



Research article

Climate change impacts and adaptations on health of Internally Displaced People (IDP): An exploratory study on coastal areas of Bangladesh

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ABSTRACT

Every year thousands of people are being displaced in coastal areas of Bangladesh due to natural calamities associated with climate change, known as Internally Displaced Peoples (IDPs). Climate change adaptation measures play a significant role in coping with the alteration of climatic components, while various forms of barriers hinder the sustainability of adaptation. This research was conducted to understand the perception of IDPs on climate change impact on health in the coastal areas of Bangladesh, including the adaptation practices and barriers to the coping strategies. To fulfill the objective, 420 individual surveys were conducted randomly in two Sub-districts of Khulna district in Bangladesh. The findings reveal that the riverbank erosion and cyclones were the primary reasons for displacement, and the social relationships were hampered in the new places of living. Also, the temperature in summer and winter, and the rainfall intensity increased, whereas rainfall slightly decreased over the last ten years. Differences of opinion were identified about the effects of the changing climatic variables on the respondents' health between the previous and present locations. Despite practicing different adaptive strategies, the weak financial condition and a lack of access to health care information are mostly hindering the sustainability of adaptation. This research may help policymakers in taking proper initiatives to ensure sustainable adaptation practices in the coastal areas.

1. Introduction

Climate change creates a significant risk to the world, where the developing countries are facing extreme vulnerabilities due to the increasing frequency and intensity of disasters and extreme weather (Ahmed and Haq, 2017). Climate change and its related effects are realized through the changing pattern of temperature, rainfall, sea-level rise, and the alteration of extreme climatic indices (Field et al., 2014). The number of Internally Displaced People (IDP) is increasing as well due to the natural disasters, and climate change is accelerating these scenarios (Oloruntoba and Banomyong, 2018; UNHCR, 2016; Ahmed, 2018), and Brzoska and Fröhlich (2016) and EJF (2017) summarized that the number of environmental or climate change-induced displaced people is higher than political, and war refugees. Also, IPCC (2019) described that 150 million people might be displaced by 2050 because of climate change-induced consequences. Also, climate change-induced migration will be increased above the baseline levels in the next 40 years, which will happen in the developing nations (Webber and Barnett, 2010). Migrants and IDPs face extreme scarcity of human rights facilities

and high competition to have equitable access to resources, along with the impacts of rapid urbanization, water unavailability, less energy, poverty, and increasing intensity and frequency of disasters (Goodwin-Gill and McAdam, 2017; Türk, 2017; UNHCR, 2017). Besides, displacement or internal migration may lead to conflicts (Raleigh et al., 2008). Nevertheless, Brown (2008), Bardsley and Hugo (2010), and Raleigh et al. (2008) suggested that internal migration can be taken as an adaptation to combat the emerging effects of climate change.

Climate change is happening globally, with significant effects on life and resources (Cubasch et al., 2013; IPCC, 2010). Because the of geographical location and socioeconomic conditions of Bangladesh, the climate change-related push factors, e.g., sea-level rise, cyclones, flash floods, riverbank erosion, salinity intrusion, are increasing, for which ultimately the number of the displaced people is rising at an alarming rate (Hasnat et al., 2020; Hossen et al., 2019). It is projected that a mean sea level of 3 m will inundate 69% of the exposed areas (Alam et al., 2018). Besides, women, older people, adolescents, and children are most vulnerable in the coastal community in Bangladesh (Hasan et al., 2019; Kabir et al., 2016a,b). Also, climatic factors will increase the outbreak of

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various waterborne diseases like cholera, diarrhea, and vector-borne diseases such as dengue, malaria, associated with common health problems (Hossain et al., 2012; Costello et al., 2011; McCarthy et al., 2001). Following this issue, CCC (2009) summarized that, during the last ten years, climate-sensitive diseases, such as diarrhea, skin diseases, malaria, typhoid, malnutrition, aching, and heatstroke have been increasing. The agricultural sector is also being affected by the increasing rate of temperature and unpredictable rainfall in Bangladesh (Hossain et al., 2020; Wright et al., 2019; Mondal et al., 2012). On the other hand, the Government of Bangladesh has formulated the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009, and the Bangladesh Climate Change Trust Fund (BCCTF), but the resilience for reducing the devastating impacts of climate change in Bangladesh is still insufficient (Das and Hossain, 2017).

Furthermore, Bangladesh is one of the most vulnerable countries to climate change. It is predicted that by 2050, one in every seven people in Bangladesh will be displaced from their place of origin due to climate change (Khan, 2019). Also, Bangladesh has been ranked the 5th most vulnerable country in the world by extreme weather, where around 30 million people are living with vulnerability to cyclones, floods, droughts, riverbank and coastal erosion (Streatfield and Karar, 2008; Shaw et al., 2013). Focusing on the displacement aspect in Bangladesh, Zaman (1996) noted that due to natural disasters, e.g., floods, cyclones, riverbank erosion, about one million people are being displaced every year. Research conducted by Akter (2009) found that, on average, 25%, 3%, and 2% of the population are displaced because of floods, droughts, and cyclones, respectively, in Bangladesh. Besides, it is predicted that the increasing sea level will inundate 18% of the total land of Bangladesh, with effects on 11% of the entire population (Shamsuddoha and Chowdhury, 2009). The Government of Bangladesh has predicted that 20 million people may be displaced in the next 40 years due to the sea-level rise (Barua et al., 2017). Climate change-induced IDPs in Bangladesh have been trying to cope with the adverse scenarios of surroundings where different forms of barriers are hindering the adaptation to climate change in the coastal areas of Bangladesh (Berchin et al., 2017; Gray and Mueller, 2012).

Adaptation practices to climate change with natural and human-made systems are the consequences of coping with the present and future effects of climate change (Ayers et al., 2014). Adaptation is crucial for climate change in vulnerable countries like Bangladesh to promote adaptive capacity and minimize social vulnerability (Vij et al., 2018). Also, BCCSAP-2009 consists of 44 programs under six pillars and focuses on developing resilience of vulnerable communities by implementing the Community Based Adaptation (CBA) (MoEF, 2009). Along with the adoption of new crop varieties, tree plantation, development of financial status, and homestead gardening as an adaptation to climate change, migration is also considered to have a significant potentiality in Bangladesh (Hossen et al., 2019; Chowdhury et al., 2018; Alam et al., 2019). Improving the adaptive capacity is essential, and to some extent, migration is also considered as a way of adaptation to ensure a healthy life (Black et al., 2011; Brouwer et al., 2007; Pachauri and Meyer, 2014). Also, adaptation practices should be integrated with the participation of different levels of stakeholders to ensure a sustainable adaptation to climate change (Schmidt et al., 2014).

