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Public awareness and health implications of climate change: Insights from Bangladesh's General Population

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Abstract

Bangladesh's topography makes it particularly susceptible to climate change. To tackle the impending tragedy of climate change, the country's infrastructural, institutional, and financial capacity must be increased. People's perception of climate change varies greatly based on their social backgrounds. Thus, understanding public perceptions of climate change may help improve government policies, adaptation, and community activities. To understand Bangladeshi people's knowledge, perception, and attitude about climate change, an online survey among the general population was conducted using a structured questionnaire methodology. The study participants are mostly from Dhaka (70.25%) and have a moderate level of education (79.75% undergraduate). Most of them have heard of climate change and acknowledge the negative effects of climate change. Over half of the participants are willing to give up personal gains to help solve current climatic and environmental issues. The majority of them, however, don't consider environmental factors while purchasing things and have never participated in climate change-related environmental protection initiatives. In Bangladesh, the general public's knowledge, attitude, and perception of climate change varies considerably. While knowledge and perceptions are high, attitudes towards climate change differ. Along with promoting awareness, people should be encouraged to participate in climate change-related activities.

Keywords: Climate change; Knowledge; Attitude; Perception; General people; Bangladesh

1. Introduction

Due to its topography, Bangladesh is more susceptible to dangers that may rise due to climate change than other countries. Bangladesh is exposed to climate-related calamities due to its place at the mouth of the drainage basin of the powerful Ganges-Brahmaputra-Meghna River systems [1]. As a result, flooding, cyclones, high rainfall, and drought are all common occurrences in Bangladesh. From 1999 to 2018, Bangladesh has suffered 191 climate-related severe events, placing it in seventh place on the 2020 Global Climate Risk Index [2]. For South and Southeast Asia, the IPCC's latest report sketched a future that is irrevocable and certain. There will be more and more regular and intermittent flooding episodes as the monsoon becomes stronger [3]. There would be a significant impact on agriculture and food security in coastal region of Bangladesh as a consequence of increased susceptibility to floods and salinity [4]. People's lives and the future generations of this nation are in danger because of climate change-related natural catastrophes.

This imminent disaster of climate change is calling for strengthening the infrastructures, institutional capacity and financial preparation as well as setting up a communal effort to combat it. However, the fact that people's views and perceptions concerning climate change vary widely and are difficult to forecast across a wide range of sociocultural backgrounds should not be overlooked. It is people's attitudes and views about climate change that determine how the

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public perceives the issue. A person's innate ability to monitor his or her immediate surroundings is seen as a strength, and individuals who have personally experienced the negative effects of climate change, such as increased air pollution and temperature extremes, are more likely to see these threats. How worried individuals are about climate change depends on where they live, whether it is an urbanized or rural region, and if they have a history of dealing with extreme weather conditions.

Some argue that climate change is a direct result of human activity, while others think that it is an action of God as a retribution for the sins of humanity. Then there are some people who do not believe that climate change is in fact, real. There are several sociodemographic elements that influence how people perceive and understand climate change. In addition to sociodemographic factors, religious activity is also connected to climate change perspectives. Now, people can only cope with climate change if they are aware of it and prepared to deal with its effects. The news, the online world, and people's daily experiences with severe weather events such as flooding, cyclones, and drought all contribute to the informal acquisition of climate change knowledge. Hence it is quite possible that people's daily encounters with severe climatic and weather events might influence their views on climate change. Research on views and perceptions of Bangladeshis about climate change has previously been conducted among university students, indigenous people and at the household level [5,9], but this study was aimed at obtaining baseline data on the general population's knowledge, perception, and attitude toward climate change. Knowledge, perception, and attitude are the emphasis of this study. Considering its status as one of the world's most vulnerable LDCs, research like this is critical to people's understanding of climate change. This research hypothesized that Bangladeshis today have minimal to moderate understanding of climate change and believe in its existence rather than rejecting it as a hoax, irrespective of their age, education level, occupation, living area (rural vs. urban), etc. It was discovered that this was the case after concluding the investigation.

2. Materials and Methods

2.1. Aim of the study

The primary objective of this study is to gather baseline data on the general public's knowledge, perception, and attitude about climate change in Bangladesh.

