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Assessment of Air Pollution Knowledge Among Health Care Professionals of Syri Block, Solan, India

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Abstract

Air Pollution knowledge of health care providers determines communication of adverse effects of pollution to the patients. Hence a study was conducted to assess knowledge, attitude and practices of health care providers on air pollution. A pilot cross-sectional study by telephonic survey, with informed consent and voluntary participation was conducted in October 2025 in health block Syri of district Solan, India.16 (36.4%) Doctors and 28 (63.6%) Paramedical staff, mean age 36.18 years, SD 9.8, participated. All perceived that air pollution affects human health and dampness (87.5% Doctors, 85.7% Paramedics)/ Foul smell (56.3% Doctors, 82.1% Paramedics) were also the causes. 81.3% Doctors significantly knew about Air Quality Index compared to 42.9% Paramedics (Chi square- 6.11, df 1, p= 0.01). 93% of respondents believed that patient's indoor hospital stay gets affected by pollution and indoor plants can improve air quality. Only 4 doctors and 1 Paramedic knew about the concept of Air Changes Per Hour ($\chi2 = 4.64$, df = 1, p = 0.03). Only 64% ($\chi2 = 7.39$, df = 1, p = 0.00) Paramedics could name three diseases caused by air pollution. Majority of respondents (61%) knew names of indoor plants. Very less respondents (6%) bothered to check air quality in hospitals. However about 50% did care about dampness and foul smell and kept windows open for ventilation. Significantly low (18% Doctors, 50% Paramedics, $\chi2 = 4.10$, df = 1, p = 0.04) had seen

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information, education and communication (IEC) materials on air quality in hospital. Only 3 Paramedics had undergone training on air quality. The pilot study with low sample size as its limitation was a pioneer attempt in the region and it had inferred that the knowledge on air quality was inadequate among health care providers. There was also lack of attitude and practice of checking air quality. This was probably due to unavailability of IEC material in hospitals and no trainings of health care providers. The Department of Health has been sent recommendations to take up sensitization of health care professionals on various aspects of air quality.

Introduction

Globally the burden of air pollution is heterogenous and its impact being ubiquitous. Growing evidence of the harmful impact of air pollution on human health especially on non- communicable diseases such as ischemic heart disease, stroke, asthma, chronic obstructive pulmonary disease and cancer, eventually led to the adoption of a resolution on air quality and health by World Health Organization (WHO) in 2015.[1] Worldwide, air pollution ranks among the top ten risk factors which attribute to the loss of healthy life years.[2] 65 % of air pollution deaths occur in Asia and a quarter of them are reported from India. In India, the air quality has dropped 13% from the year 2019 to 2023 along with the evidence of increase in the gaseous concentrations of NO_2, SO_2 and HCHO.[3] The household and ambient air pollution in India has been causing many respiratory diseases such as asthma, bronchitis, cancer, acute respiratory infections and exacerbations of preexisting airway disease.[4,5] Prevalence of cough in Primary care in India is about 10% and respiratory diseases surface among the major diseases for which one visits hospitals.[6] In the hospital set ups, a very less evidence exists about the measurement of indoor and ambient air quality. Apart from this lesser evidence reflects the assessment of the knowledge about air pollution among the health care professionals serving in these hospitals. Although the assessments and measurements of air pollution are quiet a regular study aspect among the households or in the industrial set ups.[7-9] Knowledge of Health Care Professionals on air pollution determines what all is communicated to patients.[10] Evidence suggests that the knowledge is bleak on the aspects of air pollution among the health care providers.[11,12] Apart from their knowledge, the attitude and then the right practices for ameliorating air pollution inside the hospital premises is entirely lacking among the health care professionals.[13,14] In the Western Himalayan Region, a little has been known about the existing knowledge on health impacts of air pollution among the health care providers. There is no appropriate regulatory mechanism to check air quality inside the hospital premises. An attempt was made as a pilot study to assess the environmental dynamics of air pollution among the health care providers on a health block of Himachal Pradesh state of this region in India and to pave guidelines in regard to the upliftment of the knowledge base of the health care professionals on various aspects of air quality.

Materials and Methods

Study Design

A pilot cross-sectional study was conducted by telephonic survey.

Study Population

The study was undertaken among the health care providers (Doctors and Paramedical staff-Nurses, Pharmacy Officers, Laboratory Technicians and Community Health Officers) of health block Syri, in northern region of Western Himalayas in the state of Himachal Pradesh, India.

Study Area

The study was undertaken in 3 Primary Health Centres, 2 Civil Hospitals, 1 Community Health Centre and 9 Health Wellness Centres.

Study Period

The study was completed in the months of September and October 2025.

