Correlates of secondhand smoke exposure among nonsmoking youth (15–24 years) in India: Secondary analysis from Global Adult Tobacco Survey, 2009–10

Mahendra M. Reddy¹, Srikanta Kanungo², Sitanshu Sekhar Kar²

¹Department of Community Medicine, Sri Devaraj Urs Medical College, Kolar, Karnataka, Departments of ²Preventive and Social Medicine, Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry, India

ABSTRACT

Introduction: Nonsmoking youth form a high-risk group and are at increased risk of ill-effects caused due to secondhand smoke (SHS). The objective is to determine the prevalence and correlates of SHS exposure among the nonsmoking youth in India from global adult tobacco survey (GATS), 2009–10. **Methods:** Secondary data analysis of GATS, 2009–10 was done to find the correlates of SHS at three different settings – house, workplace - indoor, and public place. All the sociodemographic variables were tested for association with SHS exposure using multivariate analysis. Prevalence ratio with 95% confidence interval [CI] was used to report the risk. **Results:** The prevalence of SHS was 48.6% (95% CI: 47.7%–49.5%) at house, 25.5% (95% CI: 23.5%–27.6%) at workplace - indoors, and 42.7% (95% CI: 41.7%–43.7%) at public places. SHS exposure among females was found to be higher at house; youth living in rural area were found at increased risk to SHS at both household and public places; and inverse relationship was seen between SHS exposure and education level at both household and workplace - indoors. Overall, the study showed that smokeless tobacco users were at increased risk of SHS exposure at all the three settings. **Conclusion:** Being female, living in rural area, lower education status, lower socioeconomic status, and use of smokeless tobacco were found to be associated with SHS exposure among nonsmoking youth in India.

Keywords: Nonsmoker, secondhand smoke, tobacco, youth

Introduction

Secondhand smoke (SHS) is a mixture of the smoke given off by the burning end of tobacco products (sidestream smoke) and the mainstream smoke exhaled by smokers.[1] Tobacco smoke contains >7000 chemicals, among which 70 are known to cause cancer. There is no risk-free level of SHS exposure; even brief exposure can be harmful to health.[2] In the year 2004, the World Health Organization (WHO) has estimated that about one-third of adults worldwide were exposed to SHS and 1% of all deaths were attributed to the exposure to SHS.[3]

Address for correspondence: Dr. Sitanshu Sekhar Kar, Department of Preventive and Social Medicine, Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry, India.
E-mail: drsitanshukar@gmail.com

To protect the nonsmokers from SHS, India implemented national legislation (Section 4 of the Cigarettes and other Tobacco Product Act, 2003) prohibiting smoking in public places and workplaces in October 2008. The law is not comprehensive as it permits designated smoking areas in large restaurants and hotels and a very minimum penalty for violations.[4,5] The recent WHO on global tobacco epidemic, 2017, reports that only about 60%–70% of public places are still smoke-free in India.[6]

Youth are at more risk of engaging themselves in high-risk behavior which includes "smoking of tobacco" due to various factors such as peer pressure, stress, transitional phase, experimentation, and imitative nature. In fact, nine in ten smokers start smoking before

they attend 18 years of age and 99% of them start before they are 26 years.[7] SHS exposure among nonsmoking youth adds more risk to this already "high-risk group" not only in terms of ill-effects caused by it but also increased risk of starting the use of tobacco. Thus, identifying the correlates of SHS exposure among the nonsmoking youth can help in formulating effective strategies to decrease the ill-effects associated with it.

With this background, this study was planned to determine the prevalence and correlates of SHS exposure at three different settings – house, workplace - indoor, and public places among the nonsmoking youth in India from a nationally representative sample of global adult tobacco survey (GATS), 2009–10.