2.2. Study design and setting

To understand Bangladeshi people's knowledge, perception and attitude about climate change, an investigative and anonymized survey among the general population was conducted. A structured questionnaire methodology was used, and an online survey was conducted to gather both quantitative and qualitative data. To ensure a high level of accuracy, the survey questions were written in English. Since exact questionnaires relevant to this research, especially in the context of general Bangladeshi citizens, were unavailable, an original, custom questionnaire was devised based on the literature review and media material, and an expert examined the questionnaire. Likert-type answers like "Yes," "No," or "Did not notice" or categorical options were used for most of the climate change knowledge and perception questions. Some questions were deleted or rephrased for better clarity because of expert feedback. Last, there were 35 questions in total in the final structured questionnaire [S1 File], divided into the following four sections:

- Sociodemographic information (10 questions)
- Climate change knowledge related questions (7 questions)
- People's perception regarding climate change (11 questions)
- People's attitude towards climate change (7 questions)

Participants' socio-demographic variables and their knowledge, perceptions, and attitudes about climate change were gathered using the final questionnaire.

2.3. Questionnaire validation

To ensure that the questionnaire was appropriate for this study, the help of an appropriate expert was enlisted to assess its suitability for the job. The expert concluded that the questions and responses were relevant to the objectives of the investigation.

2.4. Study population and inclusion criteria

Bangladeshis who were in the country at the time of data collection were the target population of the study. The total population was around 166,961,248 as per Worldometer elaboration of the latest United Nations data [6]. To be included in the survey, applicants had to be Bangladeshi nationals at the time of the survey. Convenient and snowball

sampling was used in this research. The Google form link for the survey was put on different social media platforms and the participants were requested to share it to their networks online.

2.5. Data collection technique

Survey participants were asked to fill out a Google form link and to spread the word about it to their friends and family through social media platforms like Facebook, Messenger, and WhatsApp. The form was also emailed to several additional people. Anyone could submit the form from September 17 until November 22, 2021. There were 800 total responses.

2.6. Sample size calculation

At a 95 percent confidence level, with a margin of error of 5 percent, 800 answers were collected. It was predicted that around 50% of the population would be aware of climate change. 385 individuals were needed to estimate this percentage with a 95 percent confidence interval. An overall sample size of 800 people was deemed to be appropriate for this investigation.

2.7. Statistical analysis

Microsoft Excel 2020 was used to clean, modify, sort, and analyze the data. Afterward, using Microsoft Excel, descriptive statistics (i.e., frequencies, percentages, means, and standard deviations) and first-order analysis (i.e., chi-square tests, Fisher's exact tests) were conducted. Frequency tables were used to summarize and illustrate the sociodemographic characteristics and responses of participants. Cross-tabulation and chi-square tests were used to examine the relationship between sociodemographic characteristics and knowledge of climate change. When the p-value was less than 0.05, all statistical tests were declared significant at a 95% confidence level.

2.8. Outcome measures

To evaluate respondents' degree of knowledge, attitudes, and perceptions regarding climate change, those who stated they had heard of it were asked about their source of knowledge and proceeded by questions about its causes and effects. Additionally, all respondents were asked climate-related questions to ascertain their attitude and perspective toward climate change, regardless of their level of knowledge about climate change.

3. Result

The frequency distribution of respondents by their profile characteristics such as age, greatest degree of education, nation, and district is shown in Table 1. Of the total 714 participants, 89.25 percent were between the ages of 16 and 25. The mean age of the participants was 22.63, with a standard deviation (SD) of 6.45 years. It was found that a sizable proportion of respondents were young people from schools, colleges, universities, or other educational institutions, followed by persons in their early adulthood and middle age, who account for 7.75 percent and 2.75 percent of the study population, respectively. Only two (0.25 percent) individuals were above 60 and classified as elderly. In terms of highest level of education, respondents were more likely to be undergraduates, with a percentage of 79.75 percent (638), which explains the research population's high proportion of young individuals. Among the remainder, 91 (11.38%) were postgraduates, followed by 63 (7.88%) with a higher secondary education and just 8 (1%) with secondary education. There were more inhabitants of Dhaka city than of other districts; around 70.25 percent (562) of the 800 respondents chose Dhaka as their present district of residence. This survey includes participants from different districts in Bangladesh, although they are overwhelmingly Dhaka city dwellers. Finally, all 800 respondents resided in Bangladesh, as the objective of this study was to elicit data on the general public's knowledge, perception, and attitude about climate change in Bangladesh.

