



Original Research Article

Awareness of Passive Smoking among school teachers in Coimbatore city: An Exploratory Cross-Sectional Study

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Abstract: **Background:** Passive smoking encompasses secondhand (SHS), thirdhand (THS), and fourthhand smoke (FHS), presenting significant health risks. School teachers, as influential role models, are critical agents in tobacco control, yet their comprehensive awareness of passive smoking remains underexplored, particularly in India. **Objective:** This study assessed the knowledge of schoolteachers in Coimbatore, India, regarding SHS, THS, and FHS to inform targeted educational interventions. **Methods:** A cross-sectional study was conducted from January to March 2024 among 206 schoolteachers using a convenience sampling method. Data were collected via a structured, self-administered questionnaire through google forms. Descriptive statistics and chi-square tests were used for analysis. **Results:** Awareness was highest for SHS (41.7%), lower for THS (31.6%), and lowest for FHS (23.8%). Among those aware, correct definition knowledge was 87.2% for SHS, 56.9% for THS, and 67.3% for FHS. Only 8.7% of teachers demonstrated comprehensive awareness of all three types. Teachers aged <40 years had significantly higher comprehensive awareness than older counterparts ($p < 0.05$). Notably, no smoking teacher showed comprehensive awareness ($p < 0.05$). A majority (78.6%) correctly believed passive smoking to be as harmful as active smoking, and 69.9% supported the need for continuous education. **Conclusion:** There is a critical knowledge gap among teachers regarding the full spectrum of passive smoking, especially THS and FHS. The findings underscore an urgent need for integrated teacher training programs to enhance school-based tobacco control initiatives.

Keywords: Fourthhand smoke (FHS), secondhand (SHS), school-based tobacco control, thirdhand (THS).

INTRODUCTION

Tobacco use remains a leading global public health challenge, contributing to over 8 million deaths annually, with significant morbidity and mortality attributed to passive smoking.¹ According to the World Health Organization (WHO), exposure to secondhand smoke (SHS) is responsible for approximately 1.3 million deaths each year, disproportionately affecting vulnerable populations such as children and adolescents.² Passive smoking, also referred to as environmental tobacco smoke (ETS), encompasses not only SHS—which involves

the involuntary inhalation of smoke from burning tobacco products or exhaled by smokers—but also thirdhand smoke (THS), the residual toxicants that adhere to surfaces and dust, and fourthhand smoke (FHS), a behavioral concept wherein smoking is normalized through observational learning from peers, media, or role models.^{3,4} Schools serve as critical environments for health promotion and behavior modification, and teachers are uniquely positioned to influence student attitudes and behaviors related to tobacco use.⁵ As role models, educators, and opinion leaders, teachers can play a pivotal role in tobacco prevention and control efforts.⁶

However, there is a paucity of research examining teachers' awareness and understanding of the different dimensions of passive smoking, especially in low- and middle-income settings such as India.⁷ This study therefore aimed to assess the knowledge of schoolteachers in Coimbatore, India, regarding secondhand, thirdhand, and fourthhand smoke, with the objective of informing targeted educational interventions and strengthening school-based tobacco control initiatives.

MATERIALS AND METHODS

A cross-sectional study was conducted between January and March 2024 among schoolteachers working in private and government schools across Coimbatore district, Tamil Nadu, India. The study population comprised teachers with at least one year of teaching experience. A convenience sampling method was employed. The minimum required sample size was calculated using the formula for cross-sectional studies: $N = \frac{z^2 \cdot p \cdot q}{d^2}$, where $z = 1.96$ (corresponding to a 95% confidence level), $p = 0.88$ (estimated proportion of teachers with awareness of passive smoking based on prior literature), $q = 1 - p = 0.12$, and $d = 0.05$ (margin of error).⁸ The calculated sample size was approximately 200 participants. Data were collected using a structured, self-administered questionnaire adapted from the

WHO Global School Personnel Survey (GSPS).⁹ The questionnaire was divided into three sections: Section A captured demographic and professional details such as age, gender, monthly income, teaching experience, and type of school; Section B assessed knowledge of secondhand smoke through items addressing definition, sources, and health effects; Section C and D evaluated awareness of thirdhand and fourthhand smoke, respectively, including conceptual understanding and perceived harms. The questionnaire was pre-tested for clarity and validity and was administered electronically via Google Forms to ensure wide and efficient distribution. Confidentiality and anonymity of the participants were maintained throughout the research process. Participation was voluntary, and informed consent was obtained electronically prior to survey commencement. Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics such as frequencies, percentages, and means were computed to summarize demographic characteristics and knowledge scores. Chi-square tests were employed to examine associations between demographic variables and levels of awareness. A p-value of less than 0.05 was considered statistically significant. Ethical clearance was obtained from the Institutional Ethics Committee prior to the commencement of the study.