Methods

For this study, data were analyzed from GATS 2009–10 done in India. GATS 2009–10 survey was done in all 29 states and two Union Territories covering about 99.9% of the total population of India. This household survey was done among people aged 15 years and above. The survey was conducted among 69,296 individuals forming a nationally representative sample. The detailed methodology of this survey has been published elsewhere.[8]

The classification of the study group as "smokers" and "nonsmokers" was done based on the question, *"Do you currently smoke tobacco?"* Those who responded as "not at all" were considered as "nonsmokers"; both "daily" and "less than daily" users were classified under "smokers." The current study analyzed the data among the nonsmokers belonging to the age group of 15–24 years, which represents the youth population [Figure 1]. The sociodemographic characteristics included in the study were age, gender, education status, occupation status, region, and residence (urban/rural). We also used smokeless tobacco and knowledge regarding the harmful effects of SHS (present/absent) as the variables in our study. The knowledge on harmful effects of SHS was considered to be "present" if the response to the question, *"Based on what you know or believe, does breathing other people's smoke cause serious illness in nonsmokers?"* was "Yes."
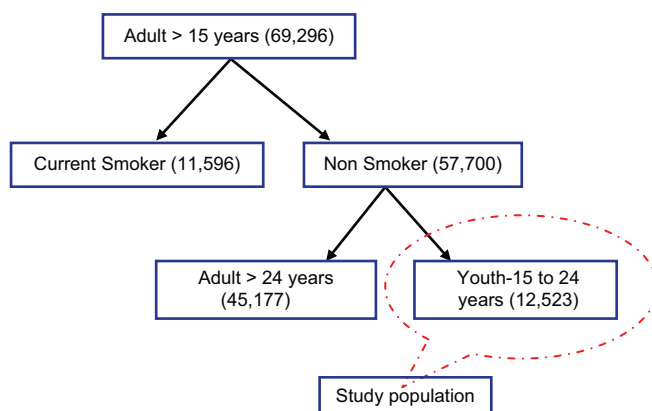

Figure 1: Flow diagram showing the derivation of study participants from global adult tobacco survey India, 2009–10

GATS-India dataset contains information for number of items possessed by a household against a list of items. "Principal component analysis" was done to generate a "wealth index" score for each household on the basis of their possession of assets. First component or principal component explaining maximum variability in the data was considered to assign a score to household. We divided the number of households into five quintiles from poorest (with minimum score) to richest (with highest score). The first two quintiles (with minimum scores) were combined as "poor," and the last two quintiles (with maximum scores) were combined as "rich," and the middle quintile was taken as "middle class."

Exposure to SHS was assessed at three places – house, workplace-indoors, and public places (Government offices/buildings, health-care facilities, restaurants, and public transport). SHS exposure at house was taken to be present if the response to the question, *"How often does anyone smoke inside your home?"* was at least once in the last 1 month. "Workplace - indoors" considered all the individuals who were working "indoors" or "both indoors and outdoors." SHS at workplace-indoors was considered to be present if the response to the question *"During the past 30 days, did anyone smoke in indoor areas where you work?"* was "Yes." SHS at public places was considered to be positive if the person had used any of the public places as listed above in the last 30 days and responded exposed to smoke at any one of these places at least once.

Statistical analysis

Data were analyzed using Stata statistical software version 11 (StataCorp LP, College Station, TX). Age was reported as mean (standard deviation [SD]). All the sociodemographic characteristics and the SHS exposure were reported as proportion (%). Correlates of SHS exposure at different places were independently assessed using bivariate logistic regression. The variables which had $P < 0.1$ were included in the multivariable analysis. (We excluded "knowledge about harmful effects of SHS" in multivariate analysis.) The collinearity between the variables in the model was checked using the variance inflation factor. The association was expressed as prevalence ratio with 95% confidence intervals (CIs). $P < 0.05$ was considered as statistically significant in the multivariable analysis.

Results

Of the total 69,296 individuals surveyed in GATS 2009–10 survey, 13,463 (19.4%) were in the age group of youth (15–24 years). Of them, 940 (7.0%) were currently smoking tobacco and rest 12,523 (93.0%) were nonsmokers and hence were included in the analysis [Figure 1].

Of the 12,523 nonsmoking youth, the mean (SD) age was 19.9 (2.7) years and females constituted 57.4%. Majority of the youth belonged to rural area (60.5%) and about 13% of the nonsmoking youth were smokeless tobacco users.

The prevalence of SHS was 48.6% (95% CI: 47.7%–49.5%) at house, 25.5% (95% CI: 23.5%–27.6%) at workplace - indoors, and 42.7% (95% CI: 41.7%–43.7%) at public places [Table 1].