Sampling Technique and Sample Size

Selective purposive sampling was undertaken. Health Block Syri is the smallest of all the blocks of district Solan and for the ease of study this block

was chosen, although this also is a limitation of the study. Voluntary informed consent was secured from 44 participants (16 doctors and 28 paramedical staff members). A pre-tested questionnaire eliciting knowledge, attitude and practice attributes of the respondents from across the various Public Health Institutes (Table 1), was administered to the study participants telephonically by the Principal Investigator.

Table 1: Public Health Institutes of Health Block Syri, District Solan

Sr. No.	Category of Public Health Institutes	Place of the Public Health Institutes
1.	Civil Hospital	1. Chail
2.		Kandaghat
2.	Community Health Centre	1. Syri
3.	Primary Health Centre	1. Chhausha
2.		Kanair
3.		Kurgal
4.	Health Wellness Centre	1. Shardaghat
2.		Basheel
3.		Mamligh
4.		Basha
5.		Kahla
6.		Kyartoo
7.		Paplol
8.		Kashmari
9.		Nagali

Human Subject Protection

Ethical Permission for the study was secured from the institutional review board of the department of Health and Family Welfare, Solan, H.P. The responses were coded and decoded by the principal investigator and were kept under lock and key for maintaining confidentiality.

Statistical Analysis Plan

The data was analyzed by the means of frequencies and proportions. Descriptive analysis was undertaken. Independent Samples t test was employed to analyze the groups of Doctors and Paramedical staff for qualitative variables. Chi-square tests were applied and p value < 0.05 was taken as significant. Analysis was undertaken by using Statistical Package for Social Sciences (SPSS), version 26 software.

Results

Out of a total of 44 participants, 17 (38.6%) were males and 27 (61.4%) were females. Among them 16 (36.4%) Doctors and 28 (63.6%) Paramedical staff with mean age 36.18 years, SD 9.8, participated. An Independent Samples t-test showed significant variation across the age of the respondents; t (42) = - 2.31, p = .001.

Table 2 infers the various characteristics related to the knowledge of air pollution, present among the doctors and the paramedical staff. It was observed that 77.3% (13 Doctors and 21 Paramedical staff) of the study participants could explain the right meaning of air pollution and among them Doctors knew more as compared to the paramedical staff. Although, with respect to the age of all the respondents there was not a significant difference as depicted by Independent Samples t test; t (42) = 1.18, p = 0.49. Only one paramedic among all the respondents perceived the indoor and outdoor air pollution as same entities. 86.4% of all the participants knew that dampness contributes to air pollution, though no difference was observed with respect to the age; t (42) = -1.26, p = 0.86. A majority (72.7%) also inferred that foul smell has a relation and contributes to air pollution although there was no significant

difference across the age of respondents and their knowledge about the relation of foul smell with air pollution: Independent Samples t-test; t (42) = -0.763, p = 3.20.

Table 2: Knowledge about air pollution among health care providers

Air pollution characteristic	Doctors (N=16) n (%)	Paramedical staff (N=28) n (%)	Chi-square	p value
Could define air pollution	13 (81.3)	21 (75%)	0.226	0.63
Indoor and outdoor air pollution are different entities	16 (100)	27(96.4)	0.585	0.44
Affects human health	16 (100)	28 (100)		
Dampness contributes to air pollution	14 (87.5)	24 (85.7)	0.028	0.86
Foul smell leads to air pollution	9 (56.3)	23 (82.1)	3.442	0.06

Table 3: Knowledge about measurement aspects of air quality among the health care providers

Air pollution characteristic	Doctors (N=16) n (%)	Paramedical staff (N=28) n (%)	Chi-square	p value
Understanding of AQI*	13 (81.3)	12 (42.9)	6.117	0.01
AQI is measurable in hospitals	13 (81.3)	13 (46.4)	5.107	0.02
Naming 3 diseases due to poor air quality	16 (100)	18 (64.3)	7.395	0.00
Poor Indoor air quality affects human health	16 (100)	28 (100)	-	-
Poor air quality can reduce the patient indoor stay period	15 (93.8)	26 (92.9)	0.013	0.91
Indoor plants improve air quality	15(93.8	26(92.9)	0.013	0.91
Name of atleast one indoor plant which improves air quality	10 (62.5)	18 (64.3)	0.014	0.09

* Air Quality Index

Table 3 illustrated the various measurement aspects of air quality. It demonstrated that only 56.8% (25) respondents knew the meaning of air quality index (AQI), the knowledge being significantly more among the doctors as compared to the paramedical staff ($p<0.05$). However, with respect to the age of the respondents there was not significant difference in the knowledge about AQI; t (42) = 0.695, p = 0.27.