On the other hand, the diverse forms of obstacles, such as social, economic, environmental, and institutional barriers, damage the potentiality of adaptation and accelerate the vulnerability (Bishokarma and Sharma, 2013). Several studies (Runhaar et al., 2012; Monwar et al., 2018) identified that a lack of political will, lack of coordination among different stakeholders, scarcity of financial allocation, limited resources, and lack of awareness are considered as obstacles to sustainable adaptation. Moreover, social status and relations, religious practices, cultural issues are also hindering the adaptation from the perspective of health issues in Bangladesh (Fresque-Baxter and Armitage, 2012).

Because of the extreme events and disasters in the recent past, a vast number of people became homeless, resettled, and migrated inside the

country, and the coastal areas were severely affected (Sharmin and Naznin, 2013; Mehedi et al., 2010). Several studies are available on the impacts of climate change on different issues such as health, resources, human settlement, including the adaptation aspects to some extent on the coastal area of Bangladesh (Agrawala et al., 2003; Akter, 2009; Haque et al., 2013; Islam and Hasan, 2016; Islam et al., 2014; Kabir et al., 2016a, b); but research on impacts of climate change on the health of the resettled communities from the perspective of adaptation is not common. The number of IDPs is increasing, and it is vital to understand the effective adaptation measures against the impacts of climate change in the coastal areas of Bangladesh. Moreover, it is essential to understand the barriers to adaptation practices in the communities of IDPs in coastal areas of Bangladesh for facilitating the proper adaptations to climate change. This research will improve the knowledge of adaptation practices against the impacts of climate change and help to identify the obstacles that hinder the climate change adaptation practices of the resettled communities in the coastal zone of Bangladesh.

2. Methodology

The study was conducted following the mixed-method approach: a combination of qualitative and quantitative approaches. An intensive review of secondary literature was done before undertaking data collection.

2.1. Study area

Khulna is one of the coastal districts of Bangladesh, with an area of 4394.46 square kilometers and a population of 2334285 (Banglapedia, 2014). To meet the research objectives, among the nine Sub-districts of Khulna district, two Sub-districts: Batiaghata and Koyra were selected purposively as the study area (Figure 1).

2.2. Sample size and data collection

A total of 420 IDP households (210 from each Sub-district) (at 95% confidence level and $\pm 5\%$ precision level) were randomly selected from Batiaghata and Koyra Sub-districts among the IDP communities. A semi-structured open-ended questionnaire was used to conduct surveys, and a reconnaissance survey was done to understand the issues to analyze in this research.

For qualitative data, four Focus Group Discussions (FGDs) (one male group and one female group for each Sub-district) were conducted where 8–10 people participated in each FGD. Besides, 8 Key Informant Interviews (KIIs) were conducted with different stakeholders from government and non-government sectors working with climate change, migration, and adaptation issues with IDPs in Khulna, including local representatives from Batiaghata and Koyra Sub-districts. For conducting KIIs, a separate open-ended questionnaire was used. This questionnaire was prepared based on the reconnaissance survey, field visit, and expert opinion following the objectives of this research. Also, to identify the key informants, the purposive technique was applied to determine the experienced person in this field. The survey was conducted from May 2018 to December 2018.

In the case of ethical issues, appropriate informed consent was taken from the respondents and participants before interviewing the IDPs. In that form, it was clearly described that this study was conducted solely for research purposes, and the respondents were participating voluntarily. Besides, all of the responses in this research were used anonymously, and confidentiality was maintained adequately.

2.3. Data analysis

After collecting all data, the input of quantitative data in Excel was carried out very carefully and was checked before conducting the analysis. Quantitative data were analyzed using Statistical Package for the

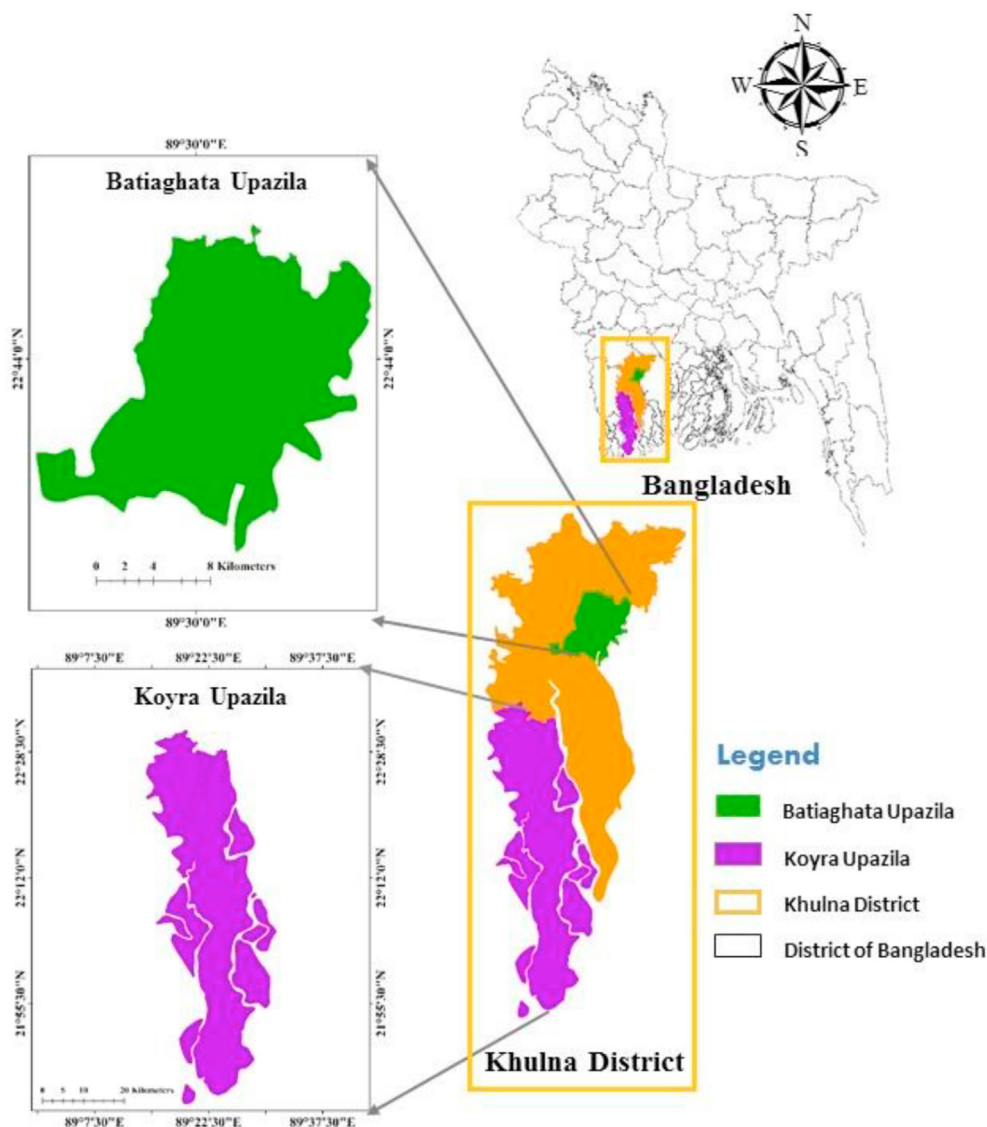


Figure 1. Map of Koyra and Batiaghata Upazila (Sub-district) in Khulna District (study area).