Multivariable analysis showed that after adjusting for other variables, females were exposed to SHS more at house (adjusted Prevalence Ratio [aPR]: 1.06, 95% CI: 1.02–1.11) and males had SHS exposure more at workplace - indoors (aPR: 1.27, 95% CI: 1.06–1.55) and other public places (aPR: 1.36, 95% CI: 1.28–1.44). Similarly, youth living in rural areas had increased exposure to SHS at house (aPR: 1.17, 95% CI: 1.12–1.22) and public places (aPR: 1.06, 95% CI: 1.01–1.12). However, SHS exposure at workplace - indoors showed no difference among those living in urban or rural area. The study also showed that those living in central and northern parts of India had increased SHS exposure at both house (central: 61.3%, north: 58.1%) and public places (central: 51.9%, north: 43.1%) but lesser at workplace - indoors (central: 22.1%, north: 20.7%) compared to other regions [Tables 2-4].

Table 1: Exposure to secondhand smoke among nonsmoking youth (15-24 years) in India (Global Adult Tobacco Survey 2009-2010)

Place of SHS exposure	Total number of nonsmoking youth, n	Number of nonsmoking youth exposed to SHS, n (%)
House	12,523	6086 (48.6)
Workplace - indoors	1779	454 (25.5)
Public places*	9035	3857 (42.7)

*Government offices/buildings, health-care facilities, restaurants, and public transport. SHS: Secondhand smoke

Table 2: Sociodemographic factors associated with secondhand smoke exposure at house among nonsmoking youth (15-24 years) in India (Global Adult Tobacco Survey 2009-2010), n=12,523

Sociodemographic characteristic	Total, n	SHS present, n (%)	PR (95% CI)	Adjusted PR (95% CI)
Age				
15-19	5575	2778 (49.8)	1.05 (1.01-1.09)	1.02 (0.99-1.07)
20-24	6948	3308 (47.6)	Reference	Reference
Gender				
Male	5330	2484 (46.6)	Reference	Reference
Female	7193	3602 (50.1)	1.08 (1.04-1.12)	1.06 (1.02-1.11)
Residence				
Urban	4946	1966 (39.8)	Reference	Reference
Rural	7577	4120 (54.4)	1.37 (1.31-1.42)	1.17 (1.12-1.22)
Region				
North	2672	1553 (58.1)	2.55 (2.32-2.80)	2.63 (2.40-2.88)
Central	2072	1271 (61.3)	2.69 (2.45-2.95)	2.35 (2.14-2.58)
East	1728	887 (51.3)	2.25 (2.04-2.49)	1.91 (1.73-2.14)
North-East	2764	1416 (51.2)	2.25 (2.04-2.47)	1.95 (1.73-2.10)
West	1573	568 (36.1)	1.58 (1.42-1.77)	1.51 (1.36-1.68)
South	1714	391 (22.8)	Reference	Reference
Education				
No formal education	1264	784 (62.0)	2.06 (1.87-2.27)	1.47 (1.33-1.63)
Primary incomplete	1002	567 (56.6)	1.88 (1.70-2.08)	1.47 (1.33-1.63)
Primary but not secondary	4476	2470 (55.2)	1.83 (1.68-2.00)	1.48 (1.35-1.62)
Secondary and higher secondary	4542	1891 (41.6)	1.38 (1.26-1.52)	1.25 (1.15-1.37)
Graduation and above	1232	371 (30.1)	Reference	Reference
Occupation				
Government/nongovernment employee	1672	751 (44.9)	1.03 (0.97-1.10)	0.98 (0.92-1.04)
Self-employee	1862	1022 (54.9)	1.26 (1.20-1.32)	1.08 (1.02-1.14)
Student	5131	2244 (43.7)	Reference	Reference
Homemaker	3435	1850 (53.9)	1.23 (1.18-1.29)	1.03 (0.98-1.09)
Unemployed	397	199 (50.1)	1.15 (1.03-1.27)	1.01 (0.92-1.12)
Wealth index				
Poor class	5431	3128 (57.6)	1.50 (1.44-1.56)	1.25 (1.19-1.32)
Middle class	2228	1093 (49.1)	1.28 (1.21-1.35)	1.21 (1.14-1.27)
Rich class	4812	1848 (38.4)	Reference	Reference
Smokeless tobacco use				
Yes	1618	1047 (64.7)	1.40 (1.34-1.46)	1.26 (1.21-1.32)
No	10,905	5039 (46.2)	Reference	Reference
Knowledge regarding effects of SHS				
Present	11,036	5340 (48.4)	Reference	-
Absent	1487	746 (50.2)	1.04 (0.98-1.1)	-