Statistically significant number of Doctors knew that the AQI can be measured in the hospital premises and they could name at least 3 diseases due to poor air quality ($p<0.05$) as compared to the paramedical staff. All the respondents knew that poor indoor air quality does affect human health and 41 (93,.2%) participants did believe that the poor quality of air determines the period of indoor stay of the patients i.e. the poorer the air quality the more is the indoor stay. They also had the knowledge that indoor plants can improve air quality. However, only 28 (63.6%) study participants could at least name one indoor plant which improves air quality.

Table 4 demonstrated knowledge attributes of sources of air pollution among the health care professionals. Only one paramedical person among all the health care providers could not name the sources of air pollution. However, majority knew at least two sources of air pollution among industrial emissions, forest fire, automobile exhaust, dust and construction work etc. 33 (75%) of the respondents knew that paint on walls, wooden structures etc. can cause air pollution. Statistically significant very low numbers of Doctors and Paramedical staff had ever heard of the concept of air changes per hour ($p<0.05$). Overall, only 5 health care providers

(11.4%) knew about air changes per hour. However, 37 (84.1%) persons were having the knowledge of air purifiers.[23] (52.3) respondents knew that the hydration status of patient does reduce the effect of air pollution on human health although no difference was observed with respect to the age of the respondents; Independent Samples t test; t (42) = -0.605, p = 0.45.

Table 4: Knowledge attributes of sources and effect of air pollution among health care providers

Air pollution characteristic	Doctors (N=16) n (%)	Paramedical staff (N=28) n (%)	Chi-square	p value
Sources of air pollution	16 (100)	27 (96.4)	0.585	0.44
Paint (wall, wood etc) leads to causes air pollution	(87.5) 14	19 (67.9)	2.095	0.14
Heard about air changes per hour	4 (25)	1 (3.6)	4.642	0.03
Heard about air purifiers	15 (93.8)	22 (78.6)	1.753	0.18
Hydration status of patient reduces the effect of air pollution on health	10 (62.5)	13 (46.4)	1.054	0.30

Table 5. Attitude and practice attributes of health care providers on air pollution

Air pollution characteristic	Doctors (N=16) n (%)	Paramedical staff (N=28) n (%)	Chi-square	p value
Ever bothered to check air quality in hospitals	2 (12.5)	1 (3.6)	1.278	0.25
Ever bothered to check dampness in hospitals	9 (56.3)	19 (67.9)	0.593	0.44
Ever bothered to check foul smell in the hospitals	14 (87.5)	25 (89.3)	0.032	0.85
Liking to hear or read about air pollution	14 (87.5)	27 (96.4)	1.278	0.25
Ever saw any IEC on air quality in hospital premises	3 (18.8)	14 (50.0)	4.194	0.04
Attended any training on air quality	0 (0.0)	3 (6.8)	1.840	0.17
Burned aggarbatti or incense sticks	5 (31.3)	7 (25.0)	0.201	0.65
Kept windows open for cross ventilation	15 (93.8)	25 (89.3)	0.246	0.62
Kept indoor plants	10 (62.5)	22 (78.6)	1.326	0.25
Use of air purifier	0 (0.0)	1 (3.6)	0.585	0.44
Ever checked air quality	1 (6.3)	3 (10.7)	0.246	0.62

Table 5 illustrated the attitude and practice attributes of the respondents on air quality management. Only 3 (6.8%) health care professionals did ever bother to check the air quality in the hospital premises. Similarly, only 28 (63.6%) bothered to check about dampness in the hospital premises. However, majority did bother about foul smell in the hospitals. Of all, 39 (88.6%) study participants did check for the source of foul smell in hospital premises. Statistically significant less numbers (17; 38.6%) of health care providers had ever seen any information, education or communication material displayed in the hospital premises.[12] (27.3%) health care providers did burn Aggarbattis or Incense sticks inside the hospital premise. 40 (90.9) respondents practiced the opening of windows for cross ventilation in the hospital premises. Only 1 (2.3%) of all the study participants did use air purifier inside the hospital. A very few health care providers (4;9.1%) did ever check the air quality index inside the hospital premises.