Social Sciences (SPSS) software (IBM SPSS 21, USA), and the univariate and bivariate analyses were conducted separately from the responses of the IDPs from the perspective of impacts of climate change and adaptation, including barriers to adaptation in the coastal areas in Bangladesh. Besides, qualitative data were summarized and appropriately analyzed, following the objectives of the research.

3. Result

3.1. Socioeconomic characteristics of the respondents

Among the respondents, 50% were male, and the rest were female (Table 1). The majority of the male (47.6%) and female (42.9%) respondents were from the 38–47 years old age group. The majority of the respondents from Batiaghata (38.1%) had primary level (1–5 years) education, whereas 38.1% of the respondents from Koyra had no schooling, and additionally, the same percentage of people also lacked primary level education. Also, among the total respondents, 69% percent of the respondents were Muslim (69%), and the rest of them (31%) were Hindu. Besides, in the case of personal monthly income, most of the respondents from Batiaghata (57.1%) and Koyra (61.9%) were found to earn equal or less than 2999 Bangladeshi Taka (BDT).

3.2. Reasons for displacements, and conditions of social services in the previous and present locations

The majority of the respondents (38.1%) highlighted the riverbank erosion as the most significant reason behind displacement (Figure 2), whereas 35.7% of the households identified cyclone as the second reason for being displaced from the place of origin. Qualitative findings showed that the majority of the IDPs were displaced from Uttar Betkashi Sub-districts of Khulna District, whereas some of the IDPs were also displaced from Mongla, Dacope, Shaymnagar, and Koyra Sub-districts. These designated areas are situated in the Khulna Division of Bangladesh. All of these areas are highly vulnerable to cyclone, riverbank erosion, tidal wave, and other natural disasters. People lost all of their belongings, including land, cattle, livelihood options, etc., due to the impacts of natural disasters, and riverbank erosion made them IDPs at massive scale. Significant loss of resources and damage to livelihood options were observed due to the occurrences of cyclone Sidr in 2007 and cyclone Aila in 2009.

After resettlement, the IDPs faced the realities of different social conditions and services in the new area of living. Among the various forms of opportunities and other social services in the destination places, most of the respondents (66.7%) stated that road communication was

Table 1. Socioeconomic characteristics of the respondents of the study area.

Characteristics	Total (%) N = 420	Gender		Sig.	Sub-district		Sig.
		Male (%) n = 210	Female (%) n = 210		Batiaghata (%) n = 210	Koyra (%) n = 210	
Sex							
Male	50	100	-	***	61.9	38.1	***
Female	50	-	100		38.1	61.9	
Age							
18–27	16.7	14.3	19.0	***	14.3	19.0	***
28–37	23.8	14.3	33.3		28.6	19.0	
38–47	45.2	47.6	42.9		52.4	38.1	
48–57	14.3	23.8	4.8		4.8	23.8	
Religion							
Muslim	69	71.4	66.7	***	52.4	85.7	***
Hindu	31	28.6	33.3		47.6	14.3	
Education (Years)							
No schooling	35.7	33.3	38.1	***	33.3	38.1	***
1–5	38.1	38.1	38.1		38.1	38.1	
6–10	14.3	9.5	19.0		9.5	19.0	
11–12	11.9	19.0	4.8		19.0	4.8	
Primary Occupation							
Housewife	19	-	38.1	***	19.0	19.0	***
Day labor	11.9	14.3	9.5		9.5	14.3	
Housemaid	11.9	-	23.8		-	23.8	
Fisherman	9.5	19.0	-		19.0	-	
Rickshaw puller	9.5	19.0	-		4.8	14.3	
Student	9.5	14.3	4.8		14.3	4.8	
Garment worker	9.5	4.8	14.3		4.8	14.3	
Farmer	9.5	19.0	-		14.3	4.8	
Worker in the seafood company	7.1	4.8	9.5		14.3	-	
Government sector	2.4	4.8	-		19.0	4.8	
Personal Monthly Income (BDT)							
≤2999	59.5	28.6	90.5	***	57.1	61.9	***
3000–5999	16.7	33.3	-		19.0	14.3	
6000–8999	21.4	33.3	9.5		19.0	23.8	
≥9000	2.4	4.8	-		4.8	-	
Household Monthly Income (BDT)							
1000–3999	7.1	-	14.3	***	-	14.3	***
4000–6999	54.8	66.7	42.3		61.9	47.6	
7000–9999	31.0	19.0	42.9		28.6	33.3	
≥10000	7.1	14.3	-		9.5	4.8	

***P < .001; **P < .01; *P < .05.

terrible in their previous location. Besides, 47.6% of the respondents stated that improved road communication exists in their present area (Table 2). Also, for sanitation facilities, drinking water supply, health care services, and cyclone shelters, most of the respondents replied positively that the standard improved in the present location, whereas it was bad or very bad in the previous locations. On the other hand, most of

the respondents (78.6%) identified that their social relationship was better in place of origin than it is at the present location of residence.

3.3. Perception of IDPs on the changing of climatic variables

Among the different climatic variables, the respondents in this research addressed their responses to the changes in temperature, rainfall, and cold in winter over the last ten years. According to most of the respondents (64.3%), the temperature was increasing rapidly over the last ten years, whereas one-third of the respondents identified that temperature was increasing slightly over the last ten years (Figure 3). Also, May to June ('Josto' month in Bengali) was identified as the hottest months by the highest percentage of the respondents (47.6%), which is usually hot, but Choitro (March–April) and Boishakh (April–May) months (in Bengali calendar) were recognized by 31.0% and 19.0% of the respondents as the hottest month in a year, respectively. On the other hand, all of the respondents (100%) agreed that their health was affected by the change in temperature at their present location.

Like temperature, perception of the IDPs also expressed the changing patterns of winter, rainfall, disaster frequency and intensity, and salinity

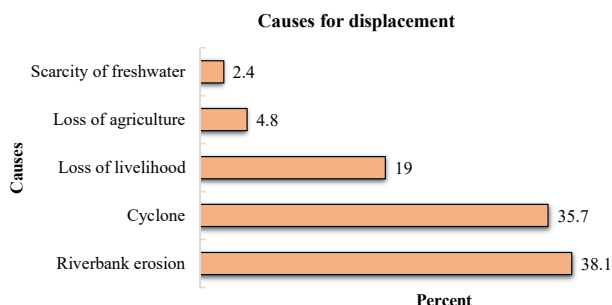


Figure 2. Reasons for displacement from the place of origin.

