

## Knowledge and perceptions about the health effects of environmental hazards among students from Hamdard University, Karachi: A cross sectional study

Maira Jamal<sup>1</sup>, Maida Binte Khalid Quddusi<sup>2</sup>, Syed Muhammad Mubeen<sup>3</sup>, Masood Ali Shaikh<sup>4</sup>

### Abstract

Environmental hazards increase the health morbidity and mortality burden. This study compared the knowledge and perceptions about the health effects of environmental hazards among medical and engineering students of Hamdard University Karachi. A total of 263 (44.1%) engineering students, and 333 (55.9%) medical students participated in the study. Cumulatively, the three most commonly identified environmental hazards included tobacco smoking 561 (94.1%), global climate change 518 (86.9%), and solar ultraviolet radiation 511 (85.7%). The study results suggest the need for better quantifying the magnitude of understanding environmental hazards, and for health education and promotion programmes at the graduate level for medical and engineering students in Karachi.

**Keywords:** Knowledge, hazards, Environment, Students, Global warming.

### Introduction

Human activities directly and adversely affect climate change which result in negative impact on public health increasing disease morbidity and mortality around the world.<sup>1,2</sup> Environmental hazards are a complex phenomenon that entail states and substances, and have been defined as "... a substance, a state or an event which has the potential to threaten the surrounding natural environment / or adversely affect people's health."<sup>3</sup> With relentless economic and population growth, the public health burden owing its genesis to environmental hazards is slated to become more pronounced, as this century progresses.<sup>4</sup>

The role of tobacco use, and exposure to second-hand smoke in respiratory and other diseases is well established.<sup>5,6</sup> Similarly, the connection between solar ultraviolet radiation and skin cancer,<sup>7</sup> outdoor air pollution and mortality,<sup>8</sup> smoking during pregnancy and low birth-

<sup>1,2</sup>Final Year Medical Student, Hamdard College of Medicine and Dentistry, Karachi Pakistan; <sup>3</sup>Department of Community Medicine, Hamdard College of Medicine and Dentistry, Karachi Pakistan; <sup>4</sup>Independent Consultant, Karachi, Pakistan.

**Correspondence:** Maira Jamal. e-mail: maira.jamal47@gmail.com

weight in infants,<sup>9</sup> noise exposure and hearing loss,<sup>10</sup> outdoor air pollution and an increase in cardiovascular hospital admissions,<sup>11</sup> and residential exposure to Radon gas being a risk factor for lung cancer is well established.<sup>12</sup> While there is some empirical evidence between exposure to Low Frequency and Electric and Magnetic Fields (ELF-EMF) and brain cancer risk,<sup>13</sup> recent studies have refuted the evidence between living near mobile phone base stations and increased risk of childhood leukaemia.<sup>14</sup>

A recent study conducted in Karachi, reported the medical students' perceptions regarding environmental wellness dimensions.<sup>15</sup> In this study, the participants were asked about conserving energy, interest in learning about environmental problems, proper disposal of garbage, one's responsibility to preserve environment, living in harmony with nature, and preference of greenery in one's house. Comparisons between male and female medical students were made and females were found to be more environmentally conscious. Another recent study from Sakarya, Turkey, that involved parents of school-going children, reported the knowledge and perceptions about health effects of various environmental hazards. The study reported highest proportion of awareness about smoking being a health risk.<sup>16</sup>

As economic and population growth is increasing in Pakistan, this public health burden will become more distinct in the country. The objective of our study was to study and compare the knowledge and perceptions about the health effects of environmental hazards among the medical and engineering students of Hamdard University.

### Methods and Results

A cross-sectional survey was conducted between February and April 2017 in the Medical and Engineering faculties of Hamdard University based in Karachi. A pretested, self-administered questionnaire with close-ended questions, adapted from a previously reported study in Sakarya, Turkey,<sup>16</sup> was used to determine the knowledge and perceptions about environmental hazards. Two trained medical students approached the medical and engineering graduate students on the university campus. After explaining the study objectives, assuring confidentiality,

and obtaining verbal informed consent, the questionnaires were distributed, and collected on completion, on the spot, after 10 to 15 minutes. For comparing two independent sample proportions, with 95% confidence level, 80% power, and assuming proportions in medical and engineering students to be 65% and 50%, respectively, a sample size of 167 students in each group was calculated using an online sample size calculator.<sup>17</sup> However, students were selected based on convenience and availability on the days the survey was being conducted. The proportion assumptions in the two groups of students were based on an unpublished small pilot study.