Table 1 Characteristics of the participants (n = 800)

Characteristics	Frequency (800)	Percentage (100)
Age		
16-25	714	89.25%
26-40	62	7.75%
41-60	22	2.75%

>60	2	0.25%
Highest level of Education		
Higher Secondary	63	7.88%
Postgraduate	91	11.38%
Secondary	8	1.00%
Undergraduate	638	79.75%
Country		
Bangladesh	800	100.00%
District		
Manikganj	13	1. 625%
Jessore	7	0. 875%
Khulna	8	1%
Pabna	6	0. 75%
Barguna	1	0. 125%
Barisal	13	1. 625%
Bhola	2	0. 375%
Bogra	7	0. 875%
Brahmonbaria	6	0. 75%
Chandpur	12	1. 5%
Chittagong	18	2. 25%
Comilla	11	1. 375%
Cox's Bazar	9	1. 125%
Dhaka	562	70. 25%
Dinajpur	3	0. 25%
Faridpur	4	0. 5%
Feni	1	0. 125%
Gajipur	12	1. 5%
Habiganj	6	0. 75%
Jessore	6	0. 75%
Jhalakhati	1	0. 125%
Joypurhat	6	0. 75%
Khulna	11	1. 375%
Kushtia	1	0. 125%
Madaripur	2	0. 375%
Mymensingh	3	0. 25%
Naogaon	6	0. 75%
Narail	1	0. 125%
Narayangonj	1	0. 125%

Pabna	6	0. 75%
Patuakhali	1	0. 125%
Pirojpur	2	0. 375%
Rajshahi	13	1. 625%
Rangamati	2	0. 375%
Rangpur	19	2. 375%
Satkhira	1	0. 125%
Sirajganj	1	0. 125%
Sylhet	2	0. 375%
Tangail	8	1%
Thakurgaon	6	0. 75%

The heading of each column is written in block letters and in bold. Each sociodemographic characteristic is also expressed in bold letters in the first column from the left.

The frequency and percentage distributions of respondents' knowledge of climate change are shown in Table 2. The vast majority (n =800) of research participants (99 percent) were aware of climate change and gained knowledge from various sources, while just 1% had never heard of it.

Additionally, a significant proportion of participants (99.75 %) believe that climate change has occurred in the recent decade, and 96.38 percent answered that they understand what the phrase "climate change" means. Most knowledgeable participants (31.75 percent) stated that they learned about climate change via newspapers, media, and teachers. When questioned about the causes of climate change, answers ranged from deforestation, fast urbanization, and lifestyle change, and excessive carbon emission to industrial effluents, black smoke from vehicles, rapid urbanization and lifestyle change, and excessive carbon emission (0.13 percent). Over half of respondents (87 percent) believed climate change would have negative consequences, while 13% said it would have both negative and good consequences. In terms of the source gas of greenhouse effect, Carbon di-oxide, Nitrous oxide, C.F.C and Ozone were the most mentioned (23%) .

Table 2 Participants' knowledge about climate change

Variables	**Frequency (800)**	**Percentage (100)**
Have you ever heard of climate change?	Total	Percentage
Yes	792	99%
No	8	1%
Do you think there has been climate change in last 10 years?		
No	2	0.25%
Yes.	798	99.75%
Do you know what the term climate change refers to?		
Maybe a little	28	3.50%
Not at all	1	0.13%
Yes	771	96.38%
How did you know about climate change?		
Newspaper	7	0.88%

