that adults who noticed SLT warnings on public transportation vehicles, stations, walls, or billboards were more likely to intend and attempt to quit using SLT is consistent with other studies.<sup>[13,14,24,26]</sup> In India, 22.9 million people ride buses, which comprise approximately 90% of the public transportation system in urban areas.<sup>[30]</sup> Another 8.2 billion passengers use India's rail system annually.<sup>[31]</sup> Anti-tobacco health warnings in public buses, trains, stations, or walls are effective means of relaying SLT health outcomes<sup>[29,32]</sup> and have the potential to reach millions of daily commuters. Billboard warnings must be succinct with large font in strategic locations to be effective.<sup>[33]</sup> Culturally, sensitive and age- and gender-tailored displays are particularly effective for SLT prevention.<sup>[6,18]</sup> Anti-tobacco campaigns employing multiple

forms of media in a complementary manner are particularly effective at inducing tobacco cessation behavior.<sup>[4,6,24]</sup>

Our finding that noticing SLT warnings in newspapers/magazines may increase intention and attempts to quit in both surveys is consistent with smoking tobacco literature.<sup>[24,32]</sup> In India, 39% of people  $\geq 12$  years read newspapers, up 9% from 2014.<sup>[34]</sup> Concomitantly, more people noticed SLT warnings in newspapers/magazines in GATS-2 than GATS-1.

This study has several limitations. First, GATS-2 was a cross-sectional survey, so we were unable to make causal inferences about relationships between SLT warnings and cessation behavior. Second, variables such as duration and intensity of SLT use were not available. Third, this study relied on self-reported information of SLT usage and cessation behavior, so there may have been social desirability bias. Notwithstanding these limitations, this study uses large, nationally representative samples of Indian adults. Both surveys had response rates of  $>90\%$ . GATS is the global standard for monitoring the impact of tobacco control policies and comparing results among other LMICs.

## Conclusions

In a nationally representative sample of Indian SLT users, we found evidence to show SLT warnings in mass media may promote SLT cessation behavior. Mass media health warnings could play an important role in the overall strategy to reduce morbidity and mortality associated with SLT use.

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## Conflicts of interest

There are no conflicts of interest.

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**Supplementary Table 1: Principal components analysis of socioeconomic status variables, India Global Adult Tobacco Survey, 2016-2017 (n=15,235)**

Characteristic	Eigen vector
Electricity	0.29
Flush toilet	0.34
Fixed telephone	0.14
Cellphone	0.26
Television	0.42
Radio	0.13
Refrigerator	0.43
Car	0.27
Motorcycle	0.37
Washing machine	0.36
Eigen value	2.84