The questionnaire comprised eleven questions on knowledge about various environmental hazards, ways to reduce/limit one's exposure to some of these hazards, and opinions about the role of human activities in causing global climate change. For all questions, three answer options were available i.e. Yes', 'No', and 'Don't know'. Those respondents whose answer was 'Yes' were further given three options to state their level of confidence in their affirmative answer, ranging from 'Extreme', 'Moderate', to 'Mild'.

Data was analysed using the Open Source statistical analysis programme R version 3.4.1, by applying Pearson Chi-Square test to assess

the independent relationships between categorical variables of environmental hazards and students' enrolment status i.e. medical and engineering. For all questions, negative and 'Don't know' answers were combined together and compared against the affirmative

**Table-1:** Engineering and medical students' knowledge and opinions about environmental risk factors and hazards.

Risk	Engineering n = 263 n (%)	Medical n = 333 n (%)	p-value
Is tobacco smoking a risk factor for respiratory disease?			0.003*
Don't Know	8 (3.0)	3 (0.9)	
No	16 (6.1)	8 (2.4)	
Yes	239 (90.9)	322 (96.7)	
Is solar ultraviolet radiation a possible risk factor for skin cancer?			<0.0005*
Don't Know	35 (13.3)	11 (3.3)	
No	25 (9.5)	14 (4.2)	
Yes	203 (77.2)	308 (92.5)	
Is there any role of human actions at the global climate change?			<0.0005*
Don't Know	24 (9.1)	18 (5.4)	
No	26 (9.9)	10 (3.0)	
Yes	213 (81.0)	305 (91.6)	
Is outdoor air pollution associated with an increase in daily mortality for chronic respiratory diseases?			<0.0005*
Don't Know	57 (21.7)	24 (7.2)	
No	17 (6.5)	19 (5.7)	
Yes	189 (71.9)	290 (87.1)	
Is there any relation between tobacco smoking during pregnancy and low birth-weight?			<0.0005*
Don't Know	86 (32.7)	40 (12.0)	
No	28 (10.6)	13 (3.9)	
Yes	149 (56.7)	280 (84.1)	
Is continued noise exposure a possible cause of irreversible hearing loss?			<0.0005*
Don't Know	103 (39.2)	69 (20.7)	
No	21 (8.0)	13 (3.9)	
Yes	139 (52.9)	251 (75.4)	
Is outdoor air pollution associated with an increase of cardiovascular hospital admissions?			0.001*
Don't Know	81 (30.8)	53 (15.9)	
No	42 (16.0)	57 (17.1)	
Yes	140 (53.2)	223 (67.0)	
Is exposure to ELF-EMF@ increase the risk of brain cancer?			0.009*
Don't Know	95 (36.1)	106 (31.8)	
No	35 (13.3)	23 (6.9)	
Yes	133 (50.6)	204 (61.3)	
Is living near mobile phones base station increase the risk of childhood leukaemia?			0.036**
Don't Know	76 (28.9)	94 (28.2)	
No	15 (5.7)	35 (10.5)	
Yes	172 (65.4)	204 (61.3)	
Ways to reduce residential radon gas is a regular ventilation?			0.029*
Don't Know	126 (47.9)	131 (39.3)	
No	24 (9.1)	29 (8.7)	
Yes	113 (43.0)	173 (52.0)	
Is residential exposure to radon gas a risk factor for lung cancer?			0.101
Don't Know	80 (30.4)	89 (26.7)	
No	19 (7.2)	15 (4.5)	
Yes	164 (62.4)	229 (68.8)	

@ Extremely Low Frequency Electric and Magnetic Fields; \* Statistically significant association using Person Chi-Square test (negative and 'Don't know' answers summed and compared with affirmative answers); \*\* Statistically significant association using Person Chi-Square test (positive and 'Don't know' answers summed and compared with negative answers).

answers, with the exception of question regarding living near mobile base station increasing the risk of childhood leukaemia; for this question affirmative and 'Don't know' answers were summed and compared with negative (correct) answer.

While Cochran-Armitage test for trend (Chi square trend)

**Table-2:** Engineering and medical students' level of confidence in their affirmative answers to knowledge and opinion questions about environmental risk factors.