Newspaper; Family members/ Relatives; Others	1	0.13%
Newspaper; Neighbors; NGO workers; Family members/ Relatives	14	1.75%
Newspaper; NGO workers; Family members/ Relatives	4	0.50%
Newspaper; Others	2	0.25%
Newspaper; Teachers; Family members/ Relatives	10	1.25%
Newspaper; Teachers; Neighbors; Family members/ Relatives	3	0.38%
Newspaper; Teachers; Neighbors; NGO workers; Family members/ Relatives	15	1.88%
Newspaper; Teachers; Neighbors; NGO workers; Others	2	0.25%
Newspaper; Teachers; NGO workers; Family members/ Relatives	3	0.38%
Newspaper; Teachers ;Others	1	0.13%
Newspaper; Television	32	4.00%
Newspaper; Television; Family members/ Relatives	24	3.00%
Newspaper; Television; NGO workers	7	0.88%
Newspaper; Television; NGO workers; Family members/ Relatives	18	2.25%
Newspaper; Television; Others	20	2.50%
Newspaper; Television; Teachers	254	31.75%
Newspaper; Television; Teachers ;Family members/ Relatives	164	20.50%
Newspaper; Television; Teachers ;Family members/ Relatives; Others	1	0.13%
Newspaper; Television; Teachers; Neighbors	2	0.25%
Newspaper; Television; Teachers; Neighbors; Family members/ Relatives	46	5.75%
Newspaper; Television; Teachers; Neighbors; Family members/ Relatives ;Others	12	1.50%
Newspaper; Television; Teachers; Neighbors; NGO workers	9	1.13%
Newspaper; Television; Teachers; Neighbors; NGO workers; Family members/ Relatives	25	3.13%
Newspaper; Television; Teachers; Neighbors; NGO workers; Family members/ Relatives; Others	4	0.50%
Newspaper; Television; Teachers; NGO workers	2	0.25%
Newspaper; Television; Teachers; NGO workers; Family members/ Relatives	46	5.75%
Newspaper; Television; Teachers; NGO workers; Family members/ Relatives; Others	1	0.13%
Newspaper; Television; Teachers; NGO workers; Others	9	1.13%
Newspaper; Television; Teachers; Others	5	0.63%
Others	4	0.50%
Teachers	26	3.25%
Teachers; Neighbors	1	0.13%
Television	9	1.13%
Television; Teachers	16	2.00%
Television; Teachers; NGO workers; Family members/ Relatives; Others	1	0.13%
What could be the reason behind climate change?		

Deforestation	29	3.63%
Deforestation; Black smoke from vehicles; Excessive carbon emission	7	0.88%
Deforestation; Black smoke of vehicles; Rapid urbanization and change in lifestyle	11	1.38%
Deforestation; Black smoke from vehicles; Rapid urbanization and change in lifestyle; Excessive carbon emission	139	17.4%
Deforestation; Excessive carbon emission	39	4.88%
Deforestation; Industrial effluents	1	0.13%
Deforestation; Industrial effluents; Black smoke of vehicles	1	0.13%
Deforestation; Industrial effluents; Black smoke of vehicles; Rapid urbanization and change in lifestyle	6	0.75%
Deforestation; Industrial effluents; Black smoke of vehicles; Rapid urbanization and change in lifestyle; Excessive carbon emission	28	3.5%
Deforestation; Industrial effluents; Excessive carbon emission	1	0.13%
Deforestation; Industrial effluents; Population growth	7	0.88%
Deforestation; Industrial effluents; Population growth; Black smoke of vehicles	2	0.25%
Deforestation; Industrial effluents; Population growth; Black smoke of vehicles; Excessive carbon emission	8	1%
Deforestation; Industrial effluents; Population growth; Black smoke of vehicles; Rapid urbanization and change in lifestyle	11	1.38%
Deforestation; Industrial effluents; Population growth; Black smoke of vehicles; Rapid urbanization and change in lifestyle; Excessive carbon emission	148	18.5%
Deforestation; Industrial effluents; Population growth; Excessive carbon emission	1	0.13%
Deforestation; Industrial effluents; Population growth; Rapid urbanization and change in lifestyle	5	0.63%
Deforestation; Industrial effluents; Population growth; Rapid urbanization and change in lifestyle; Excessive carbon emission	25	3.13%
Deforestation; Industrial effluents; Rapid urbanization and change in lifestyle; Excessive carbon emission	19	2.38%
Deforestation; Population growth; Black smoke of vehicles	6	0.75%
Deforestation; Population growth; Black smoke of vehicles; Excessive carbon emission	2	0.25%
Deforestation; Population growth; Black smoke of vehicles; Rapid urbanization and change in lifestyle; Excessive carbon emission	78	9.75%
Deforestation; Population growth; Excessive carbon emission	14	1.75%
Deforestation; Population growth; Rapid urbanization and change in lifestyle	2	0.25%
Deforestation; Population growth; Rapid urbanization and change in lifestyle; Excessive carbon emission	21	2.63%
Deforestation; Rapid urbanization and change in lifestyle	7	0.88%
Deforestation; Rapid urbanization and change in lifestyle; Excessive carbon emission	166	20.8%
Excessive carbon emission	4	0.5%
Industrial effluents; Black smoke of vehicles; Rapid urbanization and change in lifestyle; Excessive carbon emission	1	0.13%

