



Research Article

Holistic Cyclone Preparedness in a River Nomadic Community: A Study on Manta Community, Bauphal Upazila, Bangladesh

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Abstract

Cyclones remain a serious threat to Bangladesh's coastal communities. However, their impacts are not felt equally across all geographical locations and sociodemographic groups. The community of Bauphal, Patuakhali, is especially vulnerable because its livelihoods are tied to rivers, boats, fishing, and seasonal mobility rather than fixed land-based settlement. Our current study assists cyclone preparedness among the manta community. A cross-sectional survey of samples selected via the purposive sampling technique. Preparedness was examined using the Holistic Individual Preparedness model. Data were analysed through descriptive statistics and multilinear regression analysis. The overall holistic individual preparedness score was moderate ($M = 0.58$). The community was well prepared in dimensions like social integration and knowledge, while subsistence is the least developed dimension. Although multiple linear regression shows significance in the overall HIPM score, the sociodemographic predictors remained largely decoupled from the analysis of the variables. Overall preparedness, however, remains uneven, with notable gaps in formal training, cyclone shelter use, reliable communication sources, and protection of boats and fishing assets. The findings indicate that a community's preparedness is affected by economic and material vulnerability rather than information or social vulnerability. The study suggests a dimension-specific preparedness intervention instead of a uniform collective preparedness intervention. The study concludes that the preparedness among the manta community is shaped not only by awareness but also by poverty, mobility, livelihood insecurity, weak service access, and limited institutional inclusion. Prioritising material and asset-based support will help their sustenance and increase resilience to cyclones.

Keywords

Manta Community, HIPM, Cyclone Preparedness. River Dwelling Nomad

1. Introduction

Bangladesh is situated in a location where geography itself is the manufacturer of disaster risk. It is situated at the head of the Bay of Bengal, interlaced with deltaic river channels and

home to one of the densest coastal populations on earth. Bangladesh bears the full force of cyclones almost every year [1]. Over the past century alone, this unfortunate country has faced more than 50 cyclones, each one testing the limits of national

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preparedness and leaving behind trails of displacement and damage [2]. The 1970 Bhola cyclone's damage and death toll remains the harshest example of what an unprepared coastline can suffer, which reshaped both the disaster policy as well as the political history of the nation [3]. In the previous century, Bangladesh has built one of the most cited early warning systems and shelter networks available among the developing countries, anchored by a volunteer-driven system, known as the Cyclone Preparedness Program [4]. Communities defined by poverty, landlessness and river-dependent livelihoods continue to fall through gaps that national policy rarely captures [5]. Kalaiya Union of Bhauphal Upazila in the Patuakhali District sits at the sharp edge of the unevenness of the deltaic expansion. The area is framed by the Tentulia and Kalaiya rivers, opening directly into the Bay of Bengal. The area has been repeatedly identified as one of the country's most storm-exposed and socially fragile zones [6]. It is here, along the chars, canals and river mouths of southern Bangladesh, that the Manta community has built a way of life almost entirely disconnected from land. Frequently labeled as boat people, Manta households are born, raised and often die about the same vessels that serve as their home, workplace and only tangible assets [7]. Most of the people trace their existence back to riverbank erosion that swallowed their ancestral land, leaving boat dwelling as a forced adaptation passed down across generations [8]. That adaptation, however, has not been matched by protection.

Manta families frequently lacked a fixed address, national identity documents and birth registration. These obstructions quietly exclude them from the social protection schemes as well as from the disaster response network designed around the settled populations [9]. Media and development reports describe communities scattered along Rangabali, Golachipa, Dashmina and Bauphal, whose former citizenship and housing support remain incomplete even today [10]. This administrative invisibility carries direct consequences during a cyclone, as warning messages routed through mosque committee leaders and fixed addresses may simply never reach a household anchored mid-river [11]. Even where warnings do arrive, evacuation is rarely straightforward for the Manta community. A land-based family leaving home for shelter abandons the structure. Whereas a Manta family leaving its boat means abandoning their home, workplace, fishing gear and their only productive asset in one motion [12]. Livelihood protection and life safety pull in opposite directions, and the resulting hesitation delays departure or partial evacuation, putting them in

