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Original Research Article

Study of the knowledge, attitude and perceived health effects due to climate change in residents of urban health training centre in Western Maharashtra

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ABSTRACT

Background: Climate change is one of the greatest global health challenges of the 21st century. India is especially vulnerable to climate change due to its geographic locations. The impacts of climate change on urban areas are complex. The concentration of population in urban areas increases the complexity of response to such extreme weather events due to various reasons like lack of resources, capacities, and expertise. Aims and objectives were to assess the knowledge and attitude towards climate change and to determine the perception of health effects due to climate change.
Methods: This study employed a cross-sectional design with closed ended questions, face-to-face interview using a pre-tested questionnaire. Study was conducted with 385 participants and data were analysed using descriptive statistics with measures like Mean and SD for quantitative variables, percentages for qualitative variables.
Results: Participants were majority aged between 41-60 years (37.76%), 60.1% were male, 41.1% belonged to upper lower socioeconomic class. 74% participants had good knowledge towards climate change, 63.14% participants had positive attitudes towards climate change mitigation measures and 88.05% participants had good perception of health effects due to climate change.
Conclusions: Despite adequate baseline knowledge, gaps persist, necessitating targeted IEC (information, education, communication) interventions to improve public engagement and policy responsiveness, as 19.26% were unaware of the word climate change and gave neutral responses and an average of 70% agreed on statement that, government is not doing enough on climate change. The study recommends to enhance the awareness among the population through targeted IEC/BCC activities.

Keywords: Climate change, Health perception, India, Socioeconomic status, Urban health

INTRODUCTION

Climate change is a defining challenge of the 21st century, exacerbating health disparities, particularly in low- and middle-income countries. India, with its dense urban populations and geographic vulnerability, faces heightened risks from extreme weather, vector-borne diseases, and air pollution. Urban areas, such as Western Maharashtra, grapple with compounded challenges due to resource limitations and infrastructural strain. The World Health Organization (WHO) estimates that 3.6 billion people reside in regions highly susceptible to climate impacts, underscoring the urgency of understanding public awareness and preparedness.[1]

India is especially vulnerable to climate change due to its geographic location, climate-sensitive livelihoods and prevalent health concerns. As per WHO fact sheet on climate change, research shows that 3.6 billion people already live in areas highly susceptible to climate

change.[2] Between 2030 and 2050, climate change is expected to cause approximately 25,0000 additional deaths per year, from undernutrition, malaria, diarrhoea and heat stress alone.

The interplay of climate change, pollution, and urbanization creates a multifactorial stress combination that threatens food security, increases vector-borne diseases, and intensifies heat-related morbidity.[3-5] Understanding public knowledge, attitudes, and health perceptions related to climate change is critical for designing effective mitigation and adaptation strategies tailored to urban settings.

Urban areas, home to over half of the global population, face unique challenges due to the "urban heat island" effect, air pollution, and inadequate infrastructure.[6,7] For instance, studies in Hanoi and Jinan highlight how outdoor workers and residents in densely populated

cities experience heightened exposure to heatwaves, yet often lack sufficient knowledge or resources to adopt protective measures.[8,9] Similarly, research in Thailand and Laos underscores the link between climate change and dengue outbreaks, driven by ecological shifts and urbanization.[10,11] Despite growing evidence of these threats, gaps persist in public awareness and institutional preparedness. For example, a survey in Egypt revealed moderate climate change knowledge but limited understanding of its health implications, while health science students and providers globally report inadequate training to address climate-related health risks.[12,13]

The United Nations define climate change as natural process wherein wind, rainfall, temperature and other elements differ and form pattern over decades or more (United Nation, Climate action 2023). The increase in global temperatures gives rise to extreme weather events like heat waves, floods and cyclones. These natural processes impact the human societies adversely affecting their health, safety, infrastructure and other basic needs for survival. The impacts on climate change on urban areas are complex. The concentration of population in urban areas increases the complexity of response to such extreme weather events due to various reasons like lack of resources, capacities, and expertise.[14]

The primary objective of the study was to assess the knowledge and attitude towards climate change. Also to determine the perception of health effects due to climate change in a population under urban health training center (UHTC) of a medical college in western Maharashtra.

METHODS

Study design

A cross-sectional study was conducted from September 2024 to March 2025 at the UHTC affiliated with a medical college in western Maharashtra. The centre serves a diverse urban population, ideal for assessing climate-related awareness.