Table 2. Opportunities and Other Social Services in previous and present locations (N = 420).

Facilities		Very bad	Bad	Neither good nor bad	Good	Very good	Net Change
Road communication status	PvC	280 (66.7)	90 (21.4)	10 (2.4)	40 (9.5)	-	+
	PsC	-	140 (33.3)	80 (19.0)	200 (47.6)	-	
Sanitation Facilities	PvC	190 (45.2)	120 (28.6)	60 (14.3)	50 (11.9)	-	+
	PsC	10 (2.4)	50 (11.9)	50 (11.9)	300 (71.4)	10 (2.4)	
Drinking Water Supply	PvC	240 (57.1)	80 (19.0)	40 (9.5)	50 (11.9)	10 (2.4)	+
	PsC	-	100 (23.8)	190 (45.2)	120 (28.6)	10 (2.4)	
Health Care Service	PvC	270 (64.3)	130 (31.0)	20 (4.8)	-	-	+
	PsC	10 (2.4)	170 (40.5)	140 (33.3)	100 (23.8)	-	
Social Relationship	PvC	-	20 (4.8)	70 (16.7)	330 (78.6)	-	-
	PsC	10 (2.4)	70 (16.7)	310 (73.8)	30 (7.1)	-	
Cyclone Shelter	PvC	160 (38.1)	220 (52.4)	30 (7.1)	10 (2.4)	-	+
	PsC	-	20 (4.8)	20 (4.8)	360 (85.7)	20 (4.8)	

*PvC = Previous condition; **PsC = Present condition; + = Improved in present location; - = Decreased in present location.

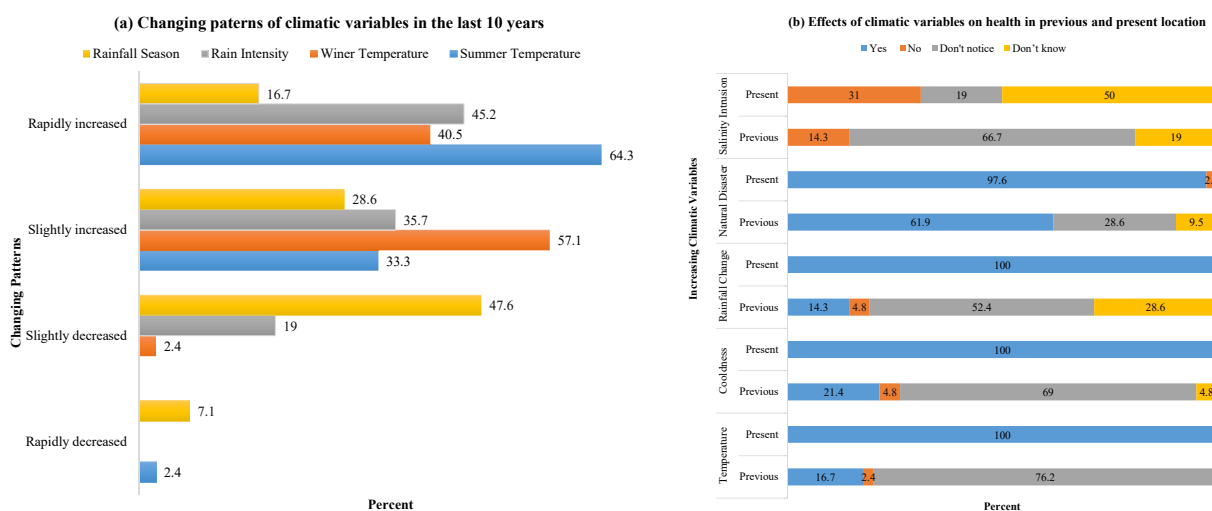


Figure 3. Perception of Internally Displace People (IDP) on (a) changing patterns of climatic variables in the last ten years and (b) impact of climatic variables in the previous ten years.

intrusion for the previous and present locations of residence. All of the respondents (100%) stated that the coldness in winter and rainfall in the rainy season have increased in the last ten years (Figure 3). Regarding the people's perception of the coldest month in a year, 'Magh' month (January–February) was identified by most of the respondents (78.6%) as the coldest month in a year. On the other hand, 57.1% of the IDPs perceived that the heavy rainfall occurred in Asar month (June–July). Besides, in the case of the impact of disasters on their health in the last ten years, 97.6% of the respondents identified that disasters affected their health in the present location, whereas 61.9% of the respondents replied positively for previous locations, respectively. In addition, the most identified disasters by respondents were cyclones, floods, storm surges, riverbank erosion, and tidal wave. Furthermore, most of the respondents (35.7%) said that the salinity intrusion had been increasing over the previous ten years. Besides, 66.7% of the respondents stated that the salinity intrusion affected their health in the previous location.

3.4. Impact of changing climate variables on health

The study found that the increase in temperature, rainfall, and disaster over the last ten years has created a direct burden to the IDPs' health. Several diseases and health problems were identified, and the rate of prevalence according to the IDPs' perception has been shown in Figure 4. Most of the respondents (71.4%) stated that the increasing intensity of the sun is causing their headache. Besides, people's perception

regarding the impact of temperature on health revealed that they were feeling a loss of energy, feeling weak, eyesight problems, skin burns, and back pain in both places, e.g., present residence and the place before displacement. Besides, 35.7% and 23.8% of the respondents replied that dryness of throat and chest pain was happening at their present location after displacement, respectively. Besides, 19% of the respondents thought that they were experiencing difficulty in breathing, and it was happening due to the increasing temperature in the present days, whereas none identified experiencing this issue before their displacement.

Furthermore, in the case of different types of health issues related to the changing extremities of coldness in winter, the IDPs identified several diseases for both places of residence and some only for the present location. Among the respondents, 61.9% said that arthritis was very common for them, and in recent winters, it appeared with more intensity than it did in the past. In this case, 14.3% of the respondents said that they had arthritis in the previous locations before displacement. Like arthritis, cold, crack in feet, and body pain was observed for both places, although there were noticeable differences in the perception of people regarding the previous and present locations. Besides, 40.5% and 35.7% of the respondents identified tonsil and cough as common diseases nowadays in their current locations, whereas none of the IDPs reported experiencing these problems at their previous place of living. In addition, 21.4% and 19% of the respondents stated that they were experiencing chest pain and fever because of the increasing intensity of winter.