SHS: Secondhand smoke; PR: Prevalence ratio; CI: Confidence interval

Table 3: Sociodemographic factors associated with secondhand smoke exposure at workplace - indoors among nonsmoking youth (15-24 years) in India (Global Adult Tobacco Survey 2009-2010), *n*=1779

Sociodemographic characteristic	Total, *n*	SHS present, *n* (%)	PR (95% CI)	Adjusted PR (95% CI)
Age				
15-19	598	168 (24.8)	Reference	-
20-24	1181	306 (25.9)	1.05 (0.88-1.24)	-
Gender				
Male	1226	334 (27.2)	1.26 (1.05-1.51)	1.27 (1.06-1.55)
Female	553	120 (21.7)	Reference	Reference
Residence				
Urban	886	203 (22.9)	Reference	Reference
Rural	893	251 (28.1)	1.23 (1.05-1.44)	1.01 (0.90-1.28)
Region				
North	498	103 (20.7)	Reference	Reference
Central	208	46 (22.1)	1.07 (0.79-1.46)	0.97 (0.71-1.33)
East	151	40 (26.5)	1.28 (0.93-1.76)	1.03 (0.74-1.43)
North-East	314	117 (37.3)	1.80 (1.44-2.25)	1.68 (1.31-2.15)
West	288	69 (24.0)	1.16 (0.89-1.51)	1.05 (0.81-1.38)
South	320	79 (24.7)	1.19 (0.92-1.54)	1.27 (0.98-1.65)
Education				
No formal education	94	39 (41.5)	2.81 (1.96-4.04)	2.43 (1.66-3.58)
Primary incomplete	121	47 (38.9)	2.63 (1.85-3.74)	2.09 (1.45-3.02)
Primary but not secondary	594	178 (30.0)	2.03 (1.51-2.73)	1.76 (1.29-2.40)
Secondary and higher secondary	663	143 (21.6)	1.46 (1.08-1.99)	1.40 (1.03-1.91)
Graduation and above	305	45 (14.8)	Reference	Reference
Occupation				
Government/nongovernment employee	775	182 (23.5)	1.29 (1.01-1.63)	1.16 (0.90-1.48)
Self-employee	498	167 (33.5)	1.84 (1.45-2.33)	1.38 (1.08-1.77)
Student	422	77 (18.3)	Reference	Reference
Homemaker	47	13 (27.6)	1.52 (0.92-2.51)	1.36 (0.81-2.26)
Unemployed	37	15 (25.5)	2.22 (1.43-3.45)	1.84 (1.19-2.85)
Wealth index				
Poor class	613	177 (28.9)	1.27 (1.06-1.52)	0.87 (0.71-1.06)
Middle class	340	89 (26.2)	1.15 (0.93-1.43)	0.89 (0.71-1.11)
Rich class	814	185 (22.7)	Reference	Reference
Smokeless tobacco use				
Yes	279	120 (43.0)	1.93 (1.64-2.28)	1.59 (1.33-1.90)
No	1500	334 (22.3)	Reference	Reference
Knowledge regarding effects of SHS				
Present	1637	411 (25.1)	Reference	-
Absent	142	43 (30.3)	1.21 (0.93-1.57)	-

SHS: Secondhand smoke; PR: Prevalence ratio; CI: Confidence interval

Education level showed significant effect on exposure to SHS at both house and workplace - indoors; as the education status improved, the exposure level reduced significantly (both significant at the level of *P* < 0.001). However, it showed no effect in relation to SHS exposure at public places after adjusting for other variables. Similarly, exposure to SHS at house and workplace - indoor was significantly higher among those who were self-employed compared to that of students (house: aPR: 1.08, 95% CI: 1.02–1.14; workplace - indoor: aPR: 1.38, 95% CI: 1.08–1.77). However, at public places, the exposure level was 12% more among those who were employed at government, self-employed, or students compared to homemakers (*P* < 0.05) [Tabl**es** 2-4].

