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Original Research Article

Assessment of knowledge, perceptions and practices regarding climate change among undergraduate medical students of a rural medical college in Haryana: a cross-sectional study

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ABSTRACT

Background: Climate change is the greatest global health threat of the 21st century. Medical students, as future healthcare providers, play a critical role in mitigation and adaptation. Evidence from rural medical colleges in Haryana remains limited. Objectives were to assess knowledge, perceptions and environmentally sustainable practices regarding climate change among undergraduate medical students of a rural medical college in Haryana.

Methods: An institution-based cross-sectional study was conducted among 100 undergraduate medical students of government medical college using a semi-structured questionnaire. Knowledge was scored on eight binary items (adequate knowledge defined as ≥50% score). Descriptive statistics, chi-square test, independent t-test and Pearson correlation were applied.

Results: Mean age was 21.8±1.1 years; 56% were from urban and 44% from rural areas. Mean knowledge score was 6.62±1.46 out of 8; 97% had adequate knowledge. Most students correctly identified cardiovascular/respiratory diseases (79%) and vector-borne infections (70%) as major health impacts. Positive perceptions were high: 95% agreed human actions cause climate change and 94% agreed both individuals and government are responsible. Mean practice score was 7.02±1.61 out of 9. Solar water heater use (35%) and frequent refrigerator defrosting (64%) were the least practised behaviours. Internet was the leading information source (90%). Knowledge and practice scores showed a weak positive correlation (r=0.187, p=0.062). No significant association was found between residential area and knowledge or practice scores.

Conclusions: Undergraduate medical students demonstrated high knowledge and favourable perceptions regarding climate change, yet gaps persisted in specific practices and awareness of local organisations and governmental actions. Strengthening climate-health education within the medical curriculum is recommended.

Keywords: Climate change, Haryana, Knowledge, Medical students, Perception, Practice, Sustainable development

INTRODUCTION

Climate change refers to long-term shifts in temperatures and weather patterns. As the Earth is an interconnected system, changes in one domain influence others beyond temperature alone.[1] The Intergovernmental Panel on Climate Change (IPCC) has emphasised that rising global temperatures, extreme weather events, sea-level rise and biodiversity loss are already evident and projected to intensify.[2] Climate change has been recognised as the biggest global health threat of the 21st century.[3]

Developing countries such as India are particularly vulnerable owing to high population density, dependence on climate-sensitive sectors including agriculture, and limited adaptive capacity.[4] In recognition of these impacts, the United Nations has identified climate action as sustainable development goal 13 (SDG 13), urging nations to strengthen resilience and adaptive capacity to climate-related hazards.[5] The World Health Organization has called upon health professionals worldwide to be at the forefront of protecting populations from the harmful health impacts of the climate crisis.[6]

Understanding the knowledge, perceptions and practices (KAP) of medical students is essential for designing effective mitigation and adaptation strategies. Adequate knowledge fosters environmentally responsible behaviour, while positive attitudes and practices contribute to collective community action.[7] Medical students represent future healthcare providers whose actions will significantly influence public-health outcomes. If they acknowledge the causes and health effects of climate change, the amplification of this message to the general population becomes more efficient.

Although several studies have assessed climate-change-related KAP among medical students in different Indian and international settings, evidence from undergraduate medical students in rural medical colleges of Haryana remains limited.[8-14]

The present study was therefore undertaken to assess knowledge, perceptions and practices regarding climate change among undergraduate medical students of a rural medical college in Haryana.

METHODS

Study design and setting

An institution-based cross-sectional study was conducted among undergraduate medical students of a government medical college of Haryana.

Study population and eligibility

All phase-III part-2 (final-year) undergraduate medical students present during the data-collection period who provided informed consent were included. Final-year students were selected because they possess greater academic and clinical exposure and are closer to internship, involving increased interaction with patients and the community. Students who were absent or who submitted duplicate responses were excluded.

Sample size and technique

Universal sampling technique was used thus all 120 final prof students were selected. A total of 100 eligible students (meeting the inclusion and exclusion criteria) completed the questionnaire and were included in the analysis. Data collection was performed in a duration of two months (August 2026 to September 2026).

Study tool

A semi-structured questionnaire comprising seven sections was used: (A) socio-demographic details; (B) knowledge regarding climate change (eight binary yes/no items); (C) knowledge of health impacts of climate change (multiple-choice); (D) perceptions regarding climate change (eight Likert-type statements: agree/disagree/don't know); (E) perceived causes of climate change; (F) environment-friendly practices (nine yes/no items); and (G) sources of information.

Scoring

Each correct knowledge response was awarded one point (maximum score 8). Participants scoring ≥50% (≥4) were classified as having adequate knowledge, consistent with the protocol. A practice score was computed by summing affirmative responses to the nine environment-friendly practice items (maximum 9).

Data collection

After explaining the purpose of the study and obtaining written informed consent, participants completed the questionnaire in a supervised setting or via a secure online form. Data were checked for completeness on the same day.