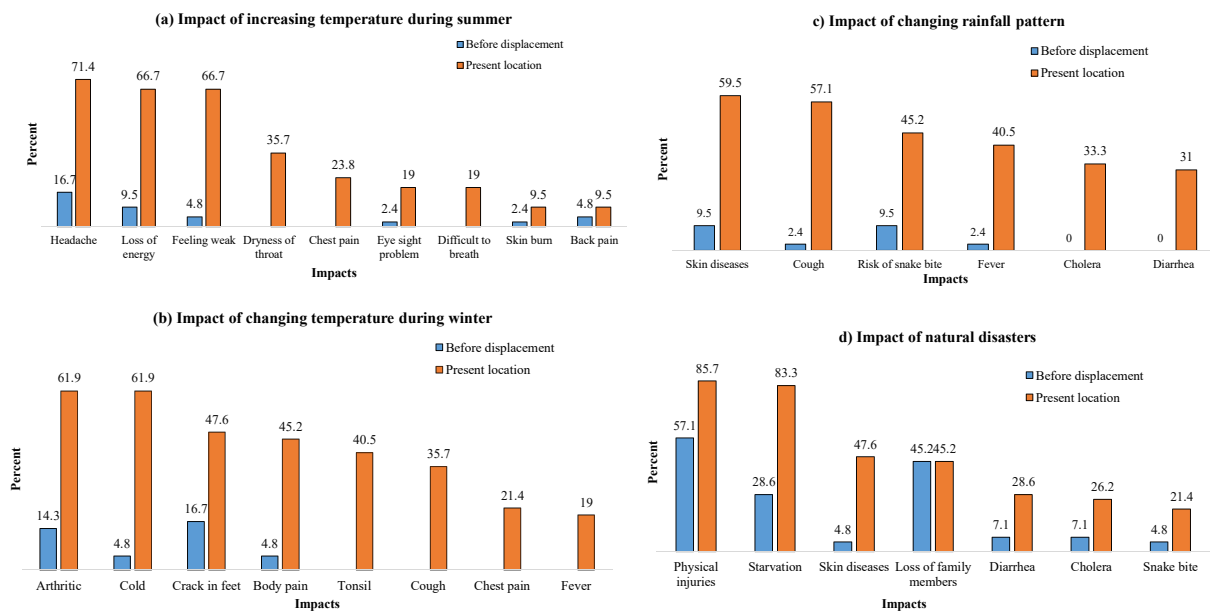


Figure 4. Perception of Internally Displaced Peoples (IDPs) on Impact of changing climate variables on health in the previous and present location: (a) increasing temperature during summer, (b) changing temperature during winter, (c) changing rainfall pattern, and (d) disasters.

Moreover, regarding the impacts of changing rainfall pattern on health in the previous and present locations, 9.5% of the respondents said that they were suffering from skin diseases in their previous locations, whereas 59.5% of them responded that they face skin diseases in the rainy season at their present locations (Figure 4). Like skin related problems, considerable differences were observed regarding the responses for previous and present locations of the IDPs on other health-related issues such as cough, risk of snakebite, and fever. Besides, 33.3% of the respondents identified cholera, whereas 31.0% replied that diarrhea was happening due to changing patterns of rainfall in the present location, and none identified these diseases at their previous locations.

The majority of the respondents (85.7%) identified physical injuries as one of the effects of disasters at their present area, whereas 57.1% of the respondents said disaster-induced injuries occurred in their previous area. Besides, significant differences in responses were recorded on the perception of the IDPs regarding different types of impact of disasters on health, e.g., loss of family members, cholera, skin diseases, and diarrhea.

3.5. Perception of IDPs on types of waterborne diseases and vector-borne diseases

The perception of IDPs was also varying for waterborne and vector-borne diseases at the previous and present location of residence. In the case of the intensity of waterborne diseases, the majority of the respondents (88.1%) said that the intensity of waterborne diseases increased at the present location than it was in the previous area. Among different kinds of waterborne diseases, 71.4% of the respondents mentioned that skin diseases were increasing at their current locations, whereas 52.4% of the respondents reported this for their previous locations (Figure 5). In addition, 52.4% of the respondents stated that diarrhea was one of the waterborne diseases at the present locations, while 50% of the respondents identified these diseases for their previous locations. Besides, differences in responses can also be noticed for other kinds of waterborne diseases, e.g., cholera, jaundice, and dysentery.

On the other hand, the majority of the respondents (88.1%) said that the intensity of vector-borne diseases in the present area than the previous place of residence. Furthermore, 40.5% of the respondents identified dengue as the frequent vector-borne disease in their previous area, while 71.4% reported dengue at their current location (Figure 5). In

addition, 40.5% of the respondents identified the sudden outbreak of Chikungunya as one of the frequent vector-borne diseases at their present locations, whereas none of the respondents identified it at their previous place.

3.6. Adaptation strategies by the respondents in the perspective of health

The respondents identified various forms of adaptation for different seasons, such as summer, winter, and rainy season, whereas additional coping strategies were also found in this study (Table 3). In regards to the adaptation practices to avoid sickness during summer, the majority of the

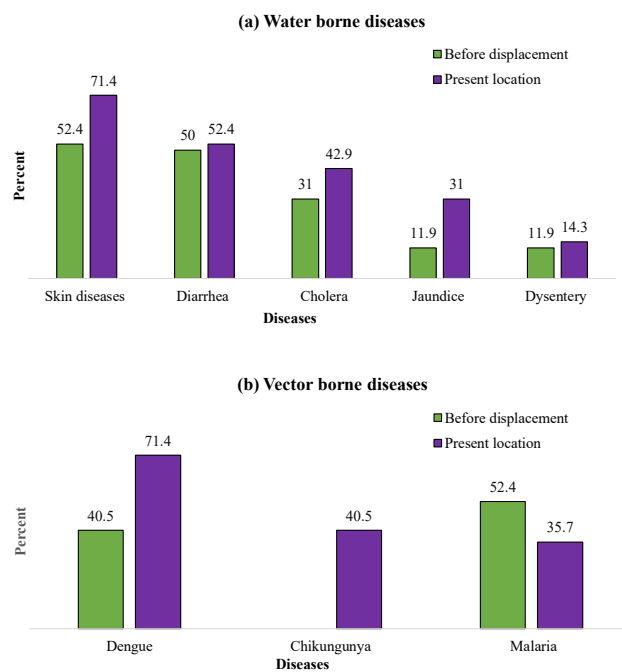


Figure 5. Perception of IDPs on the prevalence of (a) waterborne diseases and (b) vector-borne diseases due to climate change in the previous and present location.

Table 3. Perception of IDPs on different types of adaptation practices to adapt to climate change in the perspective of health[†].