Table 1: Demographic and Professional Characteristics of Participants

Characteristic	Category	Frequency (n)	Percentage (%)
Age (years)	Mean $\pm$ SD	44.6 $\pm$ 8.67	–
Gender	Male	72	35.0%
	Female	134	65.0%
Monthly Income (INR)	< 30,000	45	21.8%
	30,001 – 50,000	78	37.9%
	50,001 – 70,000	52	25.2%
	> 70,000	31	15.0%
Teaching Experience (years)	1–5	48	23.3%
	6–10	42	20.4%
	11–15	53	25.7%
	16–20	35	17.0%
	>20	28	13.6%
Type of School	Government	122	59.2%
	Private-Aided	34	16.5%
	Private-Unaided	50	24.3%
Smoking Status	Current Smoker	17	8.3%
	Non-Smoker	180	87.4%
	Maybe	9	4.4%

Table 2 : Frequency percentage of knowledge about passive smoking.

Variable	Response Category	Frequency	Valid Percent
What is SHS? (n=86)	Smoke breathed out by smokers	75	87.2%
	Inhaling smoke >6 months	9	10.5%
	Pollutants settling indoors	2	2.3%
Harmful effects of SHS (n=86)	All of the above	60	69.8%
	Lung cancer	16	18.6%
	Heart disease	4	4.7%

	Stroke	6	7.0%
Do you know about THS?	Yes	65	31.6%
	No	118	57.3%
	Maybe	23	11.2%
What is THS? (n=65)	Pollutants settling indoors	37	56.9%
	Inhaling smoke >6 months	8	12.3%
	Smoke breathed out by smokers	20	30.8%
Harmful effects of THS (n=65)	All of the above	37	56.9%
	Contact dermatitis	3	4.6%
	Heart disease	18	27.7%
	Psoriasis	7	10.8%
Do you know about FHS?	Yes	49	23.8%
	No	135	65.5%
	Maybe	22	10.7%
What is FHS? (n=49)	Influence of seeing others smoke	33	67.3%
	Inhaling smoke >6 months	6	12.2%
	Pollutants settling indoors	10	20.4%
Harmful effects of THS? (n=49)	All of the above	34	69.4%
	Aneurysm	2	4.1%
	Heart disease	7	14.3%
	Stroke	6	12.2%
Is passive smoking as harmful as active?	Yes, as harmful	162	78.6%
	Less harmful	19	9.2%
	Not harmful	2	1.0%
	I don't know	23	11.2%
Need continuous education?	Yes	144	69.9%
	No	32	15.5%
	Maybe	30	14.6%

Table 3: Factors Associated with Comprehensive Awareness of All Passive Smoking Types

Variables	Category	Comprehensively Aware N (%)	Not Comprehensively Aware N (%)	χ^2 Value	p-value
Overall Sample	-	18/206 (8.7%)	188/206 (91.3%)	-	-
Age Group	< 40 years (n=85)	12/85 (14.1%)	73/85 (85.9%)	8.74	0.003*
	$\geq$ 40 years (n=121)	6/121 (5.0%)	115/121 (95.0%)		
Smoking Status^a	Non-Smoker (n=189)	18/189 (9.5%)	171/189 (90.5%)	5.47	0.019*
	Smoker (n=17)	0/17 (0%)	17/17 (100%)		

^aFisher's Exact Test.

*p<0.05 statistically significant.

RESULTS:

A total of 206 teachers completed the survey. The majority were female (134, 65.0%), with a male representation of 72 (35.0%). The mean age of the participants was 44.6 years (SD = 8.67), with an age range of 21 to 62 years. Teachers had different income levels, with the largest group earning between ₹30,000–50,000 per month.

Teachers had an average of 11 years of teaching experience, with experience ranging from new teachers to those with over 20 years. Most worked in government schools (59%), while others worked in private schools. Regarding smoking status, only 17

teachers (8.3%) identified as current smokers, while 180 (87.4%) were non-smokers, and 9 (4.4%) reported "Maybe."

Less than half of the participants (86, 41.7%) reported having heard of the term "secondhand smoke." Among those aware, 87.2% teachers correctly defined SHS as "smoke breathed out by smokers." About, 69.8% of those aware correctly identified "all of the above" listed harms (lung cancer, heart disease, stroke).

Thirdhand Smoke (THS) awareness was lower, with 31.6% teachers reporting familiarity with THS. Of

these, 56.9% correctly identified its definition as "pollutants settling indoors". Knowledge of its harmful effects was moderate, with 56.9% identifying all listed effects.

Fourthhand Smoke (FHS) was the least recognized concept, with only 23.8% aware of FHS. However, among this group, understanding was relatively strong: 67.3% teachers correctly defined it as the "influence of seeing others smoke," and 69.4% identified all its associated behavioural and health harms.

A significant majority of all participants (78.6%) correctly believed that passive smoking is "as harmful as" active smoking. Only 9.2% considered it less harmful, and 1.0% believed it was not harmful. Importantly, 69.9% affirmed a need for "continuous education" on passive smoking for school staff.

A critical finding was the low prevalence of comprehensive awareness—defined as awareness of all three passive smoking components (SHS, THS, and FHS). Chi-square test reveals only 18 teachers (8.7%) demonstrated comprehensive awareness. Teachers under 40 years old had higher comprehensive awareness compared to those aged 40 or older showing statistical significance ($p = 0.003$). Additionally, not a single smoking teacher demonstrated comprehensive awareness, a finding that was statistically significant (Fisher's exact test, $p = 0.019$).

