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Pulmonary Medicine

KNOWLEDGE, ATTITUDE, AND PRACTICES REGARDING AIR POLLUTION AMONG MEDICAL STUDENTS IN FARIDABAD

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ABSTRACT **Introduction:** Air Pollution is a significant public health issue, emerging as a foremost environmental threat to health, even surpassing the lack of clean water. Specifically, in Delhi-NCR, frequent episodes of elevated air pollution have been documented. Medical students' knowledge of air pollution is paramount for implementing future interventions directed toward patients. **Aim:** This research aims to find out the knowledge, attitudes, and practices regarding air pollution among medical students at a private university in Faridabad. **Methods:** A cross-sectional study involving 352 medical students was conducted. A questionnaire was administered whose data were analysed using frequencies, summary measures, and non-parametric tests. **Result:** About 51.4% rated the education received at the university on the relationship between health and air quality as poor or not even received. There is a lack of correlation seen between knowledge, attitude and practice. This highlights the necessity of educational initiatives to be complemented by regulatory and cultural interventions.

KEYWORDS : Air Pollution, Knowledge, Attitude and Medical Students

INTRODUCTION

Clean air is regarded as a fundamental principle for maintaining health. However, due to rapid population and industrial growth in major urban centers, air pollution levels have surged. The World Health Organization (WHO) reported that 99% of the global population resides in regions where exposure to air pollution surpasses recommended limits. Furthermore, the WHO warned that by the year 2019, approximately 4.2 million premature deaths worldwide would be attributable to air pollution, with nearly 90% of these deaths occurring in low- and middle-income countries [1,2]. This underscores a disproportionate disease burden due to air pollution in populations facing heightened vulnerability [3].

Air pollution is assessed by measuring the quantity of particles (particulate matter (PM)) and gaseous components in the air. PM is defined as solid and liquid substances in the atmosphere, while gaseous pollutants include carbon monoxide, volatile organic compounds, nitrogen oxides, and ozone [4]. Outdoor air pollution originates from both natural and anthropogenic sources. Natural sources include volcanic eruptions, wildfires, dust storms, and biological emissions from plants and soil. On the other hand, anthropogenic sources are human activities that contribute significantly to outdoor air pollution [5,6]; however, it is also imperative to consider indoor air pollution originating primarily from combustion processes (e.g., cooking and heating) using solid fuels, wood burning, tobacco smoke, building materials, organic solvents in household and personal care products, and other domestic consumer goods [7,8,9].

According to the latest study by the National Institute of Health,1.67 million deaths per year are associated with poor air quality [10,14]. Furthermore, the economic cost of air pollution is estimated to exceed 7 lakh crore annually. The major sources of air pollution in India include industrial waste, biomass combustion for cooking, vehicular emissions, power generation, the construction sector, and episodic events like crop burning. The consequences of air pollution on human health have led to the introduction of strict environmental regulations around the world [11,12].

According to the 2021 World Air Quality Report, India is home to 63 out of the 100 most polluted cities, with New Delhi named the capital with the worst air quality in the world. The poor air quality leads to direct reductions in economic activity because it negatively impacts both cognitive or physical ability of a person [13,15]. There is also evidence that pollution affects productivity in high-skill tasks, such as student performance in standardized high-school examinations. Several steps are being implemented in India to manage and control air pollution, for example, National Clean Air Programme (NCAP)-launched in 2019 was strengthened and has been revised toward an overall ~40% reduction in PM levels by 2026 for NCAP cities. Recently, in December 2025, the Commission for Air Quality Management (CAQM) activated Graded Response Action Plan (GRAP) Stage IV measures when Delhi-NCR regions' AQI crossed 430-440,even before it touched the extreme severe mark, to prevent further deterioration[16,17].

Given the magnitude and consequences of this issue, various interventions have been designed to reduce air pollution and its health effects [18]. In this context, healthcare professionals play a fundamental role. On the one hand, they can advocate for public policies to prevent or mitigate the risks of air pollution to human health. On a clinical level, they can inform and raise awareness among patients about these risks and appropriate strategies for protection [19].

