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Climate Change Awareness and Perceived Health Impacts: A Cross-Sectional Study among Nursing Students in Sindh, Pakistan

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ABSTRACT

Background: Climate change poses significant threats to global health, particularly in low- and middle-income countries. Nurses, as frontline healthcare providers, must be equipped with climate-health literacy to address climate-sensitive conditions. This study assessed the awareness and perceived health impacts of climate change among nursing students in Sindh, Pakistan. **Methods:** A cross-sectional survey was conducted over three months (from March – May of 2025) among 292 second-year Bachelor of Science in Nursing students from public and private colleges in Sindh. Participants were selected using cluster sampling. Data were collected through a validated self-administered questionnaire and analyzed using SPSS v27. Descriptive statistics summarized awareness levels, and chi-square tests examined associations between demographic variables and climate change awareness. **Results:** Most participants (91.4%) were familiar with the term "climate change" and 87.3% acknowledged its health impacts. Key causes identified included deforestation (66.4%) and air pollution (10.6%), while fewer recognized industrial emissions (1.7%). Respiratory diseases (82.5%), infectious diseases (80.8%), and malnutrition (68.2%) were commonly perceived health outcomes. Gender and age showed significant associations with awareness indicators ($p<0.05$). However, only 43.5% of students reported personal action against climate change, and 66.1% were unaware of governmental climate policies. **Conclusion:** Although nursing students demonstrated high general awareness of climate change, gaps in understanding specific causes, health impacts, and policies were evident. Integrating climate-health education into nursing curricula is critical for developing a climate-resilient healthcare workforce.

INTRODUCTION

Climate change is increasingly recognized as one of the greatest global health challenges of the 21st century, with profound implications for ecosystems, economies, and human well-being. It refers to long-term alterations in temperature, precipitation, and atmospheric conditions, primarily driven by anthropogenic activities such as industrialization, deforestation, and excessive fossil fuel consumption[1]. These activities have accelerated the accumulation of greenhouse gases, resulting in rising global temperatures and altered weather patterns that pose direct and indirect threats to health[2].

The health consequences of climate change are wide-ranging and include heat-related illnesses, respiratory and cardiovascular diseases from air pollution, malnutrition from food insecurity, and the increased spread of vector-borne and waterborne diseases[3,4]. Low- and middle-income countries (LMICs) are particularly vulnerable due to limited infrastructure, insufficient health system preparedness, and restricted adaptive capacity[5]. Pakistan, ranked among the top 10 countries most affected by climate change, has experienced intensified environmental disruptions, including record-breaking heat waves, floods, and smog[1]. Cities such as Jacobabad and Sukkur have recorded temperatures exceeding 50°C, while major urban centers continue to experience prolonged smog seasons and declining air quality[6]. These changes exacerbate existing health inequities and challenge the capacity of healthcare systems to respond effectively[7].

Nurses, as frontline healthcare providers and community educators, play a critical role in addressing climate-related health risks. They are uniquely positioned to identify climate-sensitive health issues, promote adaptive behaviors, and advocate for sustainable practices within their communities[8]. However, the integration of environmental health and climate change education within nursing curricula remains limited globally, particularly in LMICs such as Pakistan[9]. Insufficient knowledge and awareness among nursing students may

hinder their ability to recognize and respond to emerging climate-health challenges effectively.

While studies in high-income countries have explored healthcare students' perceptions of climate change[10], research in LMIC contexts is scarce. In Pakistan, most available studies have focused on general public awareness or on practicing clinicians, often overlooking nursing students, who represent a critical segment of the future health workforce[11]. Understanding the level of climate-health awareness among this group is essential to inform curriculum development and strengthen the capacity of healthcare systems to cope with environmental threats.

This study aimed to assess the level of awareness and perceived health impacts of climate change among nursing students in Sindh, Pakistan. By identifying knowledge gaps and examining associations with demographic factors, this research seeks to inform targeted educational interventions and support the development of a climate-resilient nursing workforce in Pakistan.

Study Objectives

- To explore nursing students' awareness of climate change and its causes.
- To assess nursing students' understanding of the health-related consequences of climate change.
- To determine how demographic variables (e.g., age, gender) are associated with climate change awareness among nursing students.

METHODS

Study Design: A cross-sectional descriptive study design was employed to assess climate change awareness and its perceived health impacts among nursing students.

Study Setting and Duration: The study was conducted over three months (from March – May of 2025) in selected public and private colleges of nursing located in Sindh, Pakistan.

Study Population: The target population consisted of undergraduate students enrolled in the Bachelor of Science in Nursing (BScN) program.

Sample Size Calculation

Sample size was obtained by using formula for prevalence:

$$n=Z \quad 2\times p\,(1-p)/\,m2$$

Where Z = 1.96 (95% confidence), p = estimated proportion (use 0.5 if unknown for maximum variability), e = margin of error (as a decimal, e.g., 0.05 for 5%). The total number of eligible students enrolled in the BScN year program is 100. Using a 95% confidence level, a 5% margin of error and applying finite population correction, the calculated sample size is approximately 292 students.