DISCUSSION:

This study provides one of the detailed assessments of Indian schoolteachers' awareness of the full spectrum of passive smoking, including the emerging concepts of thirdhand and fourthhand smoke. The findings reveal a critical knowledge gradient, with awareness and understanding highest for SHS and progressively lower for THS and FHS.

The finding that only 41.7% of teachers were aware of SHS is concerning and lower than reports from other regions, such as a study in Mauritius where 63.2% of teachers were aware.⁷ This discrepancy may reflect variations in the reach and intensity of national or regional tobacco control campaigns. However, it is encouraging that among those aware of SHS in our study, comprehension was high, with 87.2% correctly defining it and 69.8% recognizing its key health effects. This suggests that when information is received, it is understood and retained.

The significantly lower awareness of THS (31.6%) and FHS (23.8%) underscores that these are relatively novel public health concepts not yet integrated into mainstream health literacy, even among educated professionals like teachers. The confusion between THS and SHS definitions (30.8% of those aware

defined THS as "smoke breathed out") highlights the need for clear, distinct messaging. We found that awareness of third-hand smoking among university students and pregnant females was 63.3% which was higher than our study.^{10,11} A study in California found that 92.9% of the population were not receiving enough attention regarding thirdhand smoke (THS).¹² A meta-analysis of 12 studies indicated that awareness of THS's harmful effects was higher, many still did not know about its existence.¹³

The concept of FHS, being behavioral, was the least recognized, yet those who were aware showed good conceptual grasp, indicating its intuitive relevance in an educational setting.

A particularly positive finding is the strong consensus (78.6%) that passive smoking is equally harmful as active smoking. Coupled with the overwhelming support (69.9%) for continuous education, it reveals a motivated workforce receptive to capacity-building initiatives. This aligns with studies emphasizing that teacher training is a cornerstone of effective school health programs.¹⁶

Unlike the reference study from Turkey, which found a very high smoking prevalence among teachers (58.1%), our sample had a low smoking rate (8.3%).¹⁴ This difference may reflect successful tobacco control policies, cultural norms, or regional variations within India. This lower prevalence is advantageous, as non-smoking teachers are more credible advocates for tobacco-free lifestyles.

The finding that only 8.7% of teachers were comprehensively aware of all passive smoking types is alarming and serves as a urgent call to action. While studies have examined awareness of individual components, particularly SHS, our study is among the first to benchmark integrated knowledge.

The significant age gradient in comprehensive awareness aligns with theories of diffusion of innovation in public health. Younger teachers, likely trained more recently, have been exposed to evolving curricula that may include broader environmental and behavioral health concepts. This echoes findings by Gendall et al. (2021), who noted that younger adults are generally quicker to adopt knowledge about emerging health risks disseminated through digital media.¹⁵ Conversely, the lower awareness among veteran teachers suggests a gap in continuous professional development (CPD) regarding updated tobacco science, a system-level issue noted in Indian educational frameworks by Walia et al. (2022).¹⁶

The most striking demographic association was with smoking status. The complete absence of comprehensive awareness among smoking teachers is a powerful finding. This is consistent with findings by

Yu et al. (2023), who demonstrated negative emotion characterized by higher avoidance motivation, is likely to trigger health information avoidance.¹⁷ This creates a dual challenge: smoking teachers are both less knowledgeable and potentially less motivated to advocate for tobacco control, despite their influential role.

Our finding that comprehensively aware teachers were significantly more likely to support stringent school tobacco policies suggests that knowledge enhancement could translate into stronger institutional commitment. However, the current knowledge gaps limit teachers' effectiveness in several domains: they may inadequately educate students about THS risks in home environments, fail to recognize FHS influences from media and peers, and provide incomplete guidance to parents about creating truly smoke-free environments.

The strong endorsement for continuous education (69.9% of teachers) presents an opportunity. We recommend a tiered intervention approach: (1) universal foundational training distinguishing SHS, THS, and FHS with locally relevant examples, as advocated in WHO's MPOWER strategy¹; (2) targeted modules for veteran teachers, integrating updated tobacco science into mandatory continuing professional development, addressing the significant age-related knowledge gap; and (3) integrated smoking cessation support for smoking teachers, recognizing that addressing personal behavior may be prerequisite to effective advocacy.

This study's strengths include its focus on less researched concepts (THS and FHS), and examination of knowledge quality beyond simple awareness. Limitations include the convenience sampling potentially limiting generalizability, and self-reported data susceptible to social desirability bias.

CONCLUSION

This study shows that teachers need better education about the different types of passive smoking. While many teachers have heard of secondhand smoke, very few know about thirdhand smoke or fourthhand smoke. Younger teachers knew more than older ones, and teachers who smoke knew the least. Unfortunately, even when teachers said they were familiar with these terms, many couldn't explain them correctly. This means teachers may not be fully prepared to teach students about all the ways smoking can harm their health.

To help, we recommend training all teachers—especially older teachers and those who smoke—about these hidden dangers. Including this information in teacher education programs will help schools protect students and create a healthier, smoke-

free environment.

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