Risk	Engineering n (%)	Medical n (%)	p-value
Is tobacco smoking a risk factor for respiratory disease?			0.062
Extreme threat	140 (58.6)	206 (64.0)	
Moderate threat	36 (15.1)	56 (17.4)	
Mild threat	63 (26.4)	60 (18.6)	
Is solar ultraviolet radiation a possible risk factor for skin cancer?			0.697
Extreme threat	73 (36.0)	106 (34.4)	
Moderate threat	50 (24.6)	76 (24.7)	
Mild threat	80 (39.4)	126 (40.9)	
Is there any role of human actions at the global climate change?			0.002*
Extreme threat	72 (33.8)	140 (45.9)	
Moderate threat	53 (24.9)	75 (24.6)	
Mild threat	88 (41.3)	90 (29.5)	
Is outdoor air pollution associated with an increase in daily mortality for chronic respiratory diseases?			0.441
Extreme threat	46 (24.3)	86 (29.7)	
Moderate threat	63 (33.3)	83 (28.6)	
Mild threat	80 (42.3)	121 (41.7)	
Is there any relation between tobacco smoking during pregnancy and low birth-weight?			0.024*
Extreme threat	50 (33.6)	115 (41.1)	
Moderate threat	31 (20.8)	72 (25.7)	
Mild threat	68 (45.6)	93 (33.2)	
Is continued noise exposure a possible cause of irreversible hearing loss?			0.005*
Extreme threat	27 (19.4)	83 (33.1)	
Moderate threat	45 (32.4)	73 (29.1)	
Mild threat	67 (48.2)	95 (37.8)	
Is outdoor air pollution associated with an increase of cardiovascular hospital admissions?			0.222
Extreme threat	32 (22.9)	65 (29.1)	
Moderate threat	40 (28.6)	60 (26.9)	
Mild threat	68 (48.6)	98 (43.9)	
Is exposure to ELF-EMF@ increase the risk of brain cancer?			0.458
Extreme threat	34 (25.6)	49 (24.0)	
Moderate threat	42 (31.6)	57 (27.9)	
Mild threat	57 (42.9)	98 (48.0)	
Is living near mobile phones base station increase the risk of childhood leukaemia?			0.486
Extreme threat	44 (25.6)	59 (28.9)	
Moderate threat	51 (29.7)	59 (28.9)	
Mild threat	77 (44.8)	86 (42.2)	
Ways to reduce residential radon gas is a regular ventilation?			0.059
Extreme threat	19 (16.8)	49 (28.3)	
Moderate threat	38 (33.6)	50 (28.9)	
Mild threat	56 (49.6)	74 (42.8)	
Is residential exposure to radon gas a risk factor for lung cancer?			0.005*
Extreme threat	28 (17.1)	71 (31.0)	
Moderate threat	53 (32.3)	63 (27.5)	
Mild threat	83 (50.6)	95 (41.5)	

@ Extremely Low Frequency Electric and Magnetic Fields; \* Statistically significant association.

test was used to determine if there was a linear trend in the proportions of degree of confidence in the affirmative answers to environmental hazards and enrolment status. Statistical significance was defined by two-sided  $p < 0.05$ .

Cumulatively, 625 questionnaires were distributed among the engineering and medical students, out of which 596 filled questionnaires were returned i.e. a response rate of 95.4%. Overall, 200 (33.6%) women and 396 (66.4%) men participated in the study, out of which 263 (44.1%) were engineering students, and 333 (55.9%) were medical students.

Table 1 shows the engineering and medical students' knowledge and opinions about environmental risk factors, including their statistical significance. With the exception of the question regarding living near mobile phones base station increasing the risk of childhood leukaemia, medical students answered all questions affirmatively in higher proportions, compared to engineering students. Differences between the two student groups were statistically significant for all the questions asked, save residential exposure to radon gas being a risk factor for lung cancer.