Sampling Technique

Cluster sampling was employed to accommodate logistical constraints and ensure representation across institutions. Nursing colleges from public and private colleges were randomly selected in Sindh. Within each selected college, participants were then randomly chosen using proportional allocation.

Inclusion Criteria

- BScN year students enrolled at public and private Colleges of Nursing in Sindh
- Students who voluntarily provide informed consent
- Both gender (Male & Female)

Exclusion Criteria

- Students unwilling to provide consent
- Students enrolled in other academic programs

Data Collection Instrument

A structured, self-administered questionnaire was used, adapted from previously validated tools[13]. It was pilot-tested, yielding a Cronbach's alpha of 0.80. The questionnaire included:

Section I: Demographics, Section II: Awareness of climate change, Section III: Perceived health impacts of climate change.

Study Variables

Independent Variable: Socio-demographic variables: Gender, Age, Geographical Location, and Ethnicity.

Dependent Variable

Primary Outcomes:

Awareness of climate change: Level of climate change awareness.

Awareness of climate change-related health impacts: Perceived health outcomes.

Data Analysis

Data were entered and analyzed using IBM SPSS Statistics version 27. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize demographic variables and awareness levels. Chi-square tests were used to examine associations between demographic characteristics and levels of awareness. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the departmental review board prior to data collection. Written permission was also obtained from the college of nursing where the data was collected. Informed consent was obtained from all participants. Participation was voluntary, and students were informed that they could withdraw at any time without any consequences. Data confidentiality was strictly maintained, with all records securely stored and accessible only to the research team.

RESULTS

This study analyzed data from 292 second-year BScN nursing students regarding their awareness of climate change and its perceived health impacts. The findings are presented in three parts: (1) participant demographics, (2) general awareness and health-related perceptions, and (3) statistical associations with demographic variables.

Participant Demographics

Among the 292 participants, 213 (72.9%) were male and 79 (27.1%) were female. The majority (72.3%) were aged between 20–30 years, followed by 25.7% below 20 years and 2.1% between 30–40 years. Regarding geographic background, most students (62.0%) were from rural areas, with 19.9% from urban areas and 18.2% from semi-urban

regions. Ethnically, the sample was predominantly Sindhi (79.1%), with smaller proportions of Baloch (9.6%), Punjabi (4.5%), Siraiki (3.8%), Pathan (1.0%), and others (2.1%).

Table 1

Demographic characteristics of participants (n = 292)

Variable	Category	Frequency (%)
Gender	Male	213 (72.9)
	Female	79 (27.1)
Age	Below 20 years	75 (25.7)
	20–30 years	211 (72.3)
	30–40 years	6 (2.1)
Geographic Area	Rural	181 (62.0)
	Semi-urban	53 (18.2)
	Urban	58 (19.9)
Ethnicity	Sindhi	231 (79.1)
	Baloch	28 (9.6)
	Punjabi	13 (4.5)
	Siraiki	11 (3.8)
	Pathan	3 (1.0)
	Others	6 (2.1)

General Awareness of Climate Change and Perceived Causes

The majority of participants (91.4%) reported familiarity with the term *climate change*, and 88.7% acknowledged changes in weather patterns. When asked about causes of climate change, deforestation was most frequently identified (66.4%), followed by natural causes (11.6%), air pollution (10.6%), water pollution (9.6%), and industrial emissions (1.7%). More than half (54.5%) considered industrialized countries primarily responsible for climate change.

Regarding global efforts to combat climate change, responses were split equally (50.0% yes, 50.0% no). Most students (69.9%) believed reducing global warming should be a priority, yet only 43.5% reported taking personal action. Awareness of governmental policies was low (21.9%), and over half (54.5%) expressed dissatisfaction with current policy responses.

Table 2

Awareness of climate change and perceived causes (n = 292)

Item	Response	Frequency (%)
Familiarity with the term "climate change"	Yes	267 (91.4)
	No	25 (8.6)
Perception of changing weather patterns	Yes	259 (88.7)
	No	30 (10.3)
	Don't know	3 (1.0)
Causes of climate change (multiple responses allowed)		
Deforestation		194 (66.4)
Natural causes		34 (11.6)
Air pollution		31 (10.6)
Water pollution		28 (9.6)
Industrial emissions		5 (1.7)

Awareness of Health-Related Consequences

Most participants (87.3%) agreed that climate change affects health. Key health impacts identified included increased incidence of respiratory diseases (82.5%), infectious diseases (80.8%), and malnutrition (68.2%).