Sample size and sampling

Assuming prevalence (unknown) for knowledge, attitudes towards climate change and perceived health effects due to climate change in urban population to be 50%, confidence interval of 95% (Z=1.96), absolute error of margin of 5% (d=0.05), the sample size is computed using the formula, $n = Z^2_{(1-\alpha/2)} P (1- P) /d^2$. Sample size came out to be 384. Sampling method was simple random sampling. The sampling frame is the population residing in the urban health training centre (UHTC) field practice area affiliated with a medical college in western Maharashtra. Participants aged ≥18 years were selected randomly using random number generation.

Data collection

A semi structured questionnaire was administered through one-to-one direct interviews. The questionnaire was prepared from literature like KAP survey on climate change commissioned by UNDP in 2016 and Tripathi et al.[1] Later it was piloted by administering the sample questionaries to 30 people and analyze the data consistency and accuracy with Cronbach's alpha (0.9). The tool comprised four sections viz. 1) Demographics: Age, gender, comorbidities and socioeconomic status (modified Kuppuswamy scale). 2) Knowledge: 4 Likert scale items to assess the knowledge aspect (e.g. "climate change is due to carbon emission"). Knowledge scores categorized as yes, no and don't know. 3) Attitude: 6 Likert-scale statements to assess the attitude towards climate change mitigation efforts (e.g. "climate change can be controlled its everyone responsibility") and attitudes scores categorized as positive, negative, and neutral. 4) Perceived health effects: 6 Likert scale items to understand the perception of health effects due to climate change (e.g. "vector borne diseases are increasing due to effects of climate change"). Scores were categorized as good, bad and no perception.

Scoring criteria

The questionnaire used two distinct 5-point scales, scored from 1 to 5. For "knowledge" questions it was, very much not confident =1, fairly not confident =2, neutral =3, fairly confident =4, very confident =5. For "attitude and perceived health effects" questions: a standard Likert scale was used for agreement, strongly disagree =1, disagree =2, neutral =3, agree =4, strongly agree =5. Reverse scoring was applied to specific items. Attitudes questions (Q1, Q4, Q5), perceived health effects questions (Q2, Q4, Q6). For these, the scoring was inverted (strongly agree =1, agree =2, etc.) to ensure consistent interpretation of the total score. 2. Generation of total score: the total column for each question likely represents the sum of the scores, from all 384 respondents. This is calculated as: (number of responses

in category 1 × 1) + (number in category 2 × 2) + ... + (number in category 5 × 5). Criteria for cut-off points (adequate versus inadequate): the total score of "25" corresponds to the highest possible positive score. (e.g., "strongly agree" on all non-reverse-scored items), and '1' was the lowest. Cut-off is the percentage of the maximum possible score. Adequate knowledge/attitude/perception: a score ≥60% of the maximum (i.e., ≥15 out of 25). Inadequate knowledge/attitude/perception: a score <60% of the maximum (i.e., <15 out of 25).

Responses were scored on a 5-point Likert scale. Knowledge and positive attitudes were scored from 1 (lowest) to 5 (highest), with negatively worded statements reverse-scored. A total score was calculated for each participant. Based on the maximum possible score, participants were categorized as having 'adequate' (≥60%) or 'inadequate' (<60%) knowledge, attitude, and perception.

Statistical analysis

Data was extracted into Microsoft excel and analysed using SPSSv24. Descriptive statistical analysis done using measures like frequencies, percentages, means, and standard deviations (SD) were calculated for all variables. Demographics such as age, gender, socio-economic status (SES), and comorbidities were summarized using frequency tables (Table 1). Knowledge, attitudes, and perceived health effects due to climate change had Likert-scale responses (1 = strongly disagree to 5 = strongly agree) were analysed to compute mean scores and SDs. For example, the statement "climate change can be controlled; it's everyone's responsibility" had a mean score of 4.6 (SD=0.81), indicating strong agreement. Reverse-coded items (e.g., "climate change has nothing to do with human health") were inverted during analysis to maintain consistency in interpretation.

Ethical considerations

Ethical approval was obtained from institutional ethical committee (Ref: IEC S. No. IEC/2024/630).

