



Original Research

Tobacco use and exposure to second-hand smoke among high school students in Ernakulum district, Kerala: A cross-sectional study

S. Aswathy^{a,*}, S. Syama^a, S. Georgy^a, M.M. Mathew^a, S. Mohandas^a, V.B. Menon^a, M. Numpelil^b^a Amrita Institute of Medical Sciences, Amrita Vishwa Vidyapeetham, Ponnemara PO, Kochi, 682041, Kerala, India^b National Health Mission, Kochi, Kerala, India

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ABSTRACT

Objectives: Tobacco use and exposure to second-hand smoke (SHS) in the home setting are major health hazards for adolescents. The objectives of this study were to estimate tobacco use and exposure to SHS among high school students in Ernakulam district of Kerala, India, and to investigate associated factors.

Study design: Cross-sectional study.

Methods: A school-based cross-sectional study was carried out in 25 randomly selected high schools from 210 schools in the Ernakulam educational district of Kerala, India. The minimum calculated sample size for ever-use of tobacco and SHS exposure was determined to be 2500, with 95% confidence interval (CI) and 10% relative precision. Data were collected using a semi-structured, pre-tested questionnaire from 2585 high school students. Data analyses were performed using SPSS version 20.

Results: The ever-use of tobacco was reported to be 3.9% (95% CI 3.16 to 4.54) and the mean age of the participants was 13.97 ± 0.77 years. One-fifth of participants had tried a tobacco product before the age of 10 years. SHS exposure at home was reported by one in every 5 respondents (20.3%). Male gender (adjusted odds ratio [aOR] 8.79; 95% CI 3.16, 24.53), presence of a family member who smokes within the home (aOR 4.28; 95% CI 2.58, 7.12), lack of awareness about the harmful effects of SHS exposure (aOR 2.47; 95% CI 1.41, 5.18) and having seen an advertisement or promotion at point of sale (aOR 2.16; 95% CI 1.29, 3.60) were found to be independent predictors for tobacco use.

Participants with respiratory infections were three times more likely to have experienced SHS exposure at home (aOR 2.87; 95% CI 2.21, 3.74), there was an 86% protective effect of SHS exposure for participants with a father in a professional occupation compared with unskilled profession (aOR 0.14; 95% CI 0.02, 0.67; $p < 0.15$) and participants with ever-use of tobacco were two times more likely to have experienced SHS exposure at home (aOR 1.63; 95% CI 3.13, 8.98).

Conclusions: SHS exposure in the home environment continues to be high. Urgent innovative measures are necessary for the implementation of tobacco smoke-free homes and to reduce tobacco use in this vulnerable population. Further studies are necessary to determine ways to reduce smoking within homes and to increase population awareness.

1. Introduction

Tobacco use is a major health hazard and an estimated 43 million children aged 13–15 around the world use tobacco [1]. It has been estimated that globally 82,000–99,000 children and adolescents begin smoking every day [2]. Tobacco kills approximately half of those who use it, totalling more than 8 million deaths each year [2].

The high sensitivity and vulnerability of children and adolescents to nicotine leads to a higher likelihood of addiction in this population group [3]. The acute effects of tobacco among adolescent smokers include an increase in salivary nicotine and increase in heart rate after the use of even a single cigarette. Thus, daily and non-daily smokers absorb physiologically active doses of nicotine, which reinforces future smoking by increasing the likelihood of addiction [4]. Global evidence

* Corresponding author.

E-mail addresses: aswathys@aims.amrita.edu, draswathygopan@gmail.com (S. Aswathy).<https://doi.org/10.1016/j.puhip.2021.100213>

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suggests that the majority of current adult tobacco users initiate tobacco use during adolescence. As per global estimates, nearly 9 out of 10 smokers start before 18 years of age and 98% start smoking by the age of 26 years [3]. About 3 in 4 adolescent smokers become adult smokers [5, 6]. The prevalence of smokeless tobacco (SLT) is higher than that of cigarettes in most of the countries in the South East Asian region [3]. Similar to smoking, SLT use usually begins in youth and continues through adulthood. SLT is also easy to hide from elders who might disapprove. Youth usually start using SLT as a dentifrice (mishri, gul, lal dant manjan, tobacco toothpastes) or gutka and flavoured SLT products as mouth freshener [7].