The three most commonly identified environmental risk factors or opinions about mitigating the risk of environmental hazards reported by engineering students were role of tobacco smoking for respiratory disease 239 (90.9%); role of human

actions in the global climate change 213 (81.0%); and solar ultraviolet radiation being a risk factor for skin cancer 203 (77.2%). While three most commonly identified environmental risk factors or opinions about mitigating the risk of environmental hazards reported by medical students were role of tobacco smoking in respiratory disease 322 (96.7%); solar ultraviolet radiation being a risk factor for skin cancer 308 (92.5%); and role of human actions in global climate change 305 (91.6%). The differences between engineering and medical students were statistically significant at the  $<0.001$  on all these indices. The three least correctly identified environmental risk factors or opinions about mitigating the risk of environmental hazards by engineering students were: continued exposure to noise as a possible cause of irreversible hearing loss 139 (52.9%), exposure to ELF-EMF leading to increased risk of brain cancer 133 (50.6%), and ways to reduce residential radon gas by ventilation 113 (43.0%). While, according to medical students these were: exposure to ELF-EMF leading to increased risk of brain cancer 204 (61.3%), living near mobile phones base stations increasing the risk of childhood leukaemia 204 (61.3%), and ways to reduce residential radon gas by ventilation 173 (52.0%). The differences between engineering and medical students were statistically significant at the  $<0.05$  on all these indices.

Table 2 shows the engineering and medical students' level of confidence in their affirmative answers to questions about environmental risk factors. Statistically significant association for linear trend, in level of confidence in one's affirmative answers to questions on environmental risk factors or opinions about mitigating the risk of environmental hazards, by the two groups of students, were found for the role of human actions in global climate change, relation between tobacco smoking during pregnancy and low birth-weight, and residential exposure to radon gas being a risk factor for lung cancer.

## Discussion

This is the first study of its kind in Pakistan, quantifying and comparing the knowledge and perceptions, of medical and engineering graduate students about the health effects of environmental hazards. Global warming and air pollution are the most glaring examples of climate change negatively affecting human health. The case study participants, comprising more educated strata of society than the general population of Karachi and the country, serve as a barometer of how educated masses understand risks emanating from environmental hazards and humanity's role in bringing about these cataclysmic changes. Like the Turkish study,<sup>16</sup> from which we adopted our study's questionnaire, tobacco smoking was most

strongly considered as a risk factor for respiratory disease. Since engineering graduate students were also part of the study, any medical jargon was not included in the questionnaire for easier comprehension of the questions. The role of human beings in causing global climate change was the second most affirmatively answered question. Although both groups of graduate students overwhelmingly replied affirmatively to these two questions, nonetheless the statistical significance of the difference between them was noteworthy. Our results rhyme with the Turkish study based on 362 parents of primary school students, who reported tobacco smoking as a risk factor for respiratory disease (affirmative replies 357, i.e. 98.6%), solar ultraviolet radiation as a possible risk factor for skin cancer (affirmative replies 342, i.e. 94.5%), and role of human actions in global climate change (affirmative replies 341, i.e. 94.2%) as the three leading environmental risk factors and their health effects.<sup>15</sup> As in our study, cumulatively the three most commonly identified environmental risk factors and their health effects were role of tobacco smoking in respiratory disease (total affirmative replies 561, i.e. 94.1%), role of human actions in global climate change (total affirmative replies 518, i.e. 86.9%), and solar ultraviolet radiation being a risk factor for skin cancer (affirmative replies 511, i.e. 85.7%).

Medical students answered 10 questions in the affirmative in higher proportions, as compared to engineering students. The only question that was answered in higher proportion by engineering students was about living near mobile phones base station increasing the risk of childhood leukaemia; as evidence of this risk does not exist.<sup>13</sup> However, this difference between two student groups was not statistically significant. For all questions, we combined the negative and 'Don't know' answers for statistical analysis, as these answers collectively reflect incorrect knowledge or ignorance about the inquired issue. With the exception of the question regarding living near mobile phones base station increasing the risk of childhood leukaemia, we combined the affirmative answers with 'Don't know' answers for statistical analysis using Pearson Chi-Square test.

Regular ventilation for reducing the residential Radon gas exposure was the most incorrectly answered question. However, the difference between the two student groups was statistically significant, while the difference between two student groups regarding residential exposure to Radon gas being a risk factor for lung cancer was not statistically significant.

Since this study was conducted only among the engineering and medical students of Hamdard University, the results are not generalisable to students of other

universities in Karachi. Nonetheless, our results suggest the need for better quantifying the magnitude of understanding environmental risk factors, and for health education and promotion programme at the level of graduate studies for medical and engineering students in Karachi.

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**Conflict of Interest:** None.

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