Statistical analysis

Data were entered into Microsoft Excel and analysed using SPSSv20.0. Descriptive statistics (frequencies, percentages, means and standard deviations) were calculated. The chi-square test was used to examine associations between categorical variables. Independent-samples t-test compared mean knowledge and practice scores between urban and rural students. Pearson's correlation coefficient assessed the relationship between knowledge and practice scores. A p value <0.05 was considered statistically significant.

Ethical considerations

Written informed consent was obtained from every participant. Participation was voluntary and students could withdraw at any time without penalty. Confidentiality and anonymity were maintained by using coded forms and password-protected data files.

RESULTS

Socio-demographic characteristics

A total of 100 final-year undergraduate medical students participated. The mean age was 21.81±1.07 years (range 19-24 years). Fifty-six students (56%) resided in urban

areas and 44 (44%) in rural areas. All participants provided informed consent.

Table 1: Socio-demographic profile of study participants (n=100).

Variables	N	%
Age (years), mean±SD	21.81±1.07	—
Residential area- urban	56	56.0
Residential area- rural	44	44.0

Knowledge regarding climate change

The mean knowledge score was 6.62±1.46 (range 0-8). Ninety-seven students (97%) had adequate knowledge (≥4). Individual item responses are shown in Table 2. Knowledge of causes (94%) and environmental effects (95%) of climate change was highest, whereas awareness of organisations dealing with climate change in India (61%) and belief that reversing global warming is possible (74%) were relatively lower.

Perceived health impacts

Cardiovascular and respiratory diseases (79%), increased infections/vector-borne diseases (70%) and forced migration/civil conflicts (56%) were the most frequently identified major health impacts. Malnutrition (22%) and obesity (15%) were less commonly selected; 6% responded "don't know/not sure" (Table 3).

Perceptions regarding climate change

The majority of students expressed positive and scientifically aligned perceptions (Table 4). Ninety-five per cent agreed that human actions cause global warming and climate change; 97% agreed that India is also responsible; 94% agreed that global warming is both a current and future problem and that both individual citizens and the government are responsible for tackling it. Only 19% agreed with the statement "We are too small to do anything about climate change," while 73% disagreed.

Table 2: Knowledge regarding climate change (n=100).

Knowledge items	Yes (%)	No (%)
Do you know the causes of climate change?	94 (94.0)	6 (6.0)
Do you know the environmental effects of climate change?	95 (95.0)	5 (5.0)
Do you know the sustainable development goal for climate action?	87 (87.0)	13 (13.0)
Is reversing of global warming possible?	74 (74.0)	26 (26.0)
Do you know any organisations dealing with climate change in India?	61 (61.0)	39 (39.0)
Is the government taking actions to reduce global warming?	80 (80.0)	20 (20.0)
Do you know the ways to reduce climate change?	92 (92.0)	8 (8.0)
Do you know the ways to protect yourself from climate change?	79 (79.0)	21 (21.0)
Adequate knowledge (score ≥4/ 8)	97 (97.0)	3 (3.0)

Table 3: Perceived major health impacts of climate change (multiple responses possible).

Health impact	N	%
Cardiovascular and respiratory diseases	79	79.0
Increased infections/vector-borne diseases	70	70.0
Forced migration and civil conflicts	56	56.0
Malnutrition	22	22.0
Obesity	15	15.0
Don't know / not sure	6	6.0

Perceived causes of climate change

Air pollution from industries and automobiles (92%), deforestation (90%), greenhouse effect (84%), land clearing for agriculture (75%) and overfishing/livestock production (60%) were the most frequently cited contributors.

Environment-friendly practices

The mean practice score was 7.02±1.61 (range 03-09). Turning off lights/devices when not in use (91%), using public transportation (92%) and reducing plastic use/recycling (90%) were the most commonly reported practices. Use of a solar water heater/cooker (35%) and frequent defrosting of refrigerator/freezer (64%) were the least practised (Table 5).

Table 4: Perceptions regarding climate change (n=100).

Statements	Agree (%)	Disagree (%)	Don't know (%)
Human actions are also a cause of global warming and climate change	95 (95.0)	4 (4.0)	1 (1.0)
Climate change is affecting Haryana	88 (88.0)	3 (3.0)	9 (9.0)
India is also responsible for global climate change	97 (97.0)	1 (1.0)	2 (2.0)
We are too small to do anything about climate change	19 (19.0)	73 (73.0)	8 (8.0)
People need more information about climate change	94 (94.0)	3 (3.0)	3 (3.0)
Children should be taught more about climate change at school	95 (95.0)	3 (3.0)	2 (2.0)
Global warming is both a current and future problem	94 (94.0)	4 (4.0)	2 (2.0)
Both individual citizens and the government are responsible for tackling global warming and climate change	94 (94.0)	3 (3.0)	3 (3.0)

Table 5: Environment-friendly practices (n=100).