On average, around 12% of adolescents (16% of boys and 8% of girls) aged 13–15 years globally report using one or more types of tobacco product [1]. India is the second largest consumer of tobacco products, with 28.6% (266.8 million) of adults in India aged ≥ 15 years currently using tobacco in some form [8]. The Global Youth Tobacco Survey (GYTS) in 2009 reported that 14.6% of students currently use any form of tobacco; 4.4% smoke cigarettes and 12.5% use other forms of tobacco [9]. The prevalence of smoking has been found to vary from 6.9% to 22.5% among male school and college students [10]. The lifetime use of tobacco products by adolescents was found to be 6.9% in Kerala [11].

Even a brief exposure to second-hand smoke (SHS) is harmful to health. Chronic exposure to SHS is as harmful as chronic active smoking with a significant dose-response relationship [12,13]. SHS impacts the heart and blood vessels, increasing the risk of myocardial infarction, stroke and emotional changes, such as depression, in non-smokers [14]. SHS exposure among non-smoking adolescents can result in harmful health effects as well as an increased risk of initiating the use of tobacco. There is a large variation in the prevalence of SHS exposure (16.4–85.4%) among adolescents in low- and middle-income countries, with a mean prevalence of 55.9% [15].

According to the Global Adult Tobacco Survey (GATS) 2016, exposure to SHS remains high at 38.7% at home and 25.7% at any of the following seven public places: government building/government office; healthcare facility; private offices/workplaces other than respondent's office; restaurant/public eating places; public transportation; night club/bar; and cinema hall/theatre [8]. This is an increase from results in the GYTS 2009 report that showed one in five students living in homes with smokers and more than one-third being exposed to smoke outside the home [9].

There are several factors that can influence the use of tobacco and exposure to SHS among adolescents, including peer pressure, parental smoking behaviour, stress and conflict [16]. SHS exposure has been found to be associated with SLT use, illiteracy, non-exposure to anti-smoking media messages, absence of knowledge regarding the harmful effects of SHS, younger age group and residence in rural areas [17,18].

Surveillance is a key strategy for control of tobacco use and for protecting people against the harmful effects of tobacco. Such data about the dangers of tobacco use among school students in Kerala are lacking. This study therefore focusses on estimating tobacco use and SHS exposure among high school students, and investigating associated factors.

2. Methods

A school-based cross-sectional study was carried out among the high schools in the Ernakulam district of Kerala state, India. The sampling framework consisted of aided schools (schools supported by the government) and government schools. Private schools were not included in this study as they were deemed to be different on several counts, including socioeconomic status and lifestyle. Considering the primary objective of this study to be the prevalence of tobacco use and exposure to SHS, the sample size was calculated. With a prevalence of tobacco use among adolescents attending school of 14.6% [9] and with 95% confidence interval and a relative precision of 10%, using formula $Z_{\alpha/2}$

pq/d^2 , the minimum sample size was calculated to be 2247. The sample size for SHS exposure was determined with $p = 24\%$ [9] and a precision of 10%, and calculated to be 1266.

A two-stage sampling technique was performed. In the first stage, 25 schools were selected from the 210 schools in the sampling frame by simple random sampling using a computer-generated random number table. From each school, students in the A division of Standard (grades) VIII and IX were selected. Inclusion criteria were considered to be students belonging to the VIII and IX grade. Considering the two-stage sampling for SHS exposure, the sample size was doubled to 2500. Data were obtained from 2585 students, accounting for a 15% increase in the sample size for prevalence of tobacco use and design effect. Individuals who did not receive parental consent were excluded from the study.

