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Awareness and perception of third hand smoke among medical students in Pakistan

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Abstract:
Background: *Third Hand Smoking (THS) is defined as the persistent residue of smoke that adheres to dust and surfaces in indoor environments and is re-emitted into air, posing a risk to public health. The objective of this study was to determine the baseline level of understanding of medical students regarding third hand smoke and to compare the responses of smokers versus non-smokers.*
Study Design and Methods: *Self-administered questionnaires were administered to undergraduate medical students in Pakistan. In the survey, various questions were asked relating to the students' knowledge and perception of THS and how badly they think THS affects the health of adults and children. The data obtained was analyzed on SPSS v23.*

Results: *Out of 380 participants, 189 (49.7%) were male and 191 (50.3%) were female and their average age was 20.16 ± 1.68 years. 86 (22.6%) were smokers while 294 (77.4%) were not. 103 (27.5%) participants reported someone in their house was a smoker. When asked about their awareness of third hand smoking, 171 (45.7%) answered in agreement while 203 (54.3%) reported they were unaware of what it might be. Responses of smokers versus nonsmokers, regarding awareness of third hand smoking, were compared and non-smokers displayed a greater level of awareness regarding all the questions.*

Conclusion: *There is need to raise awareness and knowledge of THS among people, especially medical students, and more extensive studies need to be carried out to find the full extent of the risks THS poses in humans, so that further efforts can be made to minimize the damage caused by smoking to public health.*

Keywords: *third hand smoking, medicals students, public health, awareness, perception*

Introduction:

Smoking is the act of inhaling and exhaling the fumes of burning plant material. A variety of plant materials are smoked, including marijuana and hashish, but the act is most commonly associated with tobacco as smoked in a cigarette, cigar, or pipe (1). Tobacco contains nicotine, an alkaloid that is addictive and can have both stimulating and tranquilizing psychoactive effects (2). The smoking of tobacco, long practiced by American Indians, was first introduced to Europeans by Christopher Columbus. Smoking soon spread to other areas and today is widely practiced around the world despite being medically, socially, and religiously frowned upon (3).

Tobacco has now been recognized as being highly addictive and one of the world's most-devastating causes of death and disease. The primary cause of the escalation in the number of deaths and incidents of disease from tobacco is the large increase in cigarette smoking during the 20th century (4). Based on this, the number of smoking-related deaths per year was projected to rise rapidly in the 21st century. World Health Organization (WHO) estimated that in the late 1990s, globally there were approximately four million tobacco-caused deaths annually. This estimate increased to approximately five million in 2003 and six million in 2011 and is expected to reach eight million per year by 2030 (5). An estimated 80 percent of those deaths have been projected to occur in developing countries (6). This is attributed to a decline in the use of tobacco in many countries of western Europe and North America and in Australia as opposed to its continued increase in use in countries in Asia, Africa, and South America (7).

Deep inhalation of nicotine-laden smoke results in rapid absorption of nicotine in the lungs—the nicotine diffuses into the bloodstream as rapidly as the inhaled oxygen. From the lungs the nicotine reaches the brain in 7 – 10 seconds. Nerve cells, or neurons, in the brain and peripheral nervous system have receptors on their surfaces to which nicotine binds, causing the neuron to transmit a nerve impulse to various target organs and tissues (8). This process stimulates the release of neurotransmitters, or chemical messengers, which produce the physiological and psychological effects of nicotine. For instance, nicotine stimulates the adrenal glands and prompts the release of epinephrine and norepinephrine, which are responsible for raising heart rate and blood pressure and heightening alertness and concentration. Nicotine also stimulates release of the neurotransmitter dopamine, the neurotransmitter thought to be critical to nicotine's reinforcing and pleasurable mood-altering effects (9).

Third hand smoking is a new concept in environmental and public health fields. It is defined as the persistent residue of smoke that adheres to dust and surfaces in indoor environments and is re-emitted into air, posing a risk to public health (10). Substances found in tobacco smoke alter the DNA structure of human cell and is mutagenic, making it particularly injurious to health (11-14).