Practice	Yes (%)	No (%)
Turn off lights/devices when not in use	91 (91.0)	9 (9.0)
Use energy-saving appliances	73 (73.0)	27 (27.0)
Use public transportation to save fuel	92 (92.0)	8 (8.0)
Quit/avoid non-vegetarian diet	86 (86.0)	14 (14.0)
Carpool / travel with friends	89 (89.0)	11 (11.0)
Use a solar water heater/cooker	35 (35.0)	65 (65.0)
Defrost refrigerator/freezer often	64 (64.0)	36 (36.0)
Reduce use of plastic and recycle whenever possible	90 (90.0)	10 (10.0)
Buy environmentally friendly products	82 (82.0)	18 (18.0)

Sources of information

The internet was the predominant source (90%), followed by newspapers (59%), television channels (58%), present college curriculum (47%) and movies (45%). Three students reported never having heard about climate change.

Association analyses

Mean knowledge scores did not differ significantly between urban (6.71±1.60) and rural (6.50±1.27) students (t=0.73, p=0.470). Mean practice scores were also comparable (urban 6.80±1.69 versus rural 7.30±1.49; t=−1.52, p=0.131). Adequate knowledge was present in 53/56 (94.6%) urban and 44/44 (100%) rural students (χ^2=0.94, p=0.333). A weak positive correlation was observed between knowledge and practice scores (Pearson r=0.187, p=0.062), which did not reach conventional statistical significance.

DISCUSSION

The present study assessed knowledge, perceptions and practices regarding climate change among 100 final-year undergraduate medical students of a rural medical college in Haryana. Nearly all participants (97%) demonstrated adequate knowledge, with a mean score of 6.62 out of 8. This finding is higher than the proportions of good knowledge reported by Varghese et al (70%) in Trivandrum, Pattankar et al (58.5%) in Vijayapura, and Reddy et al (75.3%) in Telangana, possibly reflecting recent curricular emphasis, greater media exposure, or differences in assessment tools.[8,9,13]

High awareness of causes and environmental effects of climate change (>90%) contrasts with relatively lower knowledge of organisations working on climate change in India (61%) and of the possibility of reversing global warming (74%). Similar gaps in detailed knowledge of institutional responses have been noted in other Indian studies.[9,13] Cardiovascular/respiratory diseases and vector-borne infections were correctly identified by the majority as major health impacts, consistent with the scientific literature and with findings from Bharadwaj et al and Zubair et al.[10,14]

Perceptions were overwhelmingly positive and aligned with scientific consensus: 95% recognised human causation and 97% acknowledged India's responsibility. The low endorsement of the "too small to act" statement (19%) suggests a sense of personal and collective efficacy, which is encouraging for future advocacy roles. Strong support for school-level education on climate change (95%) mirrors international calls for early integration of climate-health content.[11,12]

Although the mean practice score was high (7.02/9), solar water-heater use remained low (35%), reflecting infrastructural and economic barriers common in both urban and rural Indian settings. The weak, non-significant

correlation between knowledge and practice (r=0.187, p=0.062) is consistent with the knowledge-practice gap described by Pattankar et al and Reddy et al, underscoring that knowledge alone is insufficient to guarantee sustainable behaviours without enabling environments and institutional support.[9,13]

No significant urban-rural differences were observed in knowledge or practice scores, suggesting that final-year medical students, irrespective of background, share a similar level of exposure to climate-related information, largely through the internet (90%) and media. College curriculum was cited by only 47% of students, indicating an opportunity to strengthen formal climate-health teaching within the undergraduate medical programme, as recommended by multiple authors.[8-12]

Strengths of the study include a focused final-year cohort, use of a structured KAP instrument aligned with the study protocol, and application of appropriate parametric and non-parametric tests. Limitations include the single-institution design, reliance on self-reported practices (subject to social-desirability bias), and the cross-sectional nature that precludes causal inference. Income data were heterogeneous and could not be reliably categorised for analysis.

CONCLUSION

Undergraduate medical students of a rural medical college in Haryana demonstrated high levels of knowledge and favourable perceptions regarding climate change and its health impacts. Environmentally sustainable practices were generally good, yet specific behaviours such as solar-energy use lagged behind. A modest knowledge–practice correlation and limited recognition of the college curriculum as an information source highlight the need to integrate structured climate-change and planetary-health education into the undergraduate medical curriculum. Such integration may help translate knowledge into sustained action and prepare future physicians to address the health consequences of climate change.

Recommendations

We recommend to incorporate climate change, planetary health and sustainable healthcare modules into the phase-III medical curriculum with both didactic and practical components. It would highly fruitful to promote campus-level green initiatives (energy audits, solar installations, plastic-reduction campaigns) to convert knowledge into practice. Conducting multi-centric studies with larger samples and validated scales to allow generalisable estimates and longitudinal tracking of KAP trends will help in generation of scientific evidence regarding climate change.

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