Characteristics	Total (%) N = 420	Gender			Sub-District		Sig.
		Male (%) n = 210	Female (%) n = 210		Batiaghata (%) n = 210	Koyra (%) n = 210	
To avoid sickness during summer							
Drink more water compare than other time	78.60	61.9	95.2	***	66.7	90.5	***
Take oral saline	59.50	61.9	57.1		76.2	42.9	***
Do not get out at a higher temperature	50.00	42.9	57.1	**	52.4	47.6	
Use hand fan	50.00	52.4	47.6		42.9	57.1	**
Do not get out during noon	40.50	42.9	38.1		38.1	42.9	
Take rest under the tree	38.10	57.1	19.0	***	52.4	23.8	***
Finish all works earlier in the morning	35.70	19.0	52.4	***	42.9	28.6	**
Only go outside home unless urgent or necessary	28.60	23.8	33.3	*	23.8	33.3	*
Used to take extra rest at home	16.70	23.8	9.5	***	19.0	14.3	
Try not to sweat	7.10	4.8	9.5		9.5	4.8	
To avoid sickness during the rainy season							
Use mosquito net to prevent vector-borne diseases	97.60	100.0	95.2	***	100.0	95.2	***
Always be careful from snake	90.50	95.2	85.7	***	95.2	85.7	***
Clear the logged water beside the house	88.10	95.2	81.0	***	90.5	85.7	
Use rainwater for drinking	66.70	66.7	66.7		76.2	57.1	***
Try to stay in the house during rain	54.80	42.9	66.7	***	52.4	57.1	
Avoid pond and river water for drinking	45.20	52.4	38.1	**	47.6	42.9	
Use boiled water for drinking	35.70	33.3	38.1		42.9	28.6	**
Use Potassium alum for water purification	31.00	42.9	19.0	***	33.3	28.6	
Use polythene on roof	28.60	42.9	14.3	***	23.8	33.3	*
Storage foods	14.30	14.3	14.3		9.5	19.0	**
To avoid sickness during the winter season							
Use warm cloths	100.00	100.0	100.0		100.0	100.0	
Use oil and lotion to prevent skin diseases	95.20	100.0	90.5	***	95.2	95.2	
Take a bath with warm water	50.00	61.9	38.1	***	57.1	42.9	**
Drink more warm water	45.20	42.9	47.6		57.1	33.3	***
Use herbal medicine	31.00	28.6	33.3		28.6	33.3	
Do not go outside before the rising sun	19.00	19.0	19.0		23.8	14.3	*
Additional coping practices							
Discussed with neighbors about diseases	81.00	85.7	76.2	*	81.0	81.0	
Discussed with relatives	73.80	71.4	76.2		76.2	71.4	
Visit village doctors	73.80	81.0	66.7	***	66.7	81.0	***
Applied personal knowledge	45.20	47.6	42.9		42.9	47.6	
Visit health care center	40.50	33.3	47.6	**	38.1	42.9	
Discussed with people who suffered the same diseases	35.70	42.9	28.6	**	52.4	19.0	***
Take herbal treatment	14.30	9.5	19.0	*	19.0	9.5	**
Discussed with the NGO workers	7.10	9.5	4.8		9.5	4.8	

[†]Multiple Response; ***P < .001; **P < .01; *P < .05.

respondents (78.6%) replied that they drunk more water compared to the other times, whereas second-most of the respondents (59.5%) reported taking oral saline. In addition, the majority of the male (61.9%) and female (95.2%) respondents stated that they drunk more water compared to the other times. Furthermore, the minimum percentage of respondents from Batiaghata (9.5%) and Koyra (4.8%) mentioned trying not to sweat to avoid getting sick during summer.

Furthermore, during the rainy season, 97.60% of the respondents mentioned using mosquito nets to prevent vector-borne diseases. Also, 90.50% of the respondents stated that they were always careful about snakes, whereas 88.1% of the respondents drained the water beside the house during the rainy season to avoid sickness (Table 3). Also, 66.7% of the male and 81.0% of the female respondents used rainwater for drinking and drained the logged water beside the house, respectively. On the other hand, during winter, all of the respondents (100%) stated that they wear warm clothes. Also, 28.6% of the respondents from Batiaghata and 14.3% of respondents from Koyra used herbal medicines and did not go outside before sunrise, respectively.

Furthermore, despite practicing season based coping strategies, the IDPs also discussed some other additional adaptation practices that they follow to ensure a healthy life. Among the respondents, 81% said that they discussed with neighbors about their diseases, whereas 73.80% percent of the respondents said that they consulted with relatives and visited village doctors. Also, 81.0% of male and 66.7% of female respondents visited village doctors, whereas 52.4% and 19.0% of respondents from Batiaghata and Koyra, respectively, discussed with people who suffered from the same diseases.

From the qualitative findings, it found that the assurance of safe drinking water was one of the major concerns of the IDPs during the rainy season. In some cases, they used water treatment before drinking, such as using alum (*fitkiri*) and boiling water, whereas some of them stored rainwater for a few months. In some families, they did not take warm water for drinking or bathing as they thought that this step would increase the expenditure of fuelwood. Also, some of them considered the treatment practice of drinking water as one kind of burden. To some extent, some of the IDPs households had belief in the herbal medicines

too. Following this issue, one of the participants, Mrs. Sandha Rani, said that,

“...lotion and other manufacturing products were not affordable to me, as I did not have enough money... In some cases, I took herbal medicines, and our religious leader was one kind of herbal doctor. He was reliable. We felt it was safe to use herbal products.”

3.7. Factors hindering the health adaptation

Besides the different forms of adaptation practices, the IDPs also identified several types of barriers against adaptation practices (Table 4). Among the respondents, 92.9% suffered from the unavailability of money to take treatment, while 90.5% did not have access to health care information. Also, 85.7% and 71.4% of the male and female respondents, respectively, stated that social status hampered the adaptation process. Besides, 23.8% and 9.5% of the respondents from Batiaghata and Koyra, respectively, identified religious practices hindering the adaptation with climate change from the perspective of health.

Furthermore, qualitative findings depicted that the IDPs were most vulnerable because they were not economically strong enough to manage the treatments continuously or frequently. In Batiaghata, road communication was better than Koyra, but the education rate was not high enough in the IDPs community, and their access to information on health care services was not enough to increase the awareness from the perspective of health adaptation to climate change impacts. Following this issue, one of the participants, Mr. Ekram Hossain, said that,

“We had to visit a community clinic early in the morning. Doctors were not available every day in a health care center, where medicines were not available for treatment except for the basic oral saline.”

3.8. Ways to manage money for receiving health care

Although respondents faced different kinds of barriers, they adapted some measures to manage money to fulfill the financial needs regarding health care. The majority of the respondents (92.9%) took a loan from their relatives to receive health care (Figure 6). Besides, taking loans from the neighbors was the second most common (81%) way of managing money for treatment. Besides, 19% and 16.7% of the respondents said that they sold cattle and ornaments for health care, respectively. However, only 2.4% of the respondents took a loan from Non-Government Organizations (NGOs) to facilitate healthcare for their sickness.