Sociodemographic data were collected, including age, gender, father's education and occupation, mother's education and occupation, and religion. In addition, responses to the following questioned were requested: ever-use of tobacco products, age of first use of tobacco product, type of tobacco product used, reason for starting tobacco product, use of tobacco product in last 30 days and frequency of use within last 30 days. Ever-use was defined as use of tobacco anytime during the lifetime and current use has been defined as use of any tobacco product in the previous month.

In terms of exposure to SHS, the variables included exposure at home, any friend smoking in your presence, exposure to tobacco smoke in the past 7 days outside, suffered from respiratory infection in the previous month, anybody in family discussed the harmful effects of smoking with you and awareness that smoke from others smoking is harmful. Regarding health warnings and anti-tobacco messages, questions were posed on whether any health warnings were observed on tobacco products, type of health warning that is most effective, seen or heard any anti-tobacco messages in past 30 days, whether observed any people on TV or movies using tobacco, any advertisements, promotion of tobacco products at point of sale and readiness to use tobacco if offered from a friend.

Data were collected using a pre-tested, semi-structured questionnaire. The school Junior Public Health Nurses (JPHNs) of the district were trained to administer questionnaires and collect data from consenting students and parents of Standard VIII and IX. Students who were absent or sick and unable to answer the questions on the date of data collection were excluded from the study. The response rate was 99%. A convenient day was arranged for data collection after getting consent from the school authorities. After explaining the purpose of the study, assuring confidentiality, the questionnaire in the local language was self-administered in the class, reducing bias in the reporting of sensitive information. The trained JPHNs assisted students if they had any problem understanding the question.

Data were tabulated using MS excel and analysed using SPSS version 20. The primary outcome was ever-use of tobacco and the secondary outcome was exposure to SHS. Quantitative variables are expressed as mean and standard deviation (SD) and qualitative variables were expressed as percentages. The Chi square test was used to find association and a p-value of <0.05 was considered to be statistically significant. Multiple logistic regression was used to identify the independent determinants. There were some missing responses in all the variable categories (it is the right of the individual to answer or not answer a question) and all data were considered for analysis; thus, the number of responses (n) for each response was recorded. Ethical clearance from the institution was obtained before the start of the study. Variables that were significant ($p < 0.05$) in the univariate analysis were included in the multivariable logistic regression model. The model for tobacco usage was developed by adjusting for gender, smoking within homes, awareness that the smoke from other people's smoke is harmful and observed any advertisement or promotion of tobacco product at point of sale. In addition, we modelled SHS exposure that was adjusted for mother's education, father's education and occupation, ever-use of tobacco, current use of tobacco and respiratory infection.

3. Results

The lifetime-use of tobacco among adolescents in high school, and exposure to SHS at home and public places were assessed. Sociodemographic characteristics of the study population were as follows: the mean age of the participants was 13.97 + 0.77 years, one-third (31.5%) of the students were girls and approximately 1.5% of participants' fathers were illiterate (Table 1).

The ever-use of a tobacco product was reported by 98 participants (3.9%) [95% CI 3.16 to 4.54]. Among them, about one-fifth (19.3%) had tried a tobacco product before the age of 10 years. Girls constituted 8.1% of the ever-users. More than half (57.6%) of the tobacco users had used cigarettes, 20.7% used bidi while 4.3% used pan masala. About half reported that they had started to use tobacco products due to peer pressure (45.9%), for pleasure (22.4%) and for imitating role models (20.4%). Only 1.2% reported using tobacco products within last 30 days and among them the majority (82.1%) used tobacco for less than 5 days. A majority used cigarettes (57.6%) and 20.7% used bidi (Table 1).

Exposure to SHS at home was reported by one in five (20.7%) respondents and about the same percentage (17.5%) also had friends smoking in their presence. Despite the ban on public smoking, 62.9% of students reported that they were exposed to SHS in public places, most commonly in bus stops, followed by parks, railway stations etc., in the previous week. In total, 40.5% had experienced a respiratory infection in the previous month (Table 1).

Approximately three-quarters (72.5%) of adolescents reported that the harmful effects of smoking tobacco had been discussed with them by a family member. The vast majority (80.7%) knew that smoke from another person's cigarettes/bidis was harmful to them.

More than half of the participants (59.1%) had observed warnings on tobacco products, resulting in 16.8% reporting that it led them to think about quitting or not starting smoking. Most of the respondents (77.9%) stated that pictorial warnings were the most effective health warning against tobacco. The majority of students (88.6%) had seen anti-tobacco messages on television, radio, internet, billboards, posters etc. Despite the ban on tobacco advertising, promotion and sponsorship, more than one-quarter (26.6%) of participants had seen advertisements or promotions for tobacco products at points of sale in the past 30 days. It was heartening to note that a vast majority of students (92.2%) were emphatic about refusing a tobacco product if offered to them by a friend.

A bivariate analysis was performed for the lifetime use of tobacco and associated factors. Sociodemographic variables such as age and parental education did not have any significant association with tobacco use. Gender was a significant determinant, with tobacco use among boys at 5% compared with 1% among girls ($p < 0.001$). In this study, 5.7% of adolescents practicing Muslim faith were found to have reported ever-use of tobacco, followed by 3.7% among those of Hindu faith and 2.6% among those of Christian faith. This difference was found to be significant. Among participants who were exposed to SHS, 11% reported ever-use of tobacco compared with 2.7% among those who had not experienced SHS. Individuals who thought that the smoke from others was harmful were significantly less likely to have reported tobacco use ($p < 0.025$).

Multiple logistic regression of all the significant variables in bivariate analysis showed an 8.79 (95% CI 3.15, 24.53; $p < 0.001$) times higher likelihood of ever-use of tobacco in males. Those who were exposed to SHS at home were 4.2 (95% CI 2.583, 7.122; $p < 0.001$) times more likely to have ever used tobacco and those who were not aware that smoke from another person's cigarette is harmful were 2.7 (95% CI 1.407, 5.187; $p < 0.003$) times more likely to have ever used tobacco. Participants who had seen advertisements or promotions for tobacco products at point of sale were 2.15 (95% CI 1.29, 3.6; $p < 0.003$) times more likely to have used tobacco during their lifetime (Table 2).

Table 1

Sociodemographic characteristics, patterns of tobacco use, exposure to second-hand smoke (SHS), warnings about the dangers of tobacco among high school students.

Variable	Category	n	%
Sociodemographic characteristics			
Age (in years)	12–13	570	22.3
	14	1408	55.2
	15–16	575	22.5
Gender (n = 2566)	Male	1757	68.5
	Female	809	31.5
Religion (n = 2479)	Hindu	1142	46.1
	Muslim	548	22.1
	Christian	785	31.6
	Other	4	0.2
Father's Education (n = 2446)	Illiterate	40	1.6
	School	1967	80.4
	College	439	17.9
Mother's Education (n = 2471)	Illiterate	31	6.4
	School	1753	65.1
	College	687	28.5
Pattern of Tobacco Use			
Ever-use of tobacco products (n = 2573)	Yes	98	3.8
	No	2475	96.2
Age when first trying tobacco product (n = 98)	<10 years	19	19.3
	≥10 years	79	80.7
Type of tobacco product used ^a (n = 104)	Cigarette	58	57.6
	Bidi	25	20.7
	Khaini,	8	4.3
	Pan masala		
Reason for starting tobacco product ^b (n = 98)	Others	13	17.4
	Due to peer pressure	45	45.9
	For pleasure	22	22.4
	Imitating role models	20	20.4
	To look more cool	11	11.22
	Due to stress	10	10.2
Used tobacco product in last 30 days (n = 2468)	Yes	28	1.1
	No	2440	98.8
Frequency of use within last 30 days (n = 28)	Less than 5days	23	82.1
	6–19 days	4	14.2
	20–30 days	1	3.5
Exposure to SHS			
Smoking inside home (n = 2585)	Yes	395	15.2
	No	1505	58.2
	Don't know	685	26.4
Any friend smoking in your presence (n = 2501)	Yes	440	17.5
	No	2061	82.5
Exposure to tobacco smoke in the past 7 days outside (n = 2585)	Yes	1627	62.9
	No	958	37.1
Suffered from any respiratory infection in the previous month (n = 2343)	Yes	951	40.5
	No	1392	59.5
Anyone in family discussed the harmful effects of smoking with you (n = 2440)	Yes	1730	70.9
	No	710	29.1
Awareness that smoke from other people's cigarette/bidi is harmful (n = 2328)	Definitely not	169	7.2
	Probably not	57	2.4

(continued on next page)

Table 1 (continued)

Variable	Category	n	%
Sociodemographic characteristics			
	Probably yes	242	10.4
	Definitely yes	1860	79.8
Warning about the dangers of tobacco and anti-tobacco messaging			
Whether any health warnings were noticed on tobacco products (n = 1704)	Yes, but didn't think much	724	42.5
	Yes, led to thinking about quitting or not starting smoking	287	16.8
	No	693	40.7
Opinion on which type of health warning is most effective in preventing tobacco use. (n = 2138)	Pictures of people suffering from diseases	1667	77.9
	Warning messages	313	16.1
	Don't know	98	14.6
	Others	60	2.8
Whether saw or heard any anti-tobacco media messages in past 30 days (n = 2427)	Yes	2121	87.3
	No	306	12.7
Whether saw any people using tobacco on TV, movies in past 30 days (n = 2388)	Yes	1996	83.5
	No	240	10.1
	I didn't watch	152	6.3
Whether saw any advertisements, promotions for tobacco products at points of sale in past 30 days (n = 2273)	Yes	590	25.9
	No	1440	63.3
	Did not visit any point of sale	243	10.6
Readiness to use tobacco product if a best friend offered it (n = 2354)	Definitely not	2173	92.3
	Probably not	80	3.3
	Probably yes	70	2.9
	Definitely yes	31	1.3

^a Multiple answers.

Table 2
Independent determinants of tobacco use.

Variable	Adjusted odds ratio	95% CI	p-value
Gender			
Male	8.79	3.16, 24.53	<0.001
Female	1		
Smoking inside the home			
Yes	4.28	2.58, 7.12	<0.001
No	1		
Awareness that smoke from another person's smoke is harmful			
No	2.7	1.41, 5.18	0.003
Yes	1		
Observed any advertisement or promotion of tobacco product at POS in the past 30 days			
Yes	2.16	1.29, 3.60	<0.003
No	1		

CI, confidence interval.

3.1. SHS exposure at home and associated factors

Parental education appears to play a critical role in SHS exposure; in total, 41.7% of children with illiterate mothers were exposed to SHS compared with 20.6% of children with mothers who had a higher level of education (p < 0.012). Similarly, 38.7% of children of illiterate fathers were exposed to SHS compared with 20.7% of children with fathers who had a higher level of education (p < 0.02). Correspondingly, father's occupation was also significantly related to exposure to SHS at home. A decreasing gradient of SHS exposure at home was observed from unskilled to skilled to professional occupations (p < 0.001). More than half (51.2%) of those who had ever used tobacco had SHS at home compared with 19.3% of participants who were not tobacco users (p < 0.001). Similarly, tobacco users in the last 30 days were twice (40.7%) as likely to have SHS exposure at home compared with 20% of those who had not been exposed to SHS at home in the last 30 days (p < 0.014). About one-third (31%) of those who had respiratory infections in the last 30 days had been exposed to SHS at home compared with 13.3% among those who did not have respiratory infections, this association was significant (p < 0.001).

Multiple logistic regression showed that professional occupation of the father had a protective effect of 86% for SHS exposure, which was significant compared with unskilled occupation of the father (adjusted odds ratio [aOR] 0.14; 95% CI 0.02, 0.67; p < 0.15). Participants who reported ever-use of tobacco were 5.3 (95% CI 3.12, 8.98) times more likely to have SHS exposure at home and individuals who had respiratory infections were also 2.8 times (95% CI 2.2, 3.7) more likely to have had SHS exposure at home (Table 3).