Different routes of consumption include inhalation, ingestion and topical application. Third hand smoke consists of the tobacco residue from cigarettes, cigars, and other tobacco products that is left behind after smoking and builds up on surfaces and furnishings. Tobacco smoke is composed of numerous types of gasses and particulate matter, including carcinogens and heavy metals, like arsenic, lead, and cyanide. Sticky, highly toxic particulates, like nicotine, can cling to walls and ceilings. Gases can be absorbed into dust in a room, carpets, draperies, and other fabrics or upholsteries. A 2002 study found that these toxic brews can then re-emit back into the air and recombine to form harmful compounds that remain at high levels long after a person stops smoking.

Materials and Methods:

A cross-sectional observational study was conducted on undergraduate medical students in Rashid Latif Khan University Medical College, Lahore, Pakistan from August to December 2024 using convenience sampling technique.

Sample size was calculated based on the number of medical graduates in a year reported by Nadir F etal 2023 (15). Considering 95% confidence interval %, design effect 1, 50% anticipated frequency and 5% inflation for non-respondent rate, the final calculated sample size was 399.

Convenience sampling

Institutional ethical approval was sought and the guidelines were adhered to (RLKUMC/IRB/0027/24). All undergraduate medical college students enrolled in MBBS program were included and with the exception of who did not consent to participate in the study.

Data Collection: After obtaining consent, students of MBBS were asked to fill out printed out self-administered pre-validated questionnaires inspired from the article “Third-hand smoke perception and awareness among medical students: a survey study” by Aras A and Bayraktar M (16). Names of students were anonymized and serial numbers were assigned to all students to ensure confidentiality.

Data Analysis: Data were analyzed on SPSS v23. All qualitative variables have been reported as frequencies and percentages while quantitative variables, as mean ± standard deviation. Relationship between quantitative variables and outcome was assessed using One-way ANOVA test with post-hoc Tukey test. P-value <0.05 was considered significant throughout the study.

Results:

The questionnaire was administered to a total of 399 medical students from Rashid Latif Khan University Medical College and Rashid Latif Medical College. 380 individuals filled out the form while 19 did not consent to participate in the study.

Out of 380 participants, 189 (49.7%) were male and 191 (50.3%) were female and their average age was 20.16 ± 1.68 years. 86 (22.6%) were smokers while 294 (77.4%) were not. 103 (27.5%) participants reported someone in their house was a smoker.

When asked about their awareness of third hand smoking, 171 (45.7%) answered in agreement while 203 (54.3%) reported they were unaware of what it might be (Table 1).

		Frequency (N=380)	Percentage (%)
Sex	Male	189	49.7
	Female	191	50.3
Age (mean ± sd)	20.16 ± 1.68		
Do you smoke?	Yes	86	22.6
	No	294	77.4
Is there a smoker at home?	Yes	103	27.5
	No	271	72.5
Do you know what third hand smoking is?	Yes	171	45.7
	No	203	54.3

Table 1: Sociodemographic details of study participants

The questionnaire administered to participants had a total of nine questions regarding awareness of third hand smoking. Responses ranged from 1 to 5, 1 being strongly disagree and 5, strongly agree. Means of most scores were reported close to 3, corresponding to not sure; thus, signifying a lack of awareness of most undergraduate medical students regarding third hand smoking. Lowest score and hence highest degree of unawareness was reported for Q8 asking whether or not settled particles of cigarette smoke can enter the body through the skin (2.77 ± 1.41) and the highest score and hence highest level of awareness was recorded for Q1 asking whether breathing air in a room someone has smoked in can harm the health of children (3.73 ± 1.43) (Fig 1).