On the other hand, qualitative responses showed that, due to a lack of financial support, almost none of them were willing to sell cattle as cattle provided a part of income for the family. Women in the IDPs community reared cow, goat, hen, or duck to contribute to the family income, which was the only property of women. They did not want to sell those to take

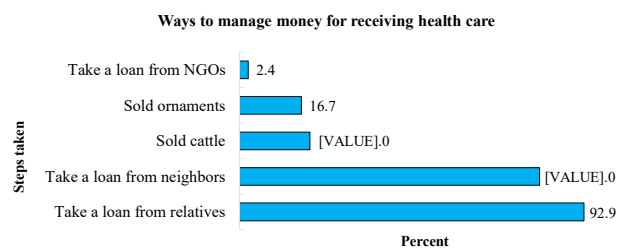


Figure 6. Perception of IDPs on ways to manage money for receiving health care.

treatment because they felt the immense financial crisis, and they did not want to prioritize their health above the family's finances.

4. Discussion

There are several indications of the severe impact of climate change on human health in Bangladesh due to the changing patterns of climatic variables, including the increasing intensity and frequency of disasters (IPCC, 2014; Haines et al., 2006; Vineis et al., 2011). Also, Amos et al. (2015) and Shahid (2010) summarized that maintenance of gender issues and identification of respondents from matured age are pre-requisite to understand the people's perception on climate change impact on the health of the IDPs, and differences between responses of male and female were noticed in this research too. Field observation in Batiaghata and Koyra also depicted that, there is a scarcity of income opportunities where the IDPs are most vulnerable due to a lack of social kinship and resources. Although some of them can manage income, their wages are not enough to maintain a family with financial flexibility, which influences their standard of living and health outcomes. All of these issues are the consequences of low income, which also matched with the findings of the research conducted by Ahmed and Haq (2019).

Riverbank erosion and cyclones are considered as the most common causes of the increasing displacement in Batiaghata and Koyra Sub-district. Moreover, the coastal areas in Bangladesh are susceptible to different forms of disasters like cyclones, tidal surges, riverbank erosion (Alam and Collins, 2010; Poncelet et al., 2010). Besides, Mallick and Vogt (2012), Martin et al. (2013), Rahman and Rahman (2015), Salauddin and Ashikuzzaman (2011) also stated that the internal migration is increasing in coastal areas of Bangladesh due to the impact of these types of disasters. On the other hand, Black et al. (2011) and Haque and Islam (2012) discussed that economic issues are significantly related to the internal migrations in developing countries. From this research, it was found that the loss of livelihood and damage to agriculture was accelerating the internal migration. Besides, after displacement as IDPs, significant changes were noticed in some of the social services and scopes of livelihood between the previous and present locations. Focusing on the social services, Afsar (2003), Farhana et al. (2012), and Rahman (2009) described that the vulnerable people tried to move in developed places

Table 4. Perception of IDPs on factors hindering the adaptation with climate change in the perspective of health[†].

Characteristics	Total (%) N = 420	Gender		Sig.	Sub-District		Sig.
		Male (%) n = 210	Female (%) n = 210		Batiaghata (%) n = 210	Koyra (%) n = 210	
Unavailability or lack of money to take treatment	92.9	90.5	95.2		85.7	100.0	***
Limited access to health care information	90.5	90.5	90.5		90.5	90.5	
Lack of qualified doctors near the resettlements	85.7	85.7	85.7		81.0	90.5	**
Poor social condition	78.6	85.7	71.4	***	81.0	76.2	
Cultural diversity	33.3	38.1	28.6	*	33.3	33.3	
Gender discrimination	26.2	9.5	42.9	***	23.8	28.6	
Differences in religious practices	16.7	4.8	28.6	***	23.8	9.5	***

[†]Multiple Response; ***P < .001; **P < .01; *P < .05.

where road communication, water availability, and have cyclone shelters, but the IDPs required time to settle with society and build up a good relationship. In some cases, conflict raises among the IDPs due to the scarcity of shared resources, and local settled communities do not allow access to their properties. Besides, including all of these issues, the migrants also consider family status and road communication conditions to confirm the destination and duration of migration (Martin et al., 2014).

According to this research, the IDPs identified changes either in increasing or decreasing trend for different climatic variables at their present location compared to their previous locations, which also coincides with the findings of Donat et al. (2014). Also, Alexander et al. (2006), and Kharin et al. (2007) stated that temperature, rainfall, and disasters are changing at an extreme level. Based on the alteration of climatic components, Shahid (2012) discussed that in recent years, Bangladesh had observed an increasing trend of rising temperature and frequency of different types of disasters, and a changing pattern of annual rainfall. Rahman and Lateh (2017) found that the mean temperature is rising at 0.20 °C per decade for Bangladesh, which expressed the increasing trend of temperature, and this also coincides with the perception of the IDPs on the increasing aspect temperature. Also, to express the probability of occurrence for natural disasters in Bangladesh, Ali (1999) predicted that cyclones and floods would rise due to the increasing trend of sea surface temperature and rainfall. Besides, sea-level rise is one of the consequences of climate change, where Bangladesh is going to face the severity of it (Karim and Mimura, 2008). Sea level rise is a slow onset process (Cahoon et al., 2006), and observing the sea level is difficult for local people over a short period. Most of the IDPs are not aware of the increasing rate of sea-level rise as it happens very slowly over a long time, and the local people are not familiar with these types of terms, but some can address this as they realize the changes in average water levels.

Moreover, in the southwest region of Bangladesh, more than 70% of the population is dependent on unprotected sources, such as rainwater, rivers, canals, and ponds as their source of drinking water (Islam et al., 2013; Hoque et al., 2016). Also, salinity intrusion in the drinking water of coastal areas is one of the consequences of climate change, which is accelerated by sea-level rise, cyclone, and excessive withdrawal of freshwater (M. H. Hasan et al., 2020; Vinei et al., 2011; Chowdhury and Hossen, 2017). In Batiaghata and Koyra, the majority of the respondents collect their drinking water from the shallow tube-wells, and they are facing scarcity of freshwater due to salinity intrusion, which agrees with the study conducted by Khan et al. (2011), and Akter (2009). Both of the cited studies also described that coastal areas of Bangladesh are suffering from the scarcity of drinking water because of the increasing level of salinity, waterlogging in coastal areas, and coastal erosion. Besides, Khan et al. (2011) noted that saline water intrusion in drinking water also increases different kinds of problems regarding maternal health.