Table 3

Perceived health-related impacts of climate change (n = 292)

Health Impact	Response	Frequency (%)
Does climate change affect health?	Yes	255 (87.3)
	No	37 (12.7)
Respiratory diseases	Yes	241 (82.5)
	No	51 (17.5)
Infectious diseases	Yes	236 (80.8)
	No	56 (19.2)
Malnutrition	Yes	199 (68.2)
	No	93 (31.8)

Inferential Analysis

Chi-square tests revealed significant associations between gender and eight determinants of climate change awareness and health perceptions ($p < 0.05$). Similarly, age was significantly associated with five determinants.

Table 4

Significant associations between gender and climate change awareness (n = 292)

Determinant	P-value	Interpretation
Perception of changing weather patterns	0.024*	Significant
Attribution of unusual weather patterns to climate change	0.000*	Significant
Personal action regarding climate change	0.000*	Significant
Awareness of government policies	0.050*	Significant
Satisfaction with government policies	0.005*	Significant
Perception of infectious diseases	0.001*	Significant
Perception of malnutrition	0.000*	Significant

Table 5

Significant associations between age and climate change awareness (n = 292)

Determinant	P-value	Interpretation
Familiarity with the term "climate change"	0.046*	Significant
Perception of changing weather patterns	0.028*	Significant
Perceived causes of climate change	0.034*	Significant
Personal action regarding climate change	0.045*	Significant
Perception of health impacts	0.003*	Significant

$P < 0.05$ considered statistically significant.

DISCUSSION

This study examined nursing students' awareness of climate change, its perceived causes and health impacts, and the influence of demographic variables such as gender and age on these perceptions. Climate change is increasingly recognized as one of the greatest public health threats of the 21st century, with the World Health Organization estimating over 150,000 deaths annually and millions of Disability Adjusted Life Years (DALYs) lost to climate-sensitive conditions, including malnutrition, vector-borne diseases, and respiratory illnesses[12].

The findings revealed a high level of awareness among nursing students, with 91.4% reporting familiarity with the term "climate change" and 88.7% acknowledging noticeable changes in weather patterns. This aligns with studies conducted among health sciences students in other low- and middle-income countries (LMICs), suggesting that younger populations, particularly those in academic settings, are becoming increasingly conscious of environmental risks[13,14]. Most participants (66.4%) identified deforestation as a major contributor to climate change, followed by natural causes (11.6%) and air pollution (10.6%). Notably, only 1.7% recognized

industrial emissions as a significant factor, indicating a gap in understanding regarding key anthropogenic drivers of climate change. Similar gaps in knowledge have been reported in South Asian studies where students exhibited partial awareness of greenhouse gas contributors[15].

Over half of respondents (54.5%) attributed the responsibility for climate change to industrialized countries, reflecting an awareness of the disproportionate contributions of developed nations to global emissions. This observation resonates with findings from youth populations in Malaysia and India, where participants similarly recognized the role of developed economies in exacerbating climate challenges[16].

A substantial proportion of students (87.3%) believed that climate change affects health, identifying respiratory diseases (82.5%), infectious diseases (80.8%), and malnutrition (68.2%) as major consequences. These perceptions align with evidence linking climate change to air pollution, altered vector ecology, and food insecurity[17,18]. Interestingly, 68.2% of participants associated climate change with cancer incidence, a connection not strongly supported by existing scientific literature[19]. This highlights the need for nuanced education on climate-sensitive health outcomes to ensure accurate understanding and prevent misinformation.

Awareness of governmental climate policies was relatively low (21.9%), and more than half of the respondents expressed dissatisfaction with current efforts. Limited policy literacy has also been documented in other Pakistani studies and underscores the importance of integrating environmental policy education into nursing and health sciences curricula[20]. Although the students demonstrated a high level of awareness, only 43.5% reported taking personal action to mitigate climate change. This gap between knowledge and behavior reflects findings from other LMIC contexts, where structural and socio-cultural barriers often hinder active engagement in environmental protection[21,22].

The analysis also showed significant associations between gender and multiple determinants, including perceptions of changing weather patterns, government action, and health impacts such as infectious diseases and malnutrition. This supports earlier research indicating that women may perceive environmental risks differently due to social roles and health priorities[23]. Similarly, age was associated with familiarity with climate change, perceived causes, and beliefs about its health effects. Older students may have greater exposure to environmental information or personal experiences that shape these perceptions[24].

CONCLUSION AND RECOMMENDATIONS

This study highlights a high level of awareness among nursing students regarding climate change and its health impacts, reflecting an encouraging trend in environmental consciousness among future healthcare professionals. However, notable gaps persist in understanding key anthropogenic drivers such as industrial emissions and in translating awareness into personal action. The low level of policy literacy and dissatisfaction with governmental efforts underscore the need for integrating environmental and climate health education into nursing curricula.

Targeted educational interventions are essential to address knowledge gaps and foster behavior change. Incorporating climate change and environmental health as core components of nursing education could empower students to become advocates for sustainable practices and policy reforms. Additionally, national and institutional policies should focus on raising climate change awareness and facilitating youth participation in mitigation strategies. Further research exploring barriers to individual and collective action among nursing students can guide the development of context-specific interventions in low- and middle-income settings.

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