The exposure to SHS at house was more in the youth belonging to the poor (aPR: 1.25, 95% CI: 1.19–1.32) and middle class

(aPR: 1.21, 95% CI: 1.14–1.27) compared to rich class. There was no association seen between the economic status and SHS exposure at both workplace - indoors and public places. Smokeless tobacco users showed higher exposure to SHS at all three places; house (aPR: 1.26, 95% CI: 1.21–1.32), workplace - indoor (aPR: 1.59, 95% CI: 1.33–1.90), and public places (aPR: 1.09, 95% CI: 1.02–1.17) [Tables 2-4].

Discussion

The current study tried to assess the correlates of SHS among nonsmoking youth in India at three different settings – house, workplace - indoors, and public places. The study showed that SHS was found to be highest at house (49%) followed by public place (43%) and workplace - indoors (25%). Multivariable analysis

Table 4: Sociodemographic factors associated with secondhand smoke exposure at public places among nonsmoking youth (15-24 years) in India (Global Adult Tobacco Survey 2009-2010), *n*=9035

Sociodemographic characteristic	Total, *n*	SHS present, *n* (%)	PR (95% CI)	Adjusted PR (95% CI)
Age				
15-19	4032	1709 (42.4)	Reference	-
20-24	5003	5003 (42.9)	1.01 (0.97-1.06)	-
Gender				
Male	4381	2204 (50.3)	1.42 (1.35-1.49)	1.36 (1.28-1.44)
Female	4654	1653 (35.5)	Reference	Reference
Residence				
Urban	3747	1528 (40.8)	Reference	Reference
Rural	5288	2329 (44.0)	1.08 (1.03-1.13)	1.06 (1.01-1.12)
Region				
North	1997	861 (43.1)	1.25 (1.15-1.37)	1.23 (1.13-1.34)
Central	1272	660 (51.9)	1.51 (1.38-1.65)	1.47 (1.34-1.60)
East	1050	411 (39.1)	1.14 (1.03-1.26)	1.12 (1.01-1.24)
North-East	2025	916 (45.2)	1.31 (1.21-1.43)	1.33 (1.22-1.45)
West	1198	495 (41.3)	1.20 (1.09-1.32)	1.17 (1.07-1.29)
South	1493	514 (34.4)	Reference	Reference
Education				
No formal education	592	249 (42.1)	Reference	-
Primary incomplete	611	262 (42.9)	1.02 (0.89-1.16)	-
Primary but not secondary	3046	1284 (42.2)	1.00 (0.90-1.11)	-
Secondary and higher secondary	3700	1570 (42.4)	1.01 (0.91-1.12)	-
Graduation and above	1081	489 (45.2)	1.08 (0.96-1.21)	-
Occupation				
Government/nongovernment employee	1294	600 (46.4)	1.39 (1.27-1.51	1.12 (1.02-1.23)
Self-employee	1301	627 (48.2)	1.44 (1.33-1.57)	1.12 (1.01-1.23)
Student	4228	1870 (44.2)	1.32 (1.23-1.42)	1.12 (1.03-1.21)
Homemaker	1933	646 (33.4)	Reference	Reference
Unemployed	265	110 (41.5)	1.24 (1.06-1.45)	0.99 (0.84-1.16)
Wealth index				
Poor class	3478	1482 (42.6)	1.00 (0.95-1.06)	-
Middle class	1694	732 (43.2)	1.02 (0.95-1.09)	-
Rich class	3883	1630 (42.5)	Reference	-
Smokeless tobacco use				
Yes	1154	579 (50.2)	1.21 (1.13-1.29)	1.09 (1.02-1.17)
No	7881	3278 (41.6)	Reference	Reference
Knowledge regarding effects of SHS				
Present	8266	3594 (43.3)	Reference	-
Absent	760	263 (34.1)	0.79 (0.71-0.87)	-

SHS: Secondhand smoke; PR: Prevalence ratio; CI: Confidence interval

showed that SHS exposure among females was found to be higher at house compared to increased risk of males at both workplace - indoors and public places. Youth living in rural area were found at increased risk to SHS at both household and public places. Inverse relationship was seen between SHS exposure and education level at both household and workplace - indoors. Overall, the study showed that smokeless tobacco users were at increased risk of SHS exposure at all the three settings.