Furthermore, the IDPs addressed several diseases, either short or long term diseases, as emerging health problems due to the increasing rate of temperature. Besides, in a study, Xu et al. (2012) and Patz et al. (2005) described that, due to climate change, different kinds of renal, respiratory, and skin diseases, including other infectious diseases, are appearing, where children are the most vulnerable. Similarly, O'Neill and Ebi (2009) identified that the increasing temperature would accelerate the allergic and infectious diseases, where mortality and morbidity of poor, children, women, and aged groups will be increased. In addition, the IDPs identified that impacts of cold on health at the present locations were higher than in the previous area, where various types of health impacts were listed. On this issue, Hajat et al. (2004) and Goodman et al. (2004) stated that because of extreme cold, skin, and other respiratory diseases, mortality rate will rise. Besides, Braga et al. (2002) highlighted that short-term mortality happened more for heat than cold temperatures.

Like temperature and coldness, the IDPs identified the changing of rainfall duration and frequency also to be responsible for skin diseases, cough, fever, cholera, diarrhea, and snakebite risk. The study conducted by Patz et al. (2005) found that the changing of rainfall patterns is also

responsible for human health problems. Disaster frequency and intensity are increasing, where different types of disasters, such as floods, cyclones, droughts, storm surges, salinity, riverbank erosion, cold wave, and a tidal wave, are increasing (Van Aalst, 2006). Due to the increasing rate of disasters, from the perspective of health, different sufferings are emerging in the coastal areas of Bangladesh, where the IDPs demarcated snakebite, physical injuries, loss of family members, cholera, skin diseases, diarrhea, and starvation were increasing among the IDPs community in the coastal areas. On this aspect, Rahaman et al. (2018) discussed that climate migrants are suffering from different climate-sensitive diseases, for example, diarrhea, cholera, dysentery, skin diseases, hypertension, asthma, malnutrition, malaria, cold fever, cough, reproductive disorder, jaundice, recurrent pregnancy loss, early or delayed menarche, urinary tract infection (UTI) and sexual un-interest. In the case of health impacts due to salinity intrusion, the IDPs were not aware of this issue because none was familiar with the facts about the effects of salinity intrusion on health. Furthermore, Ahmed and Alam (1999) predicted that 1-meter rise of sea level will happen by the middle of the twenty-first century, which shows the extreme vulnerability of the coastal areas of Bangladesh.

Moreover, in case of both water and vector-borne diseases, the IDPs marked waterborne diseases to be increasing at the present location compared to the previous place of residence, which was also valid for vector-borne diseases. Kovats and Akhtar (2008) said that the rate of the transmission scenarios of pathogens from vector to human would increase, which agrees with the findings of this research. Besides, the outbreak of waterborne diseases has been noticed due to the excessive rainfall and inadequate sanitation facilities (Auld et al., 2004). Moreover, climate change facilitates various types of vector and waterborne diseases, and the less developed countries like Bangladesh are the most susceptible to this (Pascual et al., 2002). The background work of psychological health, social cohesions, ethical and religious values is also considered a weakness in encouraging adaptation with changing environmental components (Fresque-Baxter and Armitage, 2012).

Adaptations in both physical and environmental approaches at different scales are pre-requisites to ensure sustainable life and livelihood against the impacts of climate change (Adger et al., 2005). During different seasons, e.g., summer, rainy, and winter, including during disaster, the IDPs have adopted various forms of adaptation strategies. Similarly, focusing on the measures taken by the IDPs during summer, Cheng and Berry (2013) also summarized the adaptation strategy for summer, which supports the adaptive actions to ensure safe health against increasing temperature. To cope with the changing scenarios of climate change health impacts, Haque et al. (2013) also suggested taking self-medication, applying traditional practices, visiting doctors, and discussing with relatives, friends, and neighbors. Following the importance of adaptation to ensure sustainable health against climate change, Ebi and Semenza (2008), Brouwer et al. (2007), and Sheffield and Landrigan (2011) highlighted the necessity of implementing proper adaptation mechanism for the next 20–30 years in the least developed countries like Bangladesh. Women, children, aged people are groups who require more attention for the adequate implementation of adaptation initiatives where school-based education should focus on climate change and health adaptation (Kabir et al., 2016a,b).

Understanding barriers to adaptation with climate change is crucial to establish proper coping mechanisms regarding health (Raihan et al., 2010). Among different forms of barriers, the weak financial condition is the most highlighted factor, which reduces the adaptation capacities (Moser and Ekstrom, 2010). Similarly, the financial crisis is one of the main obstacles for the IDPs in Batiaghata and Koyra areas because most of the respondents are working as day labor, a rickshaw puller, farmers, etc. Besides, Bishokarma and Sharma (2013) and Uittenbroek et al. (2013) summarized that both the formal and informal forms of social, economic, cultural, technical, physical and institutional obstacles reduce the capacity also increase the vulnerabilities. All of these factors ultimately hinder the adaptive capabilities to climate change, and all the

discussed issues coincide with the findings of this research. In addition to all of these challenges, environmental obstacles are also impeding the adaptation (Leichenko, O'Brien and Solecki, 2010).

Furthermore, water and sanitation-related obstacles also raise the frequency of different diseases, such as cholera, diarrhea, typhoid, and hepatitis. Besides, various vector-borne diseases such as malaria, dengue, asthma, will increase in the low-income areas (Martine and Fund, 2007; Rahaman et al., 2018). In the aspect of managing financial support regarding the health-related adaptation practices, Huang et al. (2011) identified that personal capacity and social relations are the essential components, which supported the findings of this research.

5. Conclusion

Every year a massive number of people are being displaced internally in Bangladesh, where coastal areas are the most vulnerable to climate change. Among the total population in coastal regions, the IDPs are considered as one of the most susceptible communities to natural disasters, including alteration of other climatic variables. Changing climatic components is imposing threats on the life of the people without differentiating the age, gender, and economic conditions of the IDPs, where women, children, and low-income generating groups are the most vulnerable. To ensure sustainable life, people are applying different coping mechanisms using their available appliances and practices against impacts of climate change regarding the alteration of temperature, coldness, disasters, and rainfall. Proper skills and training, along with the assurance of adequate livelihood opportunities, can ensure the appropriate management of the workforce from the IDPs communities in the coastal zones of Bangladesh. Government and non-government organizations should confirm social and economic supports to the IDPs communities to establish sustainable adaptation and reduce different forms of obstacles. Following this, further research may be conducted with more medical diagnosis mechanisms to understand the impacts of climate change on the health of IDPs in the coastal areas of Bangladesh.

Declarations

Author contribution statement

.Md. Arif Chowdhury and Md. Khalid Hasan: Conceived and designed the experiments.

Md. Arif Chowdhury, Md. Khalid Hasan, and Md. Robiul Hasan: Performed the experiments.

Md. Arif Chowdhury, Md. Khalid Hasan, and Md. Robiul Hasan: Analyzed and interpreted the data.

Md. Arif Chowdhury, Md. Robiul Hasan, and Tahmina Bintay Younos: Contributed reagents, materials, analysis tools or data.

Md. Arif Chowdhury: Wrote the paper.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

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