Discussion

The present study has demonstrated that the understanding of air quality in broader sense was present among the majority of the paramedical staff but the knowledge about its measurements aspects was bleak. The health care professionals, moreover did not fully agree that dampness and foul smell could lead to air pollution although the

majority viewed that poor quality of air has adverse effects on human health. They viewed that exposure to the air pollutants makes the immune system weaker and one suffers more with the respiratory illnesses. Similar studies conducted elsewhere have documented the perception of ill effects of air pollutants on human health.[15,16]

Understanding of the AQI and whether it could be measured in the hospital premises, was very poor among both the doctor and paramedical fraternity. A majority of these health care professionals did not know the details of AQI and its parameters. They also were unknown of the methods of checking AQI. A study report has similarly highlighted that the medical fraternity was unaware of the details of the measurement of air quality and its various methods which were being used in practice (CCDC, 2020).[17] Doctors in particular, have elsewhere also been highlighted to have poor knowledge about the measurement parameters of air quality and its utility in the hospital premises.[18] Present study also inferred a very poor knowledge about the names of diseases caused by air pollution among the paramedical staff especially the Community Health Officers. Similarly, Tan *et al*., in their study in 2023 demonstrated the weak knowledge base of community health care professionals and the need for strengthening the same.[10]

The study demonstrated that air quality inside the hospital premises was not a concern for most of the health care providers working there. Knowing the facts that indoor air quality affects the indoor stay of the patients and that there are certain plants available which can improve the air quality indoors, the doctors in majority could not name even one such single plant. Surprisingly in all the institutes covered in the study, there are ample indoor and outdoor plants grown by the authorities themselves but the lack of knowledge among the staff working very much there show a poor concern for air quality. The concept of air changes per hour was not known to majority of the study participants. This has similarly also been reported by Humphreys in a study in 2021.[19]

The present study has also highlighted that majority of the health care providers, though bothered to check dampness and foul smell inside the premises but practically never did take any remedial action to nullify these. With respect to air quality, almost all the doctors and paramedical staff never knew the methods to check air quality of the hospital premises and never also had taken any initiative to start with it. This infers the poor attitude of the health care providers with respect to the air quality measurements. A positive aspect revealed by the study was that majority of the health care providers were in practice of keeping the windows open for cross ventilation purpose and also keeping indoor plants. But on the other hand, despite of having the knowledge of adverse effects of burning of Agarbattis or the Incense sticks, many of them were burning these inside the hospital premises. Henceforth, it can be inferred that appropriate and adequate knowledge about ventilation, aerosols and air pollution amelioration was lacking in health care providers. Stockwell *et al*., in 2019 had demonstrated in their systematic review the importance of the understanding of ventilation aspects inside the hospitals.[20] The hospitals covered under the study lacked appropriate IEC material of air quality. Organization of seminars, workshops, awareness talks etc. in the hospitals was not observed anywhere in the present study. Majority of the study participants had never undertaken any training on air quality. Studies conducted elsewhere have demonstrated the role of improving the knowledge base of the health care providers by providing adequate trainings on air quality management in the hospital premises and the methods to be adopted for improving the air quality.[21-23]

Recommendations

Mandatory comprehensive trainings on Air Quality should be imparted to all health care professionals. Continuing Medical Education among the masses thereafter, on Air Quality should be incorporated in job description of Paramedical staff who also have field visits for community reach. Strict monitoring and evaluation methods need to be incorporated in hospitals to check air quality as it will lead to improvement in the health parameters of the hospital attendees. Appropriate IEC material should be displayed in hospitals and it should be made mandatory.

Conclusion

The study was a pioneer attempt in the region to understand the environmental dynamics of air pollution among the health care providers. The

sample size was small and this was a limitation of the study. However, the study has inferred that the knowledge on various aspects of air pollution in the hospital premises and around is insufficient among the health care providers. The Doctors and the Paramedical staff are unaware of the methods used for measuring air quality. They also do not know about the corrective measures to be taken for poor air quality. Inadequate and inappropriate knowledge among the health care Professionals surely impacts on what all is conveyed to the patients attending the hospitals about good air and its effects on human health.

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The author(s) do not have any conflict of interest.

Data availability Statement
The manuscript incorporates all data sets produced or examined throughout this research study.

Ethics Statement
The ethics permission for the study was secured from the Institutional Review Board of the Department of Health and Family Welfare Syri Solan vide no HFW/SYR/SOL-133 dated 30th October, 2024.

Informed Consent Statement
Informed verbal consent was obtained from all the participants. Voluntary participation of all the study incumbents was ensured.

Permission to Reproduce Material from other Sources
Not Applicable.

Author Contributions
- **Ajay Kumar Singh and Rajeev Kumar Aggarwal:** Study conception and Design
- **Ajay Kumar Singh and Kartik:** Data collection
- **Sumit Chawla and Ajay Kumar Singh:** Data analysis
- **Ajay Kumar Singh and Rajeev Kumar Aggarwal:** Interpretation of results.
- **Ajay Kumar Singh:** Manuscript preparation.

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