The Noncommunicable Risk Factor Survey conducted in Myanmar (2009) showed that SHS exposure among nonsmoking population in the age group of 15–24 years at home, indoor workplace, and public places was 61.6%, 59.5%, and 26%, respectively.[9] Our study showed an increased prevalence in the public places and a comparatively less prevalence at home and

workplace - indoors. The difference may be due to the strict enforcement of anti-tobacco laws at public places but less strict enforcement at their workplaces in Myanmar (The Control of Smoking and Consumption of Tobacco Product Law, 2006).[10] The National Health and Nutrition Examination Study conducted in Korea (2005) showed that SHS exposure among nonsmokers in the age group of 19–29 years young adults in house and workplace was 20.3% and 55%, respectively.[11] The difference noted could be attributed to the difference in the methodologies adopted for functional definition to assess SHS at home and work.

This is the first of its kind study which comprehensively assessed the different correlates for SHS exposure among the nonsmoking youth from a nationally representative data. This study showed

that females were at higher risk of SHS exposure at house, similar to the findings from the Korea, Myanmar, Bangladesh, and China. [9,11-13] This increased risk among females could be attributed to the various social and cultural norms that make them vulnerable under the male dominance. To protect these vulnerable women, there is a need for women empowerment to increase the health literacy regarding tobacco and other health effects. This also calls for special policy in control of SHS exposure at home in India. Similarly, males had increased exposure at workplace - indoors and public places due to their outgoing nature and also increase work culture among males compared to females in countries like India.

The current study showed that youth living in the rural areas were at higher risk of SHS exposure at both house and public places. This result was concurrent with the findings from the other studies in South East Asian countries done among adults. [9,11-13] This calls for increased anti-tobacco campaigns in the rural areas and also strict enforcement of existing anti-tobacco laws in the country. Our study also showed that those youth living in central and northern parts of India had increased SHS exposure at both house and public places which shows that there is a need for strict implementation of anti-tobacco laws and also to increase awareness of SHS-related ill-effects among youth in these parts of the country.

As with much other health-related effects, SHS exposure at house and workplace - indoors among youth showed an inverse relationship with the education level. As there was increase in the education level of the youth, the SHS exposure rates came down which was similar to the other studies conducted among adults in other countries. [9,11,12,14] Thus, education of youth forms an important public health intervention in combating the tobacco epidemic.

As shown in other studies done among adults, the current study in youth also showed that low socioeconomic status (wealth index) was associated with an increased risk of SHS exposure at all three settings. [9,11,12,15] Thus, focused interventions are needed to target the poorer sections of the society to improve the awareness, attitude, and practice regarding the tobacco use and its ill-effects.

The study highlights the fact that nonsmoking youth who are using smokeless tobacco were at increased risk of exposure to SHS at all the three settings. The youth who have already started using tobacco in other forms could be at higher chance of starting to smoke if not intervened with an immediate effect. Hence, at the policy level, nonsmoking tobacco users should be targeted as a priority so as to not only reduce the shift from smokeless to smoke form but also to quit tobacco in all forms.

This study has few strengths. This is the first study to attempt to find the correlates of SHS exposure among the nonsmoking youth in India. The study is from a nationally representative sample, thus gives a wider generalizability. The study identified special groups among the youth (females, those living in rural area, and those who are using smokeless form of tobacco) in

whom targeted interventions could be planned in the future to reduce the effects caused by SHS exposure. We have used Poisson regression model with variation correction estimation which gives robust estimate of the magnitude of association. Furthermore, use of prevalence ratio for reporting association will give more precise estimates compared to reporting of odds ratio. [16]

This study has few limitations. As the study was cross sectional, the study limits in temporal association. As the SHS exposure was defined as a proxy measure constructed from self-reported questionnaire, it might not always reflect real exposure to SHS.

The study has few implications. The study calls for focused interventions among the identified high-risk groups among youth in India for reducing the exposure levels to SHS. At the policy level, both population-based policies and clinical encounters can be tried to improve public understanding about the health hazards of SHS exposure and to encourage the public in enacting smoking policies that promote a smoke-free home. Further research to know the SHS-attributable economic costs can be done so as to generate more evidence for the policymakers for further decision-making.

Conclusion

Among the nonsmoking youth in India, about one in two were at risk of exposure to SHS at home and public place and about one in four at indoor workplace. Being female, living in rural area, lower education and socioeconomic status and use of smokeless tobacco were found to be significantly associated with SHS exposure among nonsmoking youth in India.

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Conflicts of interest

There are no conflicts of interest.

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