RESULTS

This study synthesizes findings from unique geographical and socioeconomic contexts to explore urban population, regarding climate change knowledge, attitudes, and health perceptions, to emphasize the urgent need for context-specific interventions and policy alignment with global frameworks.

The study included 385 participants, with the majority aged 41-60 years (37.66%, n=145), followed by 31-40 years (31.17%, n=120). Males constituted 60.10% (n=231) and 41% (n=58) belonged to the upper-lower socioeconomic class. Among participants with comorbidities (n=117), diabetes mellitus (38%, n=44) and hypertension (36%, n=42) were the most prevalent (Table 1).

Table 1: Participant demographics (n=385).

Demographic characteristics	Frequency	Percentage
Age group (years)		
18-30	85	22.08
31-40	120	31.17
41-60	145	37.66
>60	35	9.09
Gender		
Male	231	60.10
Female	154	39.90
Socioeconomic status		
Upper	9	2.50
Upper middle	85	21.90
Lower middle	131	34.00
Upper lower	158	41.00
Lower	3	0.5
Comorbidities (n=117)		
Diabetes Mellitus	44	38.00
Hypertension	42	36.00
COPD	12	16.00
Others	19	10.00

A majority of participants demonstrated good knowledge about climate change (74.48%, n=286). Specifically, 74.48% (n=286) confidently identified carbon emissions as a primary driver, and 58.07% (n=223) recognized climate change as a long-term shift in weather patterns. However, only 21.09% (n=81) strongly agreed that human activities directly contribute to climate change, while 47.92% (n=184) expressed moderate confidence (Table 2). The 4 items of knowledge dimension were assessed using 5-point Likert scale ranging from 1 to 5 (very confident- 5, fairly confident- 4, neutral- 3, fairly not confident- 2, very much not confident- 1). High score indicated better knowledge. Score category yes (very confident and fairly confident), no (very much not confident and fairly not confident) and don't know (neutral). The mean scores for knowledge items ranged from 3.9 (SD=0.5) to 4.7 (SD=0.8), indicating generally accurate but incomplete understanding (Table 2A).

Approximately 63.14% (n=243) held positive attitudes toward climate change mitigation. A significant number of participants i.e. 78.65% (n=302) disagreed with the statement, "It's too late to act on climate change," and 77.08% (n=296) agreed that immediate action is necessary. Notably, 78.65% (n=302) endorsed collective responsibility for controlling climate change. However, skepticism toward governmental efforts was evident: 70.31% (n=270) believed authorities were not doing enough, with 26.82% (n=103) strongly disapproving of current policies (Table 2).

Table 2: Knowledge, attitudes, and perceived health effects due to climate change.

(A) Knowledge towards climate change	Categories	N	%	M (SD)
1. Climate change is long term shift in temperatures and weather patterns	Fairly confident	223	58.07	4.3 (0.6)
	Very confident	62	16.15	
	Neutral	91	23.70	
	Fairly not confident	6	1.56	
	Very much not confident	2	0.52	
2. Global warming is part of climate change	Fairly confident	199	51.82	4.06 (0.61)
	Very confident	55	14.32	
	Neutral	84	21.88	
	Fairly not confident	45	11.72	
	Very much not confident	1	0.26	
3. Climate change is mainly due to carbon emission	Fairly confident	286	74.48	4.7 (0.8)
	Very confident	37	9.64	
	Neutral	84	21.88	
	Fairly not confident	5	1.30	
	Very much not confident	0	0	
4. Climate change is related to human activities	fairly confident	184	47.92	3.9 (0.5)
	very confident	81	21.09	
	neutral	84	21.88	
	fairly not confident	8	2.08	
	very much not confident	1	0.26	
(B) Attitudes towards climate change mitigation				
1. It's too late to do anything towards climate change	Agree	37	9.64	2.3 (0.2)
	Strongly agree	6	1.56	
	Neutral	26	6.77	
	Disagree	302	78.65	
	Strongly disagree	13	3.39	
2. It is appropriate time to do something towards climate change	Agree	296	77.08	4.3 (0.8)
	Strongly agree	15	3.91	
	Neutral	17	4.43	
	Disagree	5	1.30	
	Strongly disagree	51	13.28	
3. Climate change can be controlled, it's everyone's responsibility	Agree	302	78.65	4.6 (0.81)
	Strongly agree	53	13.80	
	Neutral	18	4.69	
	Disagree	9	2.34	
	Strongly disagree	2	0.52	
4. Climate change can't be controlled and its none of my responsibility	Agree	44	11.46	2.3 (0.3)
	Strongly agree	10	2.60	
	Neutral	15	3.91	
	Disagree	296	77.08	
	Strongly disagree	19	4.95	
5. Government is doing enough on climate change	Agree	79	20.57	2.4 (0.4)
	Strongly agree	12	3.13	
	Neutral	23	5.99	
	Disagree	167	43.49	
	Strongly disagree	103	26.82	
6. Government is not doing enough on climate change	Agree	169	44.01	3.9 (0.3)
	Strongly agree	120	31.25	
	Neutral	21	5.47	
	Disagree	65	16.93	
	Strongly disagree	9	2.34	
(C) Perceived health effects due to climate change				
1. Climate change is affecting almost all dimensions of health (physical, mental, spiritual, emotional and social etc.)	Agree	225	58.59	4.5 (0.5)
	Strongly agree	142	36.98	
	Neutral	12	3.13	
	Disagree	2	0.52	
	Strongly disagree	3	0.78	
2. Climate change has nothing to do with human health	Agree	40	10.42	2.03 (0.3)

Continued.

(A) Knowledge towards climate change	Categories	N	%	M (SD)
	Strongly agree	5	1.30	
	Neutral	29	7.55	
	Disagree	162	42.19	
	Strongly disagree	148	38.54	
3. Existing chronic diseases will be worsened due to climate change	Agree	282	73.44	4.6 (0.7)
	Strongly agree	71	18.49	
	Neutral	21	5.47	
	Disagree	7	1.82	
	Strongly disagree	3	0.78	
4. Chronic diseases won't be worsened due to climate change	Agree	41	10.68	2.04 (0.3)
	Strongly agree	3	0.78	
	Neutral	33	8.59	
	Disagree	160	41.67	
	Strongly disagree	147	38.28	
5. Vector borne diseases (due to mosquito, flies, mites etc) are on rise due to climate change	Agree	217	56.51	4.4 (0.4)
	Strongly agree	139	36.20	
	Neutral	26	6.77	
	Disagree	1	0.26	
	Strongly disagree	1	0.26	
6. Vector borne diseases (due to mosquito, flies, mites etc) are not increased due to climate change	Agree	32	8.33	1.9 (0.2)
	Strongly agree	1	0.26	
	Neutral	24	6.25	
	Disagree	165	42.97	
	Strongly disagree	162	42.19	

The 6 items of attitudes towards climate change mitigation dimension were assessed using 5-point Likert scale ranging from 1 to 5 (strongly agree- 5, agree- 4, neutral- 3, disagree- 2, strongly disagree- 1). High score indicated positive attitudes. The mean scores for attitudes were calculated across six statements with n=384. 1. "It's too late to do anything towards climate change": 2.3 (SD=0.2) *(reverse-coded)*. 2. "It is appropriate time to do something towards climate change": 4.3 (SD=0.8). 3. "Climate change can be controlled; it's everyone's responsibility": 4.6 (SD=0.81). 4. "Climate change can't be controlled, and it's none of my responsibility": 2.3 (SD=0.3) *(reverse-coded)*. 5. "Government is doing enough on climate change": 2.4 (SD=0.4). 6. "Government is not doing enough on climate change": 3.9 (SD=0.3). Positive attitudes (coded) scored higher (4.3-4.6). Skepticism (no response) toward governmental efforts scored moderate (3.9). Negative statements (reverse-coded) scored lowest (2.3-2.4), reflecting disagreement with defeatist views (Table 2B).

A striking number of participants i.e. 88.05% (n=339) perceived climate change as a direct threat to health. Participants linked it to worsening chronic diseases (73.44%, n=282) and rising vector-borne illnesses (92.71%, n=356). Over 95% (n=367) agreed that climate change impacts multiple health dimensions (physical, mental, social), with only 0.78% (n=3) strongly denying its health relevance. Paradoxically, 10.42% (n=40) still believed climate change had "nothing to do with human health" (Table 2). The 6 items of perceived health effects due to climate change were assessed using 5 point Likert scale ranging from 1 to 5 (strongly agree- 5, agree- 4, neutral- 3, disagree- 2, strongly disagree- 1). High score good perception of health effects. Mean scores for health perceptions (5-point Likert scale, higher scores = stronger agreement with health risks): 1. "Climate change affects all health dimensions": 4.5 (SD=0.5). 2. "Climate change has nothing to do with human health": 2.03 (SD=0.3) *(reverse-coded)*. 3. "Existing chronic diseases will worsen due to climate change": 4.6 (SD=0.7). 4. "Chronic diseases won't worsen due to climate change": 2.04 (SD = 0.3) *(reverse-coded)*. 5. "Vector-borne diseases are rising due to climate change": 4.4 (SD=0.4). 6. "Vector-borne diseases are not increased due to climate change": 1.9 (SD=0.2) *(reverse-coded)*. Strong agreement with climate-health linkages (4.4-4.6). Reverse-coded denial statements scored very low (1.9-2.04), indicating robust recognition of health risks (Table 2C).

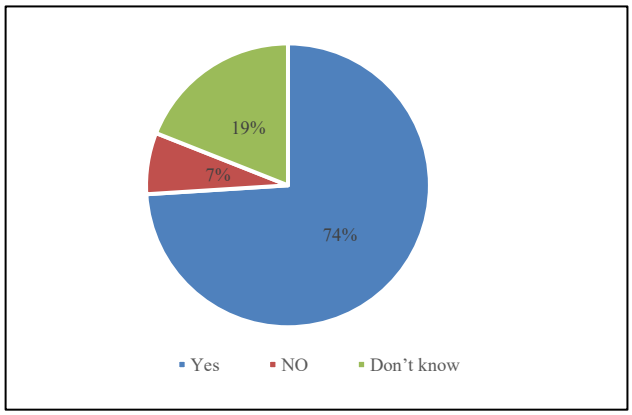

Figure 1: Knowledge towards climate change (n=385).

Summary outcome

(A) Knowledge: 74% (n=286) demonstrated confidence in climate science, while 6.52% (n=25) lacked understanding. (B) Attitudes towards climate change mitigation: Positive attitudes prevailed (63.14%, n=243), though 25.45% (n=98) remained neutral. (C) Health Perceptions due to climate change: Nearly 90% (n=339) associated climate change with adverse health outcomes, particularly chronic and infectious diseases.

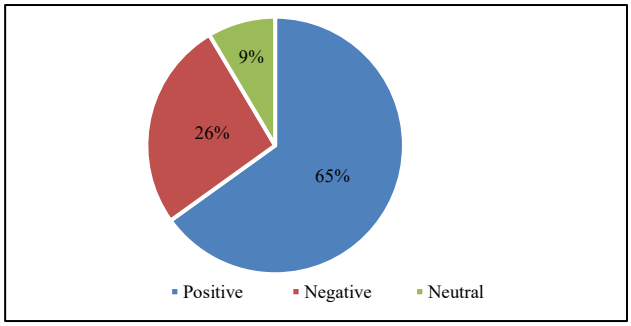

Figure 2: Attitudes towards climate change mitigation (n=385).

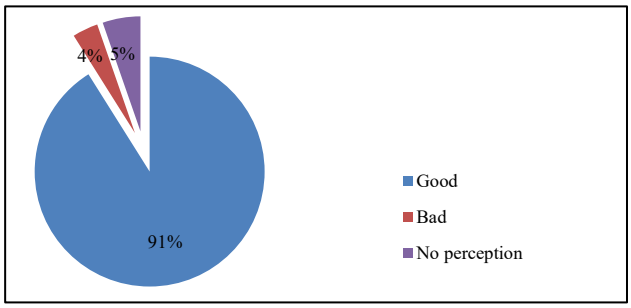

Figure 3: Perceived health effects due to climate change (n=385).

Above descriptive statistics revealed high awareness of climate change but gaps in linking it to anthropogenic causes. While most participants acknowledged its health impacts, a minority downplayed its severity, reflecting cognitive dissonance observed in prior studies.[1,12] The strong consensus on collective responsibility (78.65%) contrasted with skepticism toward governmental action, mirroring findings from Egypt and Germany.[12,14]

DISCUSSION

The findings of this study can be contextualized through the knowledge-attitude-perception (KAP) framework shape public understanding of climate change and its health implications.