4. Discussion

The prevalence of lifetime tobacco use was found to be 3.9% (95% CI 3.16, 4.64) among high school students. Tobacco use appeared to be independently determined by male gender, smoking inside the home, awareness that smoke from another person was harmful and whether advertisement or promotion of tobacco product was observed at point of sale. SHS exposure was less likely if fathers had a professional occupation, but more likely with ever-use of tobacco and also with respiratory infection.

In the South Indian regions, such as Ernakulam, Bangalore, Udupi and Kannur [11,19-21] the prevalence was similar to that obtained in the current study at 6.9%, 2.2%,7.2% and 5.5%, respectively. However, the North Indian states, such as rural West Bengal, Ahmedabad and Delhi [22-24] had a higher prevalence of tobacco use at 14.1%, 10.6%

Table 3
Independent determinants of second-hand smoke (SHS) exposure at home.

Variable	Adjusted odds ratio	95% CI	p-Value
Mothers' education			
Illiterate	1.79	0.45, 7.21	0.41
Literate and above	1		
Fathers' education			
Illiterate	2.58	0.83, 8.1	0.10
Literate and above	1		
Fathers' occupation			
Professional	0.14	0.02, 0.67	0.015
Skilled	0.63	0.31, 1.26	0.19
Unskilled	1		
Ever use of tobacco			
Yes	5.3	3.13, 8.98	<0.001
No	1		
Current use of tobacco			
Yes	1.63	0.56, 4.74	0.36
No	1		
Respiratory infections			
Yes	2.87	2.21, 3.74	<0.001
No	1		

CI, confidence interval.

and 20.9%, respectively. These differences in prevalence may be due to the varying social, economic and political characteristics of the concerned states [11]. For instance, under India's law on Cigarette and Other Tobacco Products (COTPA-Sec6b), the sale of tobacco products is banned around educational establishments. A study in four states of India showed a geographical variation in the implementation of this regulation, with violations ranging from 4% in the state of Karnataka, 80% in Andhra Pradesh, 90% in Orissa to as high as 96% in Uttar Pradesh [25]; thus, indicating a weakening of implementation of the law from south to north.

More than three-quarters of the study participants (78.3%) used smoking forms of tobacco, whereas 4.3% used pan masala and other combinations. The study in Delhi showed that 61.5% of ever-users of tobacco had tried cigarettes or bidi, and the remaining participants reported using SLT [24]. However, in Bangalore [19], all students reported using SLT. In a study of boys from high school and higher secondary schools in Trivandrum, among the higher secondary school tobacco users, 43.2% reported cigarette use and 35.7% pan masala (oral tobacco) use [26].

The mean age of onset of tobacco use was 10.5 ± 3.9 years and about one-fifth reported that they had started to use tobacco products due to peer pressure (45.9%), for pleasure (22.4%), to imitate role models (20.4%) and to look more 'cool' (11.2%). Peer pressure was also a dominant theme underpinning the reason for starting tobacco in other south Indian studies [19,21].

Multiple logistic regression showed that boys were significantly more likely to report ever-use of tobacco. This was found to be similar in the other studies [11,20,24], indicating the persistent social norms against female tobacco use, contributing to lower use among girls. However, in this context, social desirability may also lead to under-reporting. Those who were exposed to SHS were 4.2 times more likely to have ever used tobacco and those who were not aware that smoke from another person's cigarette is harmful were 2.7 times more likely to have ever used tobacco. As the current study is a cross-sectional study, temporality cannot be established and, moreover, SHS exposure among non-smoking adolescents is known to increase the risk of tobacco initiation [15]. Regarding awareness, studies have shown that those who use tobacco have a low awareness of its hazards [22,26] and interventional educational studies are also not able to make as much of an impact on tobacco users as non-users [26]. Participants who had seen advertisements or promotions for tobacco products at point of sale were 2.2 times more likely to have used tobacco during their lifetime. Reports from several urban areas in India corroborate this result and suggest low compliance with restrictions on tobacco advertisements at the point of sale [27,28].