Studies on “knowledge, attitudes, and practices” (KAP) aim to elucidate what is known, believed, and done concerning a particular topic. Data from KAP-type surveys are essential in the planning, implementation, and evaluation of a program or strategy, as well as in identifying knowledge gaps, cultural beliefs, or behavioral patterns that may facilitate or hinder the success of that strategy [20]. Although multiple publications of this nature, conducted with physicians and healthcare professionals, assessing their preparedness, knowledge, perceptions, and practices regarding pollution, climate change in general, and their impacts on health [21], exist globally, there is a notable absence of similar research conducted on medical students in the city of Faridabad, India despite the significance that this issue holds for future physicians in this city. Thus, the present study aimed to describe the knowledge, attitudes, and practices regarding air pollution among medical students in Faridabad.

MATERIAL & METHODS

Study Type

This research employed a descriptive cross-sectional design.

Study Population

The study population comprised 103 medical students enrolled in a private university in Faridabad, India. Participants of both genders, above legal age, and from all academic semesters who willingly agreed to participate were included in the study.

Data Collection Instrument

An initial questionnaire was designed to assess the variables of interest. This questionnaire consisted of 41 questions, which underwent refinement through expert reviews and pilot testing, leading to the development of the final instrument. The final data collection form was divided into four parts: (1) sociodemographic variables and perceptions of air pollution, comprising 9 items; (2) a questionnaire on knowledge about air pollution with 12 items, including questions about air pollution sources, their health effects, and mitigation strategies; (3) a questionnaire on attitudes toward air pollution with 11 items; (4) a questionnaire on practices related to air pollution with 9 items. A Likert scale with four levels, ranging from completely disagree to completely agree, was employed for the knowledge and

attitudes indices. The practices index Likert scale included four response options from never to always. The instrument was designed to present each item individually or as part of an aggregated scale for the knowledge, attitudes, and practices indices.

Data Collection

Data collection employed the distribution of questionnaires (Google Form) to the participants via closed groups, and they were requested to complete it within a specified time frame.

Data Analysis

Descriptive statistics such as percentages will then be calculated to summarise the data. The analysis will provide rich insights into participants' KAP about air pollution.

RESULTS

A total of 103 students were included in the study, with an average age of 20.2 ± 1.8 years. Most (84.5%) were female, and 64.1% were in the second year of MBBS.

52% rated the education received at the university regarding the relationship between health and air quality as either poor or not received. Concerning air quality in the city,
~99% expressed dissatisfaction and 86.4% believed it would not improve in the coming years (Table 1).

Table 1: Description of Demographic and Educational Characteristics of the Study Group.

Variables	Options	n	%
Age Group	17 to 20 years	55	53.4
	21 to 23 years	45	43.7
	Older than 23 years	3	2.9
Gender	Female	87	84.5
	Male	16	15.5
Year of medical education	First year	21	20.4
	Second year	66	64.1
	Third year	9	8.7
	Fourth year	5	4.9
	Intern	2	2
Medical History	Respiratory Other disease	5	4.9
		8	7.8
	None	90	87.4
Doctor's visit last year for respiratory symptoms	Yes	14	13.6
	No	89	86.4
Perception of education received on health and air quality relationship	Not received	30	29.1
	Excellent	6	5.8
	Good	44	42.7
	Poor	23	22.3
Perception of current air quality in the city	Excellent	1	1
	Good	7	6.8
	Regular	8	7.8
	Poor	87	84.5
Are you satisfied with city's air quality	Yes	1	1
	No	102	99
Considers that air quality in the city will improve in the coming years	Yes	14	13.6
	No	89	86.4

Knowledge

95% of medical students believed that exposure to air pollution increases the risk of complications in pregnancy and the fetus, inflammatory skin diseases, neurological diseases, cardiovascular diseases, and respiratory diseases. It is noteworthy that 28.2% did not consider that green house effect is necessary for life (Fig:1). Also more than 22% believed that keeping plants at home does not protect against air pollution.

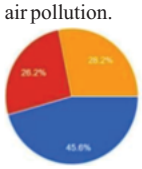


Figure 1 showed that 45.6% believed that green house effect happens naturally and is necessary for life.

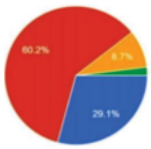


Figure 2 showed that 60.2% agreed that using face mask protects aganist air pollution

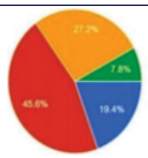


Figure 3 showed that 45.6% agreed that staying hydrated by drinking at least 1.5 L of water per day and eating healthily reduces harmful effects of air pollution

Attitude

96% of the students believed that air pollution is a problem affecting global public health. Similarly, ~99% thought that healthcare personnel should inform their patients about the effects of air pollution.