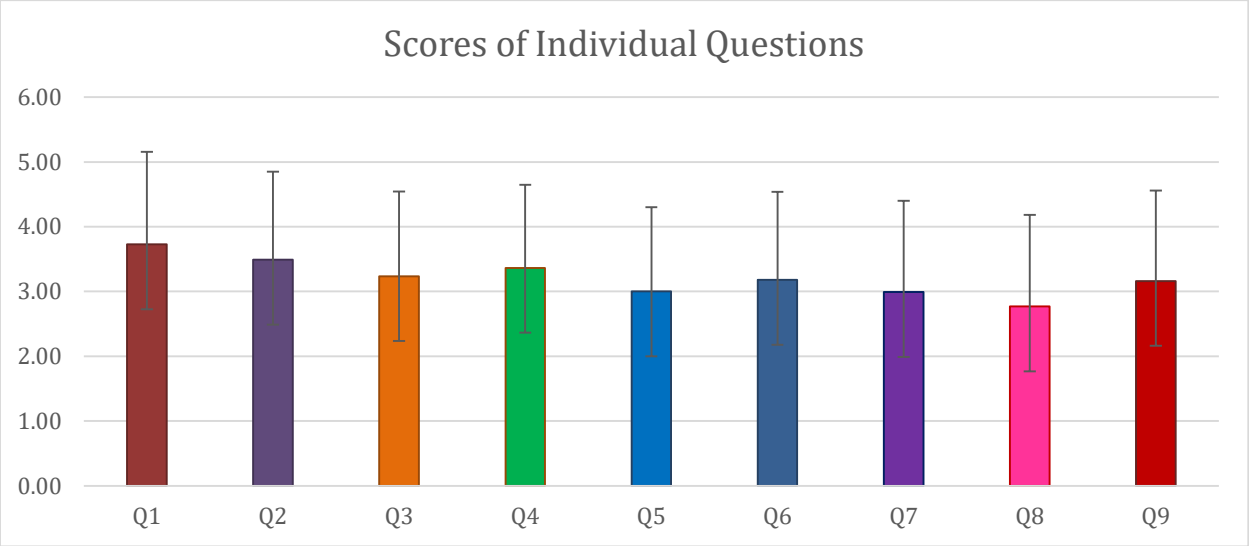

Figure 1: Mean scores of individual questions on the third hand smoking awareness questionnaire
(Scale: 1-strongly disagree, 2-disagree, 3-not sure, 4-agree, 5-strongly agree)

Responses of smokers versus nonsmokers regarding awareness of third hand smoking were compared. Non-smokers displayed a greater level of awareness regarding all the questions as exhibited by a higher score when compared to smokers. The responses significantly differed to questions regarding whether or not breathing in a room someone has smoked in effects the health of children (Smoker: 3.23 ± 1.60, Non-smoker: 3.87 ± 1.35; p=0.001) and of adults (Smoker: 3.14 ± 1.54, Non-smoker: 3.59 ± 1.29; p=0.015); smoke particles having cancerous potential (Smoker: 2.87 ± 1.36, Non-smoker: 3.34 ± 1.28; p=003); ability of smoke particles to remain in the room for days (Smoker: 2.88 ± 1.41, Non-smoker: 3.51 ± 1.21; p<0.001); smoke particles passing on through skin, hair and clothing through touch (Smoker: 2.60 ± 1.44, Non-smoker: 3.11 ± 1.38; p=0.004) and through surfaces (Smoker: 2.42 ± 1.43, Non-smoker: 2.87 ± 1.39; p=0.010); and the inability of aeration of room to eliminate smoke particles in the room (Smoker: 2.82 ± 1.52, Non-smoker: 3.27 ± 1.34; p=0.013) (Table 2).

		Smoker (mean ± sd)		**p-value**
		Yes (N=86)	**No (N=294)**	
Q1	**Breathing air in a room today where people smoked yesterday can harm the health of children**	3.23 ± 1.60	3.87 ± 1.35	***0.001****
Q2	**Breathing air in a room today where people smoked**	3.14 ± 1.54	3.59 ± 1.29	***0.015****

	yesterday can harm the health of adults			
Q3	**Particles in rooms where people smoked yesterday can cause cancer**	2.87 ± 1.36	3.34 ± 1.28	***0.003****
Q4	**Smoke particles can remain in a room for days**	2.88 ± 1.41	3.51 ± 1.21	***<0.001****
Q5	**Smoke particles can remain in a room for weeks**	2.74 ± 1.43	3.08 ± 1.25	*0.055*
Q6	**Smoke particles get absorbed into furniture and walls**	3.03 ± 1.48	3.22 ± 1.32	*0.292*
Q7	**After smoking a cigarette, smoke particles on skin, hair, and clothing can be passed on to others through touch**	2.60 ± 1.44	3.11 ± 1.38	***0.004****
Q8	**After touching surfaces where cigarette smoke has settled, particles can enter the body through the skin**	2.42 ± 1.43	2.87 ± 1.39	***0.010****
Q9	**Opening windows or using air conditioners does not eliminate all smoke particles in a room**	2.82 ± 1.52	3.27 ± 1.34	***0.013****