danger [13]. Women, children, older residents and people with disabilities experience an additional layer of difficulties simply moving between boats and embankments, particularly at night or in high wind and rain [14]. Owing to this compounded exposure, dedicated research on mantra cyclone preparedness remains thin. Existing coastal vulnerability studies in Bangladesh tend to centre on land-based households, leaving nomadic fishing communities on the margins of the literature and formal disaster planning [15]. Preparedness in a river-based housing context like this cannot be reduced to whether a household has heard warning; it has to be examined through the interacting lenses of knowledge, livelihood security, social integration, access to information, and psychological readiness. The Holistic Individual Preparedness Model (HIPM) offers exactly this multidimensional lens and has already demonstrated its value in assessing disaster preparedness elsewhere in Bangladesh [16-19]. Applying it to the Manta community of Bauphal Upazila provides a structured way to locate precisely where preparedness holds and where it breaks down. In doing so, interventions can be provided to a population that conventional cyclone preparedness frameworks were never built to reach. The purpose of this study is to assess the level of cyclone preparedness of the month communities in the Holistic Individual Preparedness Model (HIPM) and to identify the sociodemographic factors that shape this preparedness.

2. Methodology

2.1. Research Design and Study Area

This study followed a cross-sectional and quantitative survey-based approach to select a portion of the Manta community (18 years old and older) residing in Kalaiya Union, Bhauphal Upazila, in the Patuakhali District of Bangladesh as our study population. The survey was conducted through a face-to-face structured questionnaire survey. The field data enumerator used the local language of the study area to collect data. The study area is located in the southern coastal zone of Bangladesh and is affected by many hydro-meteorological hazards like cyclones, coastal floods, salinity intrusion and riverbank erosion. The Manta community was selected due to their floating residential patterns, their river-dependent livelihood, increasing risk of heavy rainfall, cyclone and storm surge, and limited access to basic resources [20].

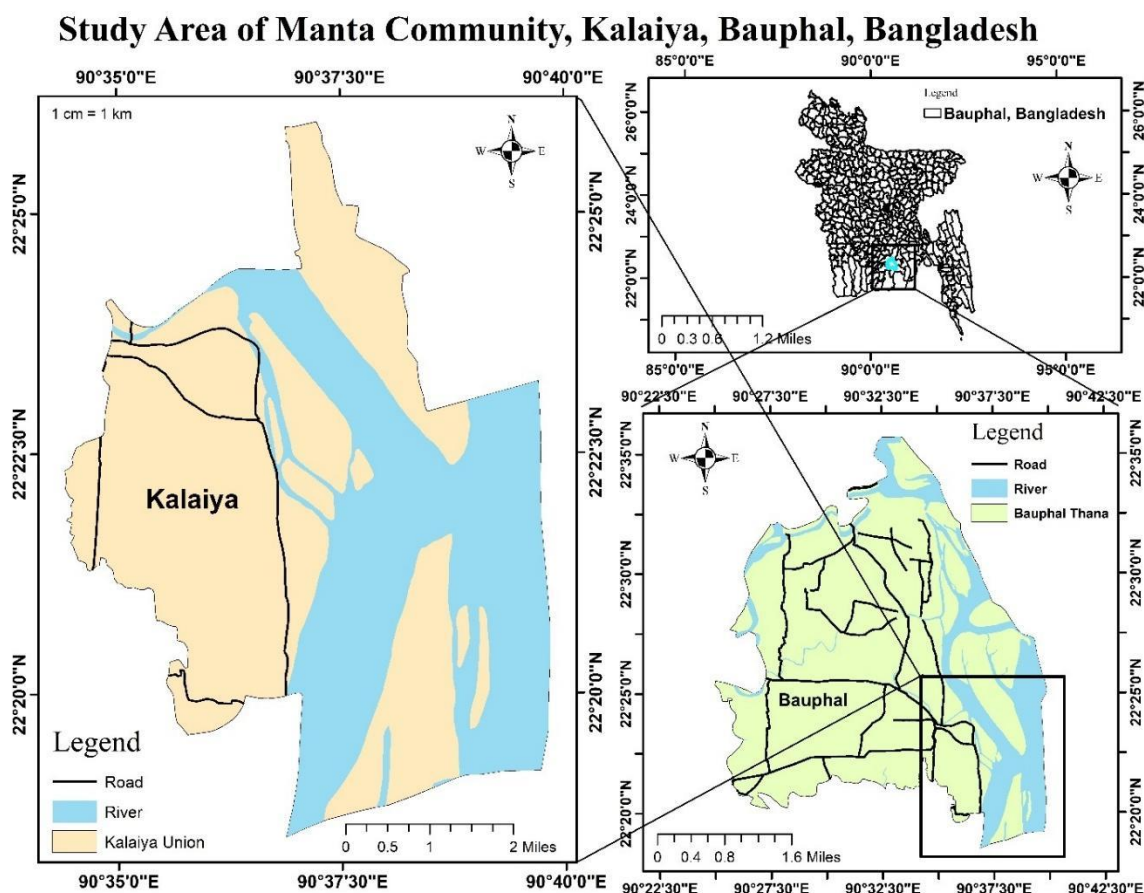


Figure 1. Study Area of Kalaiya Union, Bauphal, Bangladesh (Source: Authors).

Research on disaster risk in Patuakhali District identifies the area as extremely vulnerable to many hydrometeorological disasters and notes that Patuakhali resides near the Bay of Bengal and sits on the bank of the Tentulia river [6]. The area is where the Manta community, a marginalised river-dependent fishing groups dwell.

2.2. Study Population, Sample Size and Sampling Techniques

Owing to their nomadic lifestyle, they do not possess any official identification or permanent address. Preliminary information on their whereabouts and population quantity was collected from the Upazila Nirbahi Officer (UNO) office, local representatives, and community-level contacts during the primary survey. Approximately 63 Manta households were identified in the selected area. Considering an average of three eligible members per household, the estimated study population was calculated as: $N = 63 \times 3 = 189$ individuals.

Yamane's formula [21] was used to determine the required sample size at a 5% margin of error:

$$n = \frac{1}{1 + N(e)^2}$$

here,

n = required sample size

N = estimated study population

e = margin of error, 5% or 0.05

$$n = \frac{1}{\{1 + 189(0.05)^2\}}$$

$$n = \frac{189}{1.4725}$$

$$n = 128.3$$

$$n = 129$$

The study followed a purposive sampling technique, as the study population is mobile, specific, and living in remote locations. As there was no official population list available, based on the identified household data, the calculated sample size was 129 respondents.

2.3. Theoretical Framework

While this study focuses on the broader research paradigm of disaster preparedness and risk, it specifically employs the Holistic Individual Preparedness Model (HIPM) [22, 23] to assess the individual preparedness of the Manta, a river-dwelling community. Despite having several preparedness models, including Behavioural Theories [24], Technology Acceptance Models [25], and Risk Perception Model [26]. HIPM is more suitable due to its comprehensive approach addressing multi-

ple preparedness dimensions. Individual and household preparedness had been studied using fragmented, single approach behavioural theories. The Protective Action Decision Model (PADM) [27] theory describes how vulnerable communities process, internalise and operationalise warnings and information. The Protection Motivation Theory denotes preparedness behaviour as a response to the severity of the threat and confidence in one's own capability to withstand disaster [28]. The social vulnerability framework explains why proximity to hazard prone location increase household risk owing to the limited access to resources [29]. This HIPM model was utilised to evaluate the earthquake, flood, and cyclone preparedness in Bangladesh before [17-19]. The original HIPM model, conceived by Jensen and further developed by Nojang, was viewed as versatile and applicable for various disasters [22, 30]. They suggested that such a model should: (a) integrate observations from research on household and individual response and recovery; (b) foster cumulative assessