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Climate information pathways and factors associated with factual climate knowledge among Bangladeshi youth

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Abstract

Background

Effective climate-risk communication requires equitable access to credible information and factual understanding. In climate-vulnerable settings, evidence remains limited on how youth encounter climate information through formal education, digital media, mass media, interpersonal/community networks, and institutional or training channels, and how these pathways relate to factual climate knowledge.

Methods

This cross-sectional study analyzed a 2024 face-to-face survey of 1,130 Bangladeshi youth aged 15–24 years across selected urban and rural sites in all eight administrative divisions. Guided by knowledge-gap, digital-divide, and risk-information-processing perspectives, sixteen reported sources were grouped into five non-exclusive environmental information pathways. Adjusted logistic regression examined social patterning in source use. Ordinary least squares regression with heteroskedasticity-robust standard errors and district fixed effects estimated associations between source-group use and a 12-item answer-key-scored factual climate knowledge index.

Results

Digital media had the widest reported reach (70.0%), followed by formal education (62.1%), interpersonal/community sources (46.6%), traditional mass media (45.2%), and direct institutional/training sources (1.5%). Source use varied by gender, field-site residence, studentship, maternal education, and sampled division. In the adjusted knowledge model (N = 1,124), reported use of formal-education sources (b = 0.23, 95% CI 0.04–0.42) and maternal formal education (b = 0.41, 95% CI 0.21–0.60) were positively associated with factual knowledge. The other common source groups were not independently associated with the knowledge score.

Conclusions

Reported reach differed from measured learning. Youth climate-risk communication should be assessed by equity of access, source credibility, and factual understanding, not only exposure or participation.

1. Introduction

Climate change is both an environmental risk and a risk-communication challenge. People need to distinguish long-term climate trends from short-term weather events, understand anthropogenic causes, recognize consequences, and evaluate competing claims before they can make informed decisions about adaptation, mitigation, and environmental risk preparedness [1–3]. These requirements are

especially important in climate-vulnerable countries, where incomplete or inaccurate knowledge may limit young people's capacity to interpret hazards, assess response options, and participate in environmental decision-making.

This study distinguishes factual climate knowledge from the broader construct of climate literacy. Factual knowledge refers here to recognizing scientifically accurate statements about climate causes, processes, and consequences, and rejecting common misconceptions. Mental-model and survey research has shown that climate change is often confused with ozone depletion, general pollution, and other environmental problems, making item-level factual assessment important for environmental risk communication [4–6]. Climate literacy is broader: it includes systems understanding, evidence interpretation, risk appraisal, decision-making, and action competence [7, 8]. For environmental education and climate-risk communication, factual knowledge remains a necessary foundation because misinformation or partial understanding can weaken later engagement with adaptation and mitigation messages.

The analysis is theoretically informed by three complementary perspectives. First, the knowledge-gap hypothesis argues that when information flow increases, socioeconomically and educationally advantaged groups often acquire knowledge faster than less advantaged groups, thereby widening knowledge inequalities [9, 10]. Second, digital-divide theory emphasizes that access to environmental information is shaped not only by connectivity but also by device ownership, skills, autonomy, and the ability to convert online access into meaningful knowledge [11]. Third, risk-information-seeking and processing perspectives suggest that information exposure must be actively processed, trusted, and connected to prior understanding before it contributes to risk judgments or preventive behavior [12, 13].

Young people encounter climate information through a hybrid environmental communication ecology. Schools, books, and teachers can organize concepts sequentially and provide opportunities for guided learning. Television, radio, and newspapers can translate environmental science and policy developments for broad audiences. Internet and social media platforms can rapidly diffuse climate information and youth-oriented messages, but also expose users to misinformation, fragmented attention, and uneven source credibility [14]. Interpersonal and community networks can localize risk information, while institutional and training channels can provide more targeted environmental communication. These pathways may differ substantially in reach, credibility, and educational value.

Formal education is often expected to provide the most structured route to climate knowledge, yet curriculum inclusion alone does not guarantee effective learning. UNESCO's global review found that environmental and climate issues are unevenly integrated into curricula and that socio-emotional and action-oriented learning remain weak in many systems [15]. UNESCO's greening curriculum guidance recommends age-appropriate progression across climate science, ecosystems, climate justice, adaptation, and action [8]. Empirical work with adolescents also indicates that education can interact with prior worldview and knowledge in shaping climate change beliefs [16]. These sources support the

expectation that formal education may contribute to factual climate knowledge, but also indicate that school exposure alone cannot be assumed to produce robust understanding.

Digital media are now central to youth climate-risk communication, but their educational effects are not straightforward. Social media can make environmental information visible, support peer networks, and enable youth advocacy, but it can also circulate misinformation, simplified narratives, and emotionally charged claims. Recent research with young people shows that social media can support climate engagement while also requiring critical evaluation of source credibility and message quality [17]. From a digital-divide perspective, online reach may also be unevenly distributed by gender, residence, education, and socioeconomic position [11, 18, 19].

Bangladesh provides an important setting for this analysis. The country is highly exposed to climate-related hazards, including heatwaves, flooding, cyclones, riverbank erosion, salinity intrusion, and changing rainfall patterns. It also has a large youth population, a mixed communication environment, and marked inequalities in education, digital access, and place-based vulnerability. These conditions make climate information pathways a relevant environmental education and risk communication issue, not only a matter of general awareness.

Bangladesh-specific literature remains limited. Kabir et al. [20] examined climate change knowledge and perceptions among vulnerable Bangladeshi communities, while Hossain et al. [21], using focus groups and interviews with urban children and youth, reported demand for climate information that is trusted, understandable, local, and actionable. Hassan et al. [22] found variation in climate knowledge and attitudes among Bangladeshi university students. However, less is known about how different information pathways operate among a broader youth sample that includes students and non-students, urban and rural youth, and respondents across all administrative divisions.

Three research gaps follow. First, youth climate communication studies often focus on single sources or broad awareness rather than comparing overlapping environmental information pathways. Second, digital inequality is often inferred from general internet statistics rather than estimated directly for climate-information use. Third, studies frequently measure perceived awareness rather than factual knowledge scored against an answer key. These gaps limit understanding of whether different information pathways are associated with measurable climate knowledge relevant to environmental risk preparedness.

Accordingly, this study asks: (1) Which formal-education, digital-media, traditional mass-media, interpersonal/community, and direct institutional/training sources of climate information did surveyed Bangladeshi youth report? (2) How did use of the four sufficiently common source groups vary by gender, residence, education, studentship, maternal education, and sampled division? (3) Which source groups were associated with factual climate knowledge after adjustment for socio-demographic and geographic factors? By addressing these questions, the study contributes to environmental education, climate-risk communication, and youth climate preparedness research in a highly climate-vulnerable setting.

2. Methods

2.1 Design, setting, and participants

This study analyzed a cross-sectional, face-to-face survey conducted from September to October 2024 among youth aged 15–24 years. All eight administrative divisions were included. Within each division, two districts were randomly selected, and one upazila was randomly selected within each district. Within selected upazilas, field sites were selected to capture rural–urban variation where feasible. Most sampled upazilas included one rural union and one paurashava, municipal ward, or other urban field site; field-site classification followed the final administrative and field classification, with paurashava and ward sites coded as urban. These field sites were chosen with reference to the upazila's rural–urban structure, accessibility, field safety, and feasibility for household data collection. This process produced 32 field sites.

At each field site, trained enumerators began at a predetermined starting point and visited consecutive households until the operational age- and sex-quota targets were met. Each upazila was assigned a target of 70 respondents, divided equally between males and females and distributed across ages 15–24. Slightly fewer places were assigned to ages 15–17 because participation required parental or guardian consent and assent; more places were assigned to ages 18–24 to ensure adequate coverage of adult youth. If a household contained more than one eligible person, one was selected at random. The quotas supported balanced inclusion across sex and age groups but were not a strict proportional reproduction of the national single-year age–sex distribution. Of 1,132 eligible people contacted, 1,130 consented and completed the survey. The design therefore provides broad geographic coverage of selected sites but not a probability-weighted nationally representative sample.

2.2 Questionnaire and variables

The questionnaire was developed in English, translated into Bangla, and back-translated into English. Bilingual research team members compared the versions for conceptual equivalence. Climate, environmental education, survey, and youth-research experts reviewed the instrument for content validity and contextual appropriateness. Thirty eligible youth were approached for pilot testing; 29 completed the pilot and were excluded from the main survey. The pilot assessed clarity, comprehension, sequencing, response options, skip patterns, and interview length.

Respondents could select more than one of 16 climate-information sources. Before analysis, conceptually related sources were placed into five non-exclusive groups according to communication setting, likely intermediary, and theoretical expectations from knowledge-gap, digital-divide, and risk-information-processing perspectives: formal education, digital media, traditional mass media, interpersonal/community sources, and direct institutional or training sources (Supplementary Table S2 and S8). This grouping reflects the environmental communication pathways through which youth may encounter climate-risk information.

Factual climate knowledge was measured with all 12 true/false/do-not-know items from the climate-knowledge component of the Attitudes towards Climate Change and Science Instrument (ACSI) [23]. The items assessed human causes, scientific processes, consequences, and common misconceptions. Six statements were keyed True (items 36.1, 36.6, 36.8, 36.9, 36.10, and 36.12), and six misconception statements were keyed False (items 36.2–36.5, 36.7, and 36.11). Each response matching the answer key received 1 point; an incorrect or “do not know” response received 0, producing an index from 0 to 12. The analysis used an item-level answer-key score rather than an unkeyed count of “True” selections, ensuring that false-keyed misconception items were scored correctly. Kuder–Richardson reliability was low (KR-20 = 0.25). The total score was therefore treated as an index of performance across heterogeneous factual items rather than as a unidimensional reflective scale, consistent with the distinction between factual knowledge tests and latent attitude scales. Item wording, answer keys, and response distributions are reported in Supplementary Table S1.

2.3 Statistical analysis

Respondent-level frequencies and percentages were calculated. Percentages for source groups do not sum to 100% because the groups were non-exclusive. Pearson chi-square tests described unadjusted differences in the four common source groups by gender, rural/urban field site, classifiable educational attainment, current studentship, and sampled division (Supplementary Table S3). Continuity correction was applied for two-by-two contingency tables; the rare direct institutional/training group (n = 17) was not tested inferentially because of sparse cells.

Separate logistic regression models estimated adjusted odds ratios (ORs) for formal education, digital media, traditional mass media, and interpersonal/community source use. Models included age, gender, rural/urban field site, educational attainment, current studentship, maternal formal education, and sampled division. Direct institutional/training sources were not modeled as an outcome because only 17 respondents reported them.

Associations between source-group use and factual climate knowledge were estimated using ordinary least squares (OLS) regression with heteroskedasticity-robust (HC1) standard errors. OLS was used because the answer-key-scored knowledge index is bounded at 12 and underdispersed (mean 5.72; variance 1.97), making Poisson assumptions less suitable for the main specification. The four common source groups were entered simultaneously to estimate their adjusted associations while accounting for overlap in source use. The model adjusted for age, gender, rural/urban field site, educational attainment, current studentship, maternal formal education, and district fixed effects. Three respondents with "Other" educational attainment, two with maternal education recorded as "Other" and one with missing studentship were excluded as unclassifiable or missing, yielding complete-case N = 1,124. All six records were distinct. The pre-existing dataset variable "knowledge" counts "True" selections and was not used; the outcome was recalculated from the item-specific answer key, reversing the six false-keyed misconceptions. Field-site-clustered standard errors with 31 degrees of freedom were used in a sensitivity analysis (Supplementary Table S6). Data processing and models were independently checked in Python; estimates are interpreted as adjusted associations, not causal effects.

2.4 Ethics

The study received approval from the Institutional Review Board (IRB) of Independent University, Bangladesh (IUB; research project number 2024-SLASS-01; Certificate of Approval dated 27 August 2024). All methods were performed in accordance with the relevant guidelines and regulations, including the Independent University, Bangladesh Institutional Review Board (IRB) Policy. The IUB policy is guided by The Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects of Research, which sets out respect for persons, beneficence, and justice. The approved submission described voluntary verbal informed consent documented through the SurveyCTO form and requested waiver of signed-consent documentation. Additional parental or guardian consent and assent procedures for participants aged 15–17 years were reported by the research team.

3. Results

3.1 Participant characteristics

The analytical sample comprised 1,130 youth aged 15–24 years, with a mean age of 20.19 years (SD 2.69). Females represented 51.1% of participants. After final field-site classification, 637 respondents (56.4%) were from urban field sites and 493 respondents (43.6%) were from rural field sites. Just over half were currently studying (55.4%). Educational attainment was primary education or less for 39.6%, secondary for 28.6%, higher secondary for 28.2%, tertiary for 3.4%, and other/unclassified for 0.3%. Participants were distributed across all eight sampled divisions (Table 1).

Table 1
Characteristics of surveyed participants (N = 1,130)

Characteristic	Category	n	%
Age group	15–17	191	16.9
	18–20	398	35.2
	21–24	541	47.9
Gender	Female	577	51.1
	Male	553	48.9
Residence	Urban	637	56.4
	Rural	493	43.6
Education	Primary or less	447	39.6
	Secondary	323	28.6
	Higher secondary	319	28.2
	Tertiary	38	3.4
	Other	3	0.3
Current studentship	Not currently studying	503	44.5
Current studentship	Missing	1	0.1
	Currently studying	626	55.4
Maternal education	Other or not classifiable	2	0.2
Maternal education	No formal education	318	28.1
	Some formal education	810	71.7
Division	Barisal	140	12.4
	Chittagong	140	12.4
	Dhaka	143	12.7
	Khulna	140	12.4
	Mymensingh	143	12.7

Note. Percentages use the full consenting sample (N = 1,130). "Other" educational-attainment responses (n = 3), "Other" maternal-education responses (n = 2), and one missing studentship response were excluded from the adjusted models (N = 1,124). The two maternal-education "Other" responses are shown as "Not classified" in Table 1 *rather than treated as lacking formal education. All six exclusions were distinct. Mean age was 20.19 years (SD 2.69). Urban/rural field-site counts reflect the administrative coding of paurashavas and wards.*

Characteristic	Category	n	%
	Rajshahi	142	12.6
	Rangpur	142	12.6
	Sylhet	140	12.4

Note. Percentages use the full consenting sample (N = 1,130). "Other" educational-attainment responses (n = 3), "Other" maternal-education responses (n = 2), and one missing studentship response were excluded from the adjusted models (N = 1,124). The two maternal-education "Other" responses are shown as "Not classified" in Table 1 *rather than treated as lacking formal education. All six exclusions were distinct. Mean age was 20.19 years (SD 2.69). Urban/rural field-site counts reflect the administrative coding of paurashavas and wards.*

3.2 Reported information sources

Digital media had the widest reported reach (70.0%), followed by formal education (62.1%), interpersonal/community sources (46.6%), and traditional mass media (45.2%). Only 1.5% reported a direct institutional or training source (Fig. 1). At the individual-source level, social media was most common (59.0%), followed by the internet (42.3%), school/college (41.5%), and television (40.8%) (Supplementary Table S2). This pattern indicates broad digital visibility, but it also shows that structured education, broadcast/print media, and community communication remained substantial parts of the youth information environment.

3.3 Differences in source-group use

Digital media use differed by gender and field-site residence. After adjustment, males had more than twice the odds of females of reporting digital media (OR 2.30, 95% CI 1.72–3.09), while rural respondents had lower odds than urban respondents (OR 0.69, 95% CI 0.51–0.92). Rural residence was also associated with lower odds of reporting traditional mass media as a source (OR 0.71, 95% CI 0.55–0.92), whereas residence was not independently associated with formal education or interpersonal/community source use. Digital media use also increased with educational attainment (Table 2).

Current students had higher odds of reporting formal-education sources than youth who were not studying (OR 2.07, 95% CI 1.46–2.93). Formal-source use also increased with educational attainment and was more common among respondents whose mothers had formal education. In contrast, current students had lower odds of reporting interpersonal/community sources (OR 0.62, 95% CI 0.45–0.87). Results by sampled division describe differences among study sites, not division-level prevalence.

Table 2
Adjusted associations with reported source-group use

Predictor	Formal education	Digital media	Traditional mass media	Interpersonal/community
Male (ref. female)	0.66 (0.50–0.86)*	2.30 (1.72–3.09)*	0.93 (0.72–1.18)	1.03 (0.79–1.34)
Rural (ref. urban)	1.11 (0.83–1.47)	0.69 (0.51–0.92)*	0.71 (0.55–0.92)*	0.86 (0.66–1.13)
Currently studying	2.07 (1.46–2.93)*	0.98 (0.65–1.46)	1.11 (0.81–1.53)	0.62 (0.45–0.87)*
Maternal formal education	1.75 (1.28–2.40)*	1.52 (1.08–2.14)*	0.89 (0.66–1.19)	0.76 (0.55–1.03)
Secondary education	2.76 (1.93–3.94)*	1.68 (1.14–2.46)*	1.36 (0.98–1.89)	0.61 (0.43–0.87)*
Higher secondary	4.62 (2.95–7.25)*	2.79 (1.73–4.51)*	1.25 (0.85–1.86)	0.41 (0.27–0.62)*
Tertiary education	5.17 (2.10–12.76)*	2.91 (1.10–7.70)*	2.32 (1.13–4.80)*	0.43 (0.19–0.97)*

Note. Cells show adjusted odds ratios (ORs) with 95% confidence intervals. Each column represents a separate logistic regression model. Female sex, urban field site, not currently studying, no maternal formal education, and primary education or less are the reference categories. Models also include age and sampled division. Heteroskedasticity-robust (HC1) standard errors were used; analytical N = 1,124. An asterisk indicates a 95% CI excluding 1.00. Full model output is in Supplementary Table S4.

3.4 Source groups and factual climate knowledge

The answer-key-scored factual climate knowledge index averaged 5.72/12 (SD 1.40; observed range 0–10). Figure 2 presents adjusted OLS coefficients and 95% confidence intervals for the four commonly reported source groups. Coefficients represent adjusted differences in correct answers associated with each binary source indicator. Formal-education source use was associated with 0.23 more correct answers (95% CI 0.04–0.42; p = 0.018). Digital media (b = − 0.05, 95% CI − 0.25 to 0.15), traditional mass media (b = − 0.13, 95% CI − 0.30 to 0.05), and interpersonal/community sources (b = 0.003, 95% CI − 0.18 to 0.19) were not independently associated with the score. Maternal formal education was also positively associated with factual knowledge (b = 0.41, 95% CI 0.21–0.60; Supplementary Table S5). Field-site-clustered sensitivity estimates showed the same direction and overall interpretation (Supplementary Table S6).

The null estimate for the combined digital-media group should not be interpreted as evidence that digital communication has no educational value. The model tested reported use of internet or social media against a factual knowledge index; it did not measure content quality, exposure frequency, attention, trust, media skills, or outcomes such as concern and participation.

4. Discussion

4.1 Main findings

The surveyed youth reported a mixed environmental information environment in which reach, inequality, and measured knowledge did not align in a simple way. Digital media had the widest reported reach, but its use varied by gender, residence, and educational attainment. Formal-education sources were more commonly reported among current students and youth with higher educational attainment, whereas interpersonal/community sources were more common among non-students and less-educated youth. Direct institutional or training sources had very limited reach. Among the four commonly reported source groups, only formal-education source use was associated with a small increase in the factual climate knowledge index. Maternal formal education was also a positive correlate of knowledge in the adjusted model.

Theoretically, the findings support the value of separating three climate-risk communication questions that are often combined: who is reached, who is excluded, and whether reported source use is associated with measured learning. The knowledge-gap hypothesis predicts that information growth may disproportionately benefit educationally advantaged groups [9, 10], while digital-divide theory shows that online access involves more than connectivity alone [11]. The present findings are consistent with both perspectives: source reach was unequal, and reach did not necessarily translate into higher factual knowledge. The findings also align with risk-information-seeking and processing perspectives, which emphasize that exposure must be transformed into sufficient attention, comprehension, and processing before it can support risk judgment [12, 13].

4.2 Digital media: wide reach but unequal use

The adjusted differences by gender and residence are consistent with documented digital divides in Asia and South Asia [24, 25]. The survey did not measure device ownership, data cost, digital skills, privacy of access, platform algorithms, or autonomy over internet use, so it cannot identify which mechanisms produced these differences. Nevertheless, the pattern cautions against treating youth as a uniformly digitally connected group. In van Dijk's terms [11], material access, skills access, and usage opportunities remain relevant even when digital platforms appear widely available.

The lack of an independent association between digital-media use and factual climate knowledge should not be read as evidence that digital communication has no educational value. The model tested reported use of the internet or social media against a factual knowledge index; it did not measure content quality, exposure frequency, credibility judgments, attention, or information-processing effort. Risk-information-

seeking and processing perspectives suggest that exposure must be converted into sufficient, trusted, and elaborated processing before it shapes understanding [12, 13]. Digital climate-risk communication may therefore require curated content, trusted messengers, and stronger links with schools, community organizations, and public environmental institutions.

4.3 Formal education and environmental learning

Formal-education source use was independently associated with a small increase in factual knowledge, but the finding should not be interpreted as causal proof of curriculum effectiveness. Formal-source use was also associated with current studentship, educational attainment, maternal education, and sampled region. The survey did not measure curriculum quality, teacher preparation, exposure duration, classroom pedagogy, assessment, or learning progression. The result therefore indicates an adjusted association between reported formal-source use and factual knowledge, not the effect of any specific educational intervention.

The finding remains important because formal education is the communication setting most able to organize climate concepts sequentially and assess comprehension. Environmental and climate-literacy guidance emphasizes core scientific principles, evidence interpretation, informed decision-making, and action-oriented learning [7, 8, 16]. The modest size of the association in this study suggests that formal education may be necessary but insufficient: school and college sources need stronger conceptual sequencing, misconception correction, and links between local hazard experience and scientific explanation.

4.4 Interpersonal, mass-media, and institutional sources

Interpersonal/community sources were more commonly reported among non-students and respondents with lower educational attainment, suggesting that they may be important for reaching youth who are less connected to formal education. However, their reported use was not independently associated with factual knowledge. This does not mean that community communication is irrelevant. Rather, it indicates that broad source categories may combine supportive and misleading exchanges. Community communication may be most useful when linked with trusted institutions, locally relevant examples, and scientifically accurate materials.

Traditional mass media also showed substantial reach but no independent association with factual knowledge after adjustment. Mass media may be better understood as a salience-building or agenda-setting channel than as a direct source of item-level scientific knowledge, especially when messages are brief, episodic, or focused on disasters. Climate-risk communication scholarship has long cautioned that information effects depend on framing, repetition, trust, and social context rather than exposure alone [2]. Direct institutional and training sources were too rare to model, but their low reach indicates a missed opportunity for more targeted youth-oriented environmental communication.

4.5 Implications for environmental education and climate-risk communication

The findings have three implications for environmental education and climate-risk communication. First, monitoring should distinguish reach from learning. Reporting the number of participants, online impressions, or source mentions is insufficient unless programs also assess comprehension and misconception correction. Second, communication strategies should be equity-sensitive. Digital materials are important, but non-digital routes remain necessary for rural youth, young women, out-of-school youth, and those with weaker educational support. Third, formal education should be strengthened as a structured pathway for environmental learning, while community, media, and digital channels should reinforce rather than replace it. The policy implication is not to privilege one channel universally, but to design a multi-channel environmental communication system in which each source type performs a distinct role.

5. Strengths and limitations

Strengths include the large sample size, geographic diversity, individual-level analysis across 16 sources, a clear distinction between source reach and factual knowledge, and sensitivity analysis using field-site-clustered standard errors. The analysis avoids tests based on multi-response combinations and reports supporting inferential models in the supplement.

The survey used multistage area selection followed by quota-based household recruitment, and no sampling weights were applied; percentages describe the sample and selected sites rather than national prevalence. Consecutive household visits from predetermined starting points may have introduced selection bias. Cross-sectional associations cannot establish whether source use changed knowledge or whether more knowledgeable youth selected particular sources. Binary indicators captured reported source use but not exposure frequency, duration, message content, credibility, trust, attention, comprehension, or information-processing effort. The five groups combine heterogeneous sources and should be interpreted as communication settings, not as equivalent interventions. The knowledge index had low internal consistency (KR-20 = 0.25), which may attenuate associations and indicates the need to interpret the score as a heterogeneous factual index rather than a unidimensional scale. The outcome measured factual knowledge rather than the broader construct of climate literacy. Finally, direct institutional/training exposure was too uncommon for stable adjusted modeling.

6. Conclusion

Among the surveyed Bangladeshi youth, digital media had the widest reported reach, but its use varied by gender, residence, and education. Formal-source use was strongly stratified by current enrollment and educational attainment, while direct institutional and training sources were rarely reported. In the adjusted model, formal-education source use and maternal formal education were positively associated with factual climate knowledge, whereas digital media, traditional mass media, and interpersonal/community source use were not independently associated with the score. These findings suggest that environmental information reach should not be equated with factual learning. Youth-oriented climate-risk communication in Bangladesh should combine equitable digital access,

strengthened formal environmental education, credible mass-media content, and locally grounded community communication to support factual understanding and climate preparedness.

Declarations

7.1 Ethics approval

The study received approval from the Institutional Review Board (IRB) of Independent University, Bangladesh (IUB; project 2024-SLASS-01), as confirmed by the Certificate of Approval dated 27 August 2024, for the project titled “Knowledge and perception of Bangladeshi youths towards climate change mitigation and relevant factors.” The present manuscript reports a focused analysis of data collected for that approved project and uses a title specific to the climate-information and factual-knowledge analyses. The full-board application described a proposed probability-proportional-to-size, stratified selection strategy; the Methods section reports the area and quota-based field recruitment actually implemented. All methods were performed in accordance with the relevant guidelines and regulations, including the Independent University, Bangladesh Institutional Review Board (IRB) Policy. The policy is guided by The Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects of Research, with its principles of respect for persons, beneficence, and justice.

7.2 Consent to participate

Informed consent was obtained from all consenting participants. The full-board application specifically proposed that informed consent would be presented verbally, confirmed by participants and recorded at the beginning of the SurveyCTO questionnaire; the application requested a waiver of signed-consent documentation, not a waiver of informed consent. The study subsequently received IRB approval under project 2024-SLASS-01. The approval certificate does not separately itemize the decision on the documentation waiver. The research team reports that participants aged 15–17 years additionally provided assent with parental or guardian consent. No survey was administered unless a consent response of “Yes” was recorded. Identifiers collected for field administration were excluded from the analysis dataset, and no identifiable participant-level information is reported in this manuscript.

7.3 Consent for publication

The manuscript reports anonymized survey data and does not include identifiable individual information.

7.4 Availability of data and materials

The dataset and questionnaire supporting this study are deposited in Harvard Dataverse under “Replication Data for: Climate change knowledge and its associates among Bangladeshi youths:

Findings from a cross-sectional study" (https://doi.org/10.7910/DVN/4NJE1E). The record indicates a Creative Commons Zero (CC0 1.0) public-domain dedication.

7.5 Clinical trial number: not applicable.

7.6 Funding

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7.7 Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this study.

7.8 Acknowledgments

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7.9 Author contributions

Md Ohidujjaman: conceptualization, methodology, funding acquisition, project administration, formal analysis, writing - original draft. ARM Mehrab Ali: conceptualization, methodology, software, validation, formal analysis, writing - original draft. Noor Adelyna Mohammed Akib: supervision, review, and editing. Theam Foo Ng: supervision, review, and editing. All authors read and approved the final manuscript.

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Figures

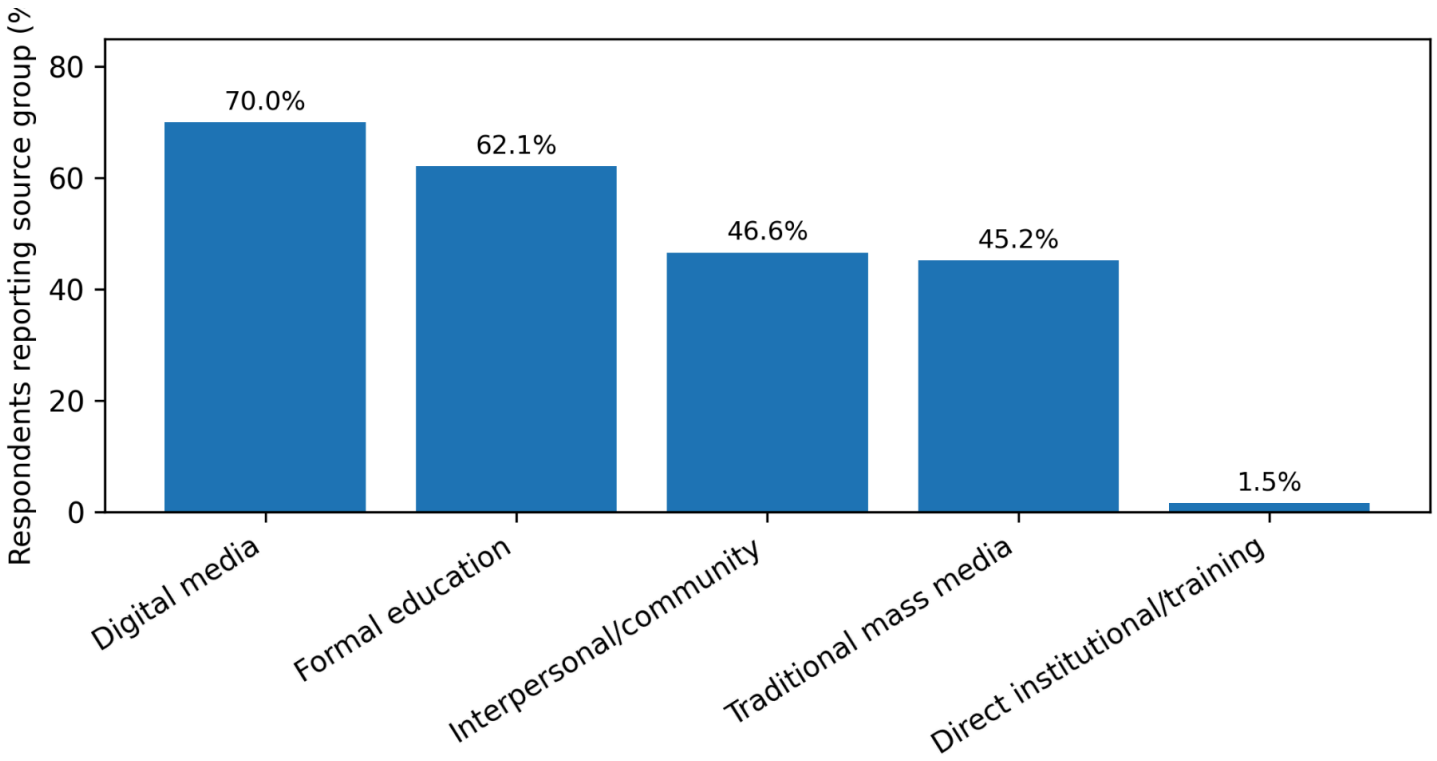

Figure 1

Reported reach of five non-exclusive climate information source groups

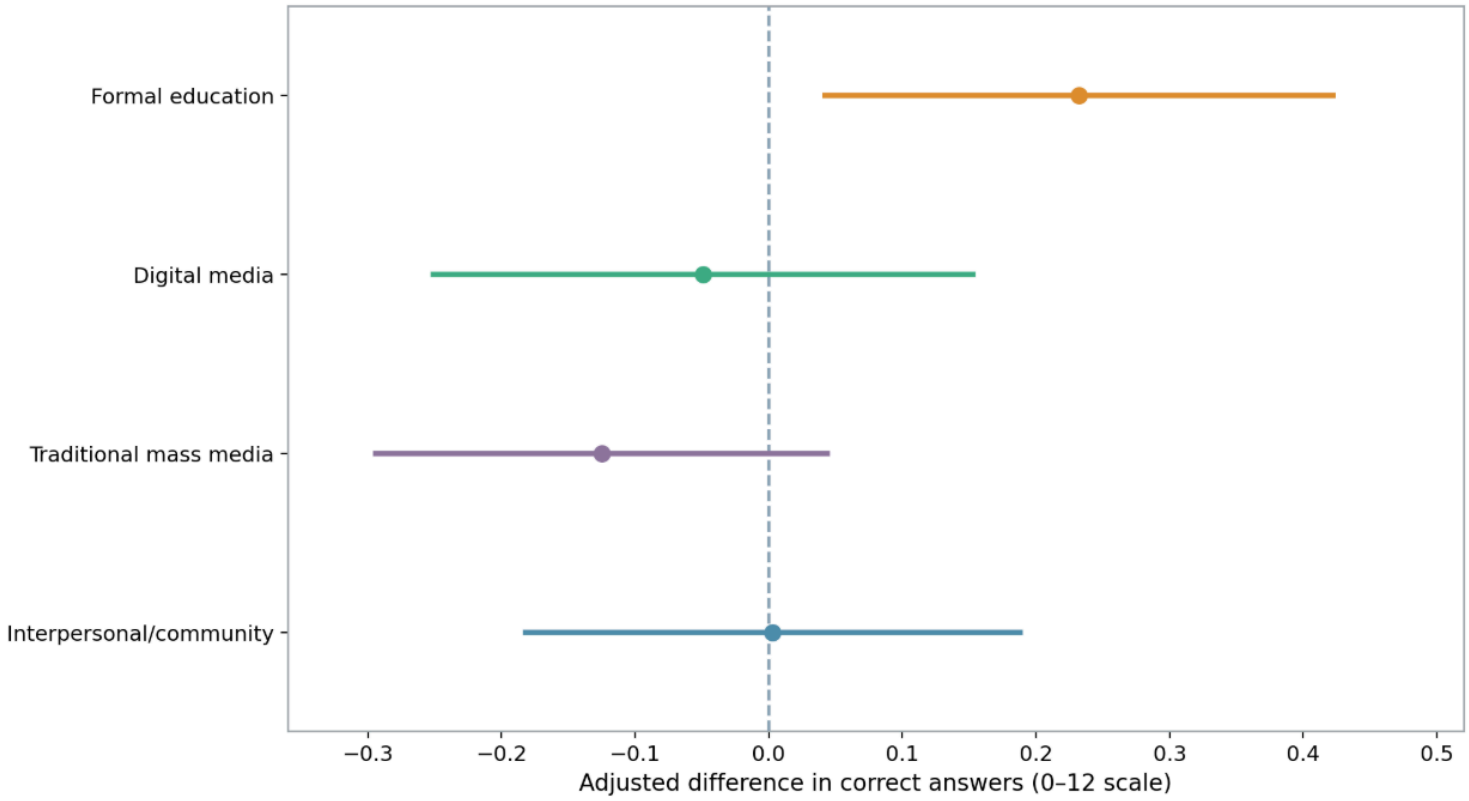

Figure 2

Adjusted OLS coefficients for the four common climate-information source groups and the 12-item factual knowledge index (N=1,124). Points show adjusted differences in the number of correct answers, and horizontal bars show heteroskedasticity-robust (HC1) 95% confidence intervals. Models adjust for age, gender, field-site residence, educational attainment, current studentship, maternal formal education, the four source-group indicators, and district fixed effects.

Supplementary Files

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