Industrial effluents; Population growth; Black smoke of vehicles	1	0.13%
Industrial effluents; Population growth; Black smoke of vehicles; Rapid urbanization and change in lifestyle; Excessive carbon emission	6	0.75%
Population growth; Black smoke of vehicles	2	0.25%
Rapid urbanization and change in lifestyle	2	0.25%
What is the effect of climate change?		
Both	104	13%
Negative	696	87%
Positive	0	0%
According to your knowledge, which gas causes the greenhouse effect?		
C.F.C	13	1.625%
C.F.C; Ozone	12	1.5%
Carbon di-oxide	128	16%
Carbon di-oxide ;C.F.C	75	9.375%
Carbon di-oxide; C.F.C; Ozone	139	17.375%
Carbon di-oxide; C.F.C; Ozone; Water	6	0.75%
Carbon di-oxide; Nitrous oxide	43	5.375%
Carbon di-oxide; Nitrous oxide; C.F.C	71	8.875%
Carbon di-oxide; Nitrous oxide; C.F.C; Ozone	183	22.875%
Carbon di-oxide; Nitrous oxide; C.F.C; Ozone; Water	31	3.875%
Carbon di-oxide; Nitrous oxide ;C.F.C ;Water	1	0.125%
Carbon di-oxide; Nitrous oxide; Ozone	31	3.875%
Carbon di-oxide; Nitrous oxide; Ozone; Water	1	0.125%
Carbon di-oxide; Ozone	62	7.775%
Carbon di-oxide; Ozone; Water	1	0.125%
Nitrous oxide; C.F.C	2	0.25%
Ozone	1	0.125%

The heading and sub heading of each column is written in block letters and in bold. Each question about knowledge of climate change is also expressed in bold letters in the first column from left.

Table 3 summarizes respondents' perception on climate change. More than 90% of the participants believed there has been an increase in the episode of cyclone, sea waves and drought in last 10 years. Additionally, 98% of respondents stated that they had seen changes in rainfall patterns over the previous decade and 90% stated that there was a lack of fresh water owing to an increase in salinity. Most respondents strongly agreed that climate change is responsible for rising occurrences of extreme weather events (80%), and more than 95% believe that climate change is having an influence on people's health and agricultural production. Around 56% strongly agreed with the assertion that climate change is the catalyst for natural ecological crises. Most of the participants (99%) believed that the sea level has risen because of climate change. Finally, over 47% of respondents agreed strongly that climate change raises the threat of infectious illnesses.

Table 3 Participants' Perception towards climate change

Variables	**Frequency (800)**	**Percentage (100)**
Do you think the episode of cyclone increased in last 10 years?	Total	Percentage
Didn't notice	14	1.75
No	4	0.5
Yes	782	97.8
Do you think the episode of sea waves increased in last 10 years?		
Didn't notice	54	6.75%
No	4	0.50%
Yes	742	92.75%
Do you think the episode of droughts increased in the last 10 years?		
Didn't notice	45	6%
No	14	2%
Yes	741	93%
Did you notice any change in rainfall patterns in the last 10 years?		
Didn't notice	12	2%
No	4	1%
Yes	784	98%
Do you think the increase in salinity caused a scarcity of fresh water?		
Don't know	74	9%
No	8	1%
Yes	718	90%
Climate change increases extreme weather		
Agree	155	19%
Don't know	7	1%
Strongly agree	638	80%
Climate change affects human health		
Agree	280	35%
Disagree	1	0%
Don't know	7	1%
Strongly agree	512	64%
Climate change affects agricultural production		
Agree	307	38%
Strongly agree	493	62%
Climate change initiates natural ecological crisis		
Agree	342	43%
Don't know	10	1%

Strongly agree	448	56%
Climate change causes sea-level rise		
Agree	247	31%
Don't know	7	1%
Strongly agree	546	68%
Climate change increases threat of infectious diseases		
Agree	369	46%
Disagree	14	2%
Don’t know	39	5%
Strongly agree	378	47%

The heading and subheading of each column is written in block letters and in bold. Each question about perception regarding climate change is also expressed in bold letters in the first column from the left.

Table 4 summarizes respondents' attitudes on climate change. Most respondents (98 percent) believed that human activities (rather than natural factors) are the primary cause of climate change. Among the 800 respondents, 627 (79 percent) agreed that both developed and developing countries should have a greater share of the responsibility for climate change, while 16 percent said the former should bear the responsibility. Most respondents (88 percent) stated that while climate change cannot be totally averted, it can be mitigated through endeavor, and an even bigger proportion (93 percent) indicated that they would join actual efforts to mitigate climate change if called upon. On a more positive note, 97 percent of them indicated that they are extremely willing to forego some personal gain to address present climate change-related problems. When asked if they consider environmental factors before making a purchase, the percentages revealed a very different picture, with 77 percent of respondents responding that they typically pay little heed to such information. Additionally, 49% of respondents stated that they had never had the opportunity to participate in any environmental protection activities related to climate change, followed by 42% who had previously participated in such activities.

Table 4 Participants’ Attitude towards climate change

Variables	**Frequency (800)**	**Percentage (100)**
Do you believe human activities (compared to natural factors) are the main cause of climate change?	Total	Percentage
No	7	1%
Uncertain	7	1%
Yes	786	98%
Do you think the developed countries or developing countries need to take a greater responsibility for climate change?		
Both	627	79%
The former	128	16%
The latter	4	1%
Unable to explain clearly	41	4%
Do you think climate change can be avoided?		
Absolutely	44	6%
It can be mitigated through endeavor	696	88%
Not possible	49	5%

Unable to explain clearly	11	1%
If someone called for it, would you join the actual efforts to mitigate climate change?		
No	2	0.25%
Uncertain	52	6.5%
Yes	746	93.25%
Are you willing to sacrifice some individual benefit to solve existing problems?		
Not very willing	21	2.625%
Not willing at all	2	0.25%
Very willing	777	97.125%
Do you consider any environmental factors before your purchase?		
I do check these information activities every time before buying	181	23%
Usually paid little attention to such information	619	77%
Did you participate in any environmental protection activities related to climate change ever before?		
Didn't get a chance	388	49%
No	76	10%
Yes	336	42%

The heading and subheading of each column is written in block letters and in bold. Each question about the attitude towards climate change is also expressed in bold letters in the first column from the left.

Table 5 compares respondents' knowledge of climate change by their age and highest level of education. In the multivariate study, education level and age were shown to be strongly linked with climate change knowledge. This suggests that when respondents are classified according to their age and education level, there is a statistically significant difference in their knowledge. Respondents with an undergraduate degree and those at the young age group (16-25) were more likely to have knowledge about climate change than others, presumably due to the knowledge gained through educational institutions and their effectiveness in obtaining information about climate change through technology.

Table 5 Relationship between socio-demographic variables and knowledge of climate change

Education Level	**Knowledge of Climate change**		**Percentage**		**Result of Chi square test**
	No	**Yes**	**No**	**Yes**	
Higher Secondary	3	60	37.5%	7.58%	χ^2 =21.5104
Postgraduate	1	90	12.5%	11.36%	*df*= 3
Secondary	1	7	12.5%	0.88%	*P*=.000082
Undergraduate	3	635	37.5%	80.18%	
Total	8	792	100%	100%	
Age-group	Knowledge of Climate change		Percentage		Result of Chi square test
	No	Yes	No	Yes	
Young (16-25 years)	3	727	37.5%	91.79%	χ^2 =96.1948
Early adulthood (26-40 years)	1	49	12.5%	6.19%	*df*= 3
Middle age (45-60 years)	3	15	37.5%	1.89%	*P*< 0.00001

Old age (>60 years)	1	1	12.5%	0.13%	
Total	8	792	100%	100%	

The table is divided into 2 sections, one section is for education level and the other is for the age group. In both sections, the heading and subheading of each column are written in bold. The row indicating the total frequency and percentages in each section is also expressed in bold letters.

4. Discussion

This study is a quantitative endeavor to measure the general public's knowledge, perceptions, and attitude toward climate change in Bangladesh. The bulk of participants were in their twenties and have a rudimentary degree of formal education. They possess extensive knowledge and comprehension of the occurrence, causes, and consequences of climate change. Additionally, they have a strong understanding of climate change and the affiliated diversity in severe weather events, temperature, rainfall, salinity, and sea level, along with the impact of these changes on human health and agriculture, as well as the occurrence of ecological crises and the spread of infectious diseases. Knowledge, perception, and attitude study had been previously conducted among university students and CDC health professionals in Philippines and China, respectively [7,8]. In Bangladesh, Knowledge, and perception study about climate change among university students and Knowledge and perception study about climate change and its impact on human health has been conducted in past [5,9]. In this study, the authors followed a somewhat identical method, but the sample size was bigger, more representative, and included more diversified population from Bangladesh. Over 95 percent of the 800 participants were aware of 'climate change,' which is a very promising indicator. They were also aware of the detrimental consequences of climate change. According to this study, most people who were aware of climate change cited mass media like television, newspapers, and teachers as their sources. Very few person reported hearing about climate change via non-governmental organization (NGO) workers, family members/relatives, and others. This demonstrates the importance of mass media and discussions with teachers in educational institutions. Service providers, such as NGO workers and elder members of families, require improved access to resources that provide knowledge of climate change such as television, internet etc. There appears to be a sectoral divergence in the government system's dealing with environmental concerns. In general, the analysis demonstrates that mass media coverage, particularly newspaper and television coverage, and opinion leaders, particularly teachers, are the primary sources of knowledge regarding climate change now.

The majority of the participants thought that climate change had occurred in the decade before the survey. This notion is borne out by statistics collected at the national level on Bangladesh's climate. According to data from the Bangladesh Meteorological Department (BMD), any 10-year period between 1951 and 2011 had greater temperatures and unpredictable rainfall than the prior ten years [10]. Additionally, a sizable proportion of respondents cited deforestation, rapid urbanization lifestyle change, and excessive carbon emissions as the primary causes of climate change, along with mentioning carbon dioxide, nitrogen oxide, carbon monoxide, carbon dioxide, and ozone as the primary suspects of the greenhouse effect. The participants' other less scientific explanations, such as black smoke from automobiles, may be explained by their poor education levels and limited exposure to scientific truths. In summary, this implies that they are aware of how anthropogenic actions in their immediate environment contribute to climate change and have expressed an interest in learning more about it.

The general public's perceptions of climate change are likewise aligned with the findings at the national scale. Over Bangladesh, the annual maximum temperature is growing by 0.09 °C, while the annual minimum temperature is rising by 0.10 °C. The yearly lowest temperature increases at a faster rate than the annual maximum temperature [11]. Over 95% of respondents reported noticing changes in rainfall patterns throughout the previous decade, which is corroborated by the fact that annual average rainfall over Bangladesh is rising by around 10.6 millimeters per decade, whereas monsoonal rainfall is falling by 7.6 mm per decade. The frequency of severe rainfall in June, July, and August has grown during the previous few decades [12]. Additionally, participants believed that extreme weather phenomena such as cyclones, sea waves, and droughts had risen in frequency during the previous decade. Cyclone frequency has been growing in each decade since the 1970s, according to the BMD database [13]. Another evidence-based study corroborates our participants' perceptions of salt intrusion, increased water salinity, and lack of fresh water because of this [14]. Participants unanimously agreed that agricultural food crop productivity had decreased over the previous decade and that climate change had had a detrimental effect on population health. Additionally, they concurred that climate change is to blame for an increase in the threat of infectious illnesses and the onset of natural ecological disasters. These discoveries have far-reaching consequences for food security and livelihoods. Concerning sea level rise,

the participants' perceptions are backed up by past records on sea level rise in 3 coastal districts. The results indicate that the mean annual water level has increased by 4.5 millimeters per year in about 20% of the overall area of these three districts, which is ascribed to global sea level rise caused by human activity [15,16].

When it comes to attitude towards climate change, most participants feel that human actions (rather than natural processes) are the primary cause. This is one of the study's most significant findings because it demonstrates that they are aware of how manmade activities in their nearby territory contribute to climate change. They believe that while the harm caused by climate change cannot be reversed, climate change may still be mitigated by effort. Additionally, they stated that both developed and developing nations must work cooperatively to combat climate change. LDCs such as Bangladesh are not entirely self-sufficient in terms of mitigating the harmful effects of climate change. Thus, considering present circumstances, this appears to be the most sensible strategy to addressing climate change. On a more positive note, a sizable proportion of participants shown a strong readiness to forego some personal gain to fix current environmental issues. However, when it came to everyday actions, the data revealed a different picture, as most respondents claimed that they paid little attention to environmental factors prior to making a purchase. This clearly demonstrates the need of increasing public knowledge about environmentally friendly products and the building of a green economy in Bangladesh. This discovery is especially beneficial for policy making and government planning. Additionally, most participants stated that they had never had the opportunity to participate in any environmental protection activities connected to climate change, which might be a result of the general public's lack of access to and enthusiasm for environmental conservation activities. This demonstrates a clear sectoral divide in the way the government system addresses environmental concerns, as unmistakably, environmental protection activities require increased promotion to reach out to and engage most of the Bangladesh's population, in order for these initiatives to be successful in mitigating the damage caused by climate change. In this study, young individuals (aged 16-25) on undergraduate level of education were more likely to have a stronger understanding of climate change than others. Additionally, other research found that respondents' understanding of climate change was highly dependent on their degree of education [8,9]. As a result of our study, it can be concluded that education and educational institutions are critical for improving awareness of climate change and associated adaptation concerns.

The research offers several strengths. Participants in the study were drawn from a wide range of climate change-prone regions. Climate-vulnerable places in Bangladesh might benefit from the findings of this study. Using these insights, researchers can devise new methods for changing people's and communities' behavior to better adapt to climate change and reduce the environmental problems it causes. A future cohort research might use these data as a starting point. The research also has a few drawbacks. In the first place, because the research was cross-sectional, causality cannot be established, and findings may not be extrapolated to other periods. A longitudinal study is essential here. In addition, the study relied on online self-reporting, which is prone to social acceptance bias as well as memory bias. Finally, the study adopted a snowball sampling approach that might be responsible for selection bias. As a result, a random sampling method should be used to conduct additional inquiry.

Abbreviations

- **BMD:** Bangladesh Meteorological Department
- **LDC:** Least Developed Countries
- **IPCC:** Intergovernmental Panel on Climate Change
- **CDC:** Centers for Disease Control and Prevention

5. Conclusion

The knowledge of climate change far exceeded the expectation (99 percent), and the general public's perception of altering climate was similarly greater (99.75 percent). Attitudes concerning climate change appear to depict a quite different image, as seen by the general public's lack of active engagement in environmental protection activities in Bangladesh. The public needs to be increasingly involved in such field-level actions to solve climate change-related environmental challenges. The level of education is a major factor in how people understand climate change and how it affects the surrounding environment. Based on these fundamental findings, policymakers may establish effective policies to safeguard the environment from the severe effects of climate change for the general population in Bangladesh and comparable LDCs. Educating children about climate change in schools might be a potential avenue for future study to safeguard future generations.

Compliance with ethical standards

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Preprint

An earlier version of the manuscript has been published as a preprint via Research Square [17].

Supplementary Materials

Supplementary material File. Questionnaire (English). The file contains the final structured questionnaire used in the survey, which has 35 questions in total, divided into four sections, aimed to collect qualitative and quantitative data from the study participants

Availability of data and materials

The author confirms that the data supporting the findings of this study are available within the article and its supplementary materials.

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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Statement of ethical approval

The Ethical Review Board (ERB) of Uttara Adhunik Medical College, Dhaka, Bangladesh, has authorized the study protocol.

Statement of informed consent

Before commencing the survey, written informed consent was collected from participants using the written consent note at the beginning of the Google form.

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