Table 2: Comparison of responses to individual questions among smokers and non-smokers using independent samples t test

(Scale: 1-strongly disagree, 2-disagree, 3-not sure, 4-agree, 5-strongly agree)

**=significant*

Discussion:

It is estimated that 22.5% of adults worldwide smoke some form of tobacco products, resulting in the deaths of an estimate of 11% males and 6% females yearly (17). Other than the active smokers, the people surrounding them are also vulnerable to the adverse effects of smoking, through second and third-hand smoking. In a study conducted in 2022, it was observed that pollutants from cigarette smoke contaminating the environment are very difficult to clean and it may take many hours for their concentrations to decrease (18). Research also shows that the pollutants adsorbed to different surfaces in the environment are slowly re-emitted into the air overtime (19). Therefore, awareness of the harmful effects of smoking will not only result in a lower prevalence of smoking but also protect the rest of the community from the negative health effects associated with smoking.

This study was adapted from 'Third-hand smoke perception and awareness among medical students: a survey study, Aysun Aras & Mustafa Bayraktar' (16) and aimed to assess the knowledge and awareness of undergraduate medical students in Pakistan about third-hand smoke. It was found that 45.7% of the participants claimed to know what THS is, compared to the 14.5% in the above-mentioned study.

In our study, 22.6% of the participants were active smokers, and when responses of smokers were compared to the non-smokers, the non-smokers showed a higher level of awareness concerning all the questions asked. Studies showed that smokers have a lower level of awareness about the harmful effects of smoking compared to non-smokers (20). This may be due to smokers' cognitive bias, as they might be aware of the risks, but deny or rationalize these risks, due to their beliefs that smoking reduces stress and relieves tension. This dismissal of the risks may also be due to the fact that the negative effects will impact the smokers in the future, while the pleasurable effects they receive are immediate and the consequences yet to come, in the distant future, are relatively easier to overlook (21, 22).

Studies show that socioeconomic status also has an effect on the prevalence of smoking, as poorer people are more likely to be smokers (23). This can be explained by the lack of education and harsher conditions faced by these disadvantaged individuals, due to which they may turn to smoking to mitigate or distract themselves from their conditions (24). Lower levels of education have also directly been related to higher prevalence of smoking (25).

The differences in responses of smokers versus non-smokers were significant regarding the health of children. A meta-analysis of 12 studies concluded that the people's knowledge of harmful effects of THS in children was 82% overall, and 89.8% in health professionals (26). Complete home smoking bans should be implemented, especially in households with children, as infants and children are generally more susceptible to the risks posed by THS than adults, due to their age-specific behaviors, such crawling and putting objects in their mouths (27). It has been shown that home bans are more likely in more educated households and as of 2006, only half of the household in the U.S., with both children and active smokers, had complete home smoking bans (28). Studies also show that legislative public smoking bans significantly increase home smoking restrictions in the general population (29).

The full effects of human exposure to THS have not been studied in depth yet. Study shows that 92.9% college students think that THS is not receiving the attention it requires (30). This highlights that there's need to raise awareness and knowledge of THS among people, especially medical students, and more extensive studies need to be carried out to find the full extent of the risks of THS in humans, so that further efforts can be made to minimize the damage caused by smoking to public health. In addition to this, legislative smoking bans in public places should be imposed. THS-related topics should also be integrated into medical education, so medical students, as future healthcare providers, are better equipped with comprehensive knowledge about the extent of the negative impacts smoking has, so they are able to better counsel and educate their patients.

Conflict of Interest:

The authors declare no conflict of interest.

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