Approximately 74% of participants demonstrated good knowledge of climate change, reflecting a baseline awareness of its causes (e.g., greenhouse gases) and consequences (e.g., extreme weather). However, 19.26% remained unfamiliar with the term "climate change", highlighting disparities in information accessibility. The Diffusion of Innovations theory elucidates this gap of knowledge dissemination often follows socioeconomic hierarchies, privileging urban, educated populations with better access to media and institutional resources. While 63.14% held positive attitudes (e.g., believing individual actions matter), 70% criticized governmental inaction. This paradox mirrors the health belief model (HBM), where perceived threats (e.g., climate risks) and perceived barriers (e.g., institutional failure) coexist. The high scepticism toward policy efforts resonates with political ecology theories, which posit that marginalized communities often distrust top-down interventions due to historical neglect or inequitable resource distribution. Neutral or negative attitudes (36.86%) may stem from cognitive dissonance: individuals recognize climate risks but feel powerless to address systemic issues, leading to disengagement. A striking 88.05% perceived climate change as a direct health threat, particularly linking it to heatwaves, vector-borne diseases, and respiratory illnesses. This aligns with the Risk Perception Attitude Framework, where heightened risk awareness motivates behavioural or policy demands. However, the disconnect between health perception and attitudes toward governance underscores a gap in self-efficacy theory, while individuals acknowledge risks, they may lack confidence in their agency or institutional support to mitigate them.

The reviewed studies collectively highlight a disconnect between climate change awareness and actionable health-protective behaviours in urban populations. For instance, while residents in Jinan, China, recognized heatwaves as hazardous, many underestimated their personal risk, leading to insufficient preventive practices.[9] Similar trends were observed in Hanoi, where outdoor workers acknowledged heat-health risks but cited economic pressures as barriers to adopting protective measures.[8]

Vector-borne diseases like dengue exemplify how climate change intersects with urban health. In Thailand and Laos, rising temperatures and erratic rainfall have expanded mosquito habitats, yet public awareness of these linkages remains low.[10,11] Strengthening community engagement through localized messaging, such as linking dengue prevention to weather trends could enhance adaptive capacity.

Healthcare systems also play a pivotal role. Studies reveal that health professionals often lack training in climate-related health impacts, hindering their ability to guide patients or advocate for systemic change.[13,14] Integrating climate change into medical curricula and institutional policies is essential to bridge this gap. Urban vulnerability is further compounded by inequities. The multifactorial stress model proposed by Zandalinas et al emphasizes that compounding hazards, such as heat combined with air pollution, require holistic interventions. Policies must prioritize equitable resource distribution, such as cooling

centers and green spaces, while fostering cross-sector collaboration.

Addressing climate change's health impacts in urban populations requires a dual focus on enhancing public knowledge and strengthening institutional capacity. Future research should explore culturally relevant communication strategies and evaluate the effectiveness of community-led adaptation initiatives. By fostering collaboration between governments, healthcare providers, and communities, cities can transform into hubs of climate resilience, safeguarding health in an era of environmental uncertainty. This study reveals a paradox: while 74% of participants demonstrated good knowledge of climate change, 19.26% were unfamiliar with the term, highlighting uneven awareness. Positive attitudes (63.14%) contrasted with criticism of governmental inaction, suggesting public demand for stronger policy measures.

The study Tripathi et al demonstrated that urban Indian populations exhibit higher climate awareness, yet gaps persist in translating knowledge into actionable attitudes.[1] The high perception of health risks (88.05%) aligns with international studies, where climate change is increasingly linked to vector borne diseases and respiratory illnesses.

Strengths include a robust sample size and pretested tools. Limitations encompass the single-centre design and limited generalizability.

CONCLUSION

Theoretically, these findings underscore the need for multi-level interventions. Enhancing knowledge through targeted IEC (information, education, communication) campaigns must be coupled with efforts to rebuild institutional credibility. Integrating community-based participatory research (CBPR) frameworks could empower marginalized groups to co-design climate resilience strategies, thereby aligning SDH and KAP principles. Future research should explore how cultural narratives and localized environmental histories further modulate these dynamics.

Recommendations

Targeted IEC campaigns, BCC workshops at community level, and school curricula integration on climate change are recommended to bridge knowledge gaps. Policymakers must address public distrust by enhancing transparency and increased awareness activities in climate change related various initiatives.

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