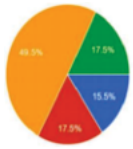
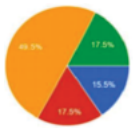


Figure 4 showed that 49.5% did not consider air pollution as a multifactorial problem whereas 33% did consider it as a multifactorial problem so his/her action has no impact.



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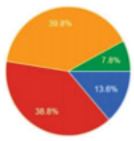

Figure 5 showed that almost half (52.4%) are willing to reduce their daily consumption of dairy products and meat to protect air quality.

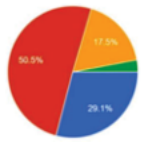

Figure 6 showed that 50.5% agreed to use bicycles for transportation to protect air quality.

Practices

34% did not monitor air pollution indicators in the city.

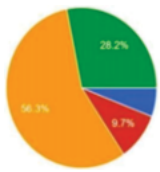

Figure 7 showed that 56.3% have always recommended measures to their family or friends to protect themselves from the effects of air pollution.

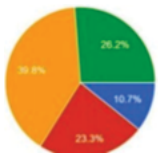

Figure 8 showed that 39.8% always used face mask to protect themselves from air pollution.

DISCUSSION

Our study showed that medical students have a high level of knowledge regarding air pollution. Approximately 97% of medical students recognised the risks associated with exposure to air pollution and its impact on health. This aligns with other studies conducted in different populations, such as Lebanon, China, Ghana, and Ireland [22,23].

The result of our study highlights trends in knowledge regarding the benefits of water hydration and a healthy diet in mitigating the health impacts of environmental pollution. Specifically, 35% of respondents did not see the value of staying hydrated throughout the day and a healthy diet as beneficial. These findings show that there is a crucial need for increased awareness and education about the importance of dietary habits in combating the adverse health effects of environmental pollutants [24].

Many studies consistently showed that adequate water intake plays a vital role in physiological processes essential for overall health, including detoxification, respiratory health, immune function and temperature regulation, all contributing to mitigating the effects of pollution [25]. Therefore, promoting healthy lifestyle practices, including regular water consumption and a balanced diet, is crucial in strategies to mitigate the health impacts of environmental pollution.

The attitude index showed that ~ 97% of medical students in this study recognised that air pollution is a public health problem globally, despite this, one in three students believed that it's a multifactorial

problem and their actions had no impact on air pollution. Therefore, 47.6% are not willing to decrease their regular consumption of dairy products and meat, and 35% are not ready to use alternative modes of transportation. In KAP studies, an increase in knowledge corresponding to no change or even decrease in attitude can be explained by "cognitive dissonance theory", which states that when new knowledge conflicts with existing beliefs, cultural norms and personal habits, it creates psychological discomfort, therefore the person may reject the message or develop a negative attitude towards it.

Various studies conducted with different populations indicate that women tend to exhibit more favourable attitudes toward air pollution [23]. Although in our study the number of males and females is not the same, with female respondents being more, still we can conclude that women had higher scores in attitudes. However, this was not related to practices, similar to what was reported in the study by Al-Khamees, where women scored significantly higher than men in attitudes but were also significantly more likely to engage in polluting practices [26].

A study showed that the question of what shapes pro-environmental behavior is such a complex one that it cannot be visualized through one single framework or diagram Therefore, adopting more sustainable practices could face practical and logistical barriers that need to be fully addressed with basic knowledge. Also, "implementation intention" theory states that general intentions are weak but special plans lead to action, so even if knowledge or intentions are good, there is no change seen in behavior because of lack of concrete planning. Here, comes the role of policy makers who come with strategies that can tackle air pollution efficiently. In India, rules like Air Act 1981, Environment Protection Act 1986, National Clean Air Programme (NCAP), Graded [27,28].

Response Action Plan (GRAP)- for Delhi-NCR have been made by the government but are not well articulated. Therefore, with rising air pollution and its hazardous effects on public health, there is an urgent need for proper implementation of these acts which require active participation of every citizen.

CONCLUSIONS

The results of this study highlighted that medical students answered the majority of questions regarding the sources and effects of air pollution correctly. However, there are gaps between knowledge and practices which underscore the need to strengthen environmental health education through a more comprehensive approach that encompasses normative and cultural actions. Healthcare professionals, if well informed, will incorporate this knowledge into practice and daily patient interactions. Incorporating the principles of "One Health" and environmental health—especially air pollution awareness—into medical education and routine clinical practice is essential for achieving improved patient outcomes and sustainable public health advancement.

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