4.1. SHS exposure and associated factors

In the present study, 20.9% and 19.2% of high school students had exposure to SHS inside the home and among their friends, respectively. These results are similar to a study [29] among higher secondary school students in Ernakulam district, where exposure to SHS inside the home and among their friends was 23.2% and 18.8%, respectively, in 2016. Among school children in Mumbai, 16.5% of students were exposed to SHS at home [30] and 39.9% of students were exposed to SHS outside their homes. The study results are also consistent with the overall prevalence of exposure to SHS in low- and middle-income countries being 55.9%, varying from 16.45% in Tajikistan to 85.4% in Indonesia [15]. In Sri Lanka, the prevalence of exposure to SHS during the previous week was 17.6% at home and 25.7% in enclosed public places [31]. However, some countries have reported higher exposures, such as Malaysia [32] and Thailand [33] at 56.4% and 48.6%, respectively, although in the Malaysian study it is not clear whether the results refer to SHS exposure at home or also include other places.

Although parental educational level had an important role to play in exposure to SHS in the bivariate analysis, after regression it was no

longer a significant determinant. However, following logistic regression, father's occupation continued to be an independent determinant, with an 86% protective effect for SHS exposure among the children of professionals. This is probably because unskilled workers are less educated, may not be aware of the risks of SHS exposure and may also spend more time at home due to the uncertainty in their job. A similar study in Ernakulam found that father's lower educational status was an important determinant [29] and in Sri Lanka, mother's unemployment status was a significant determinant of exposure to SHS, which could also be a proxy for lower educational status [31]. The vulnerable population in the lower rungs of socioeconomic status appear to be impacted to a greater extent by SHS exposure. Although COTPA aims to protect non-smokers from tobacco use, it does not apply to homes. In these situations, participatory interventions may work better [18], such as women's movements where not smoking within the home becomes the community norm [34].

Participants who reported ever-use of tobacco were 5.3 times more likely to have SHS exposure at home. This could be a case of reverse causality as this is a cross-sectional study. Studies have shown that children whose parents, relatives or role models smoke are more likely to initiate tobacco use [24]. Similar results were also found among Malaysian adolescents [32], where SHS exposure was significantly higher among respondents who smoked.

Respondents who had respiratory infections were 2.8 times more likely to have had SHS exposure at home. This is logical because SHS exposure elevates the levels of antibodies to allergens delivered by aerosols, thereby enhancing allergic inflammatory responses [35]. Illiteracy and a lower socioeconomic status increased the chances of exposure to SHS at home among the respondents of GATS-II. Respondents who lacked knowledge regarding the harmful effects of smoking were also more likely to be exposed to SHS at home [18].

SHS exposure among high school adolescents continues to be a problem and urgent strategies are necessary to reduce this exposure and to prevent the emergence of tobacco use in this vulnerable population. Consistent, periodic awareness campaigns among all age groups are necessary.

A limitation of the current study is that it relied on self-reporting. Tobacco use has been reported by only 3.9% of the study population and a certain amount of underreporting due to social desirability cannot be ruled out. In addition, the results of this study are not generalisable to private schools. It is also important to note that some respondents did not respond to some variables; however, this did not exceed 20%. Moreover, in the main outcomes of interest, ever-use of tobacco and exposure to SHS, the response rate was 99.5% and 95.5%, respectively. Although, smoking inside the home has been found to be an independent risk factor and vice versa, the type of study design precludes the assessment of temporality. Similarly, respiratory infections are more likely to occur among those with exposure to SHS.

5. Conclusion

To curb SHS exposure within homes, innovative measures are necessary for the implementation of COTPA. This will also help in reducing the prevalence of tobacco use in the future.

Ethical approval

Ethical approval was obtained from the institutional ethical committee.

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Authors' contributions

AS contributed to study conception, data collection, interpreted data and drafted the manuscript. SG and SS contributed to drafting manuscript. MMM analysed the data. SMK drafted and edited the manuscript. VBM participated in data collection and data analysis and interpretation. MN contributed to study conception, data collection and editing. All authors critically revised the manuscript for important intellectual content. The manuscript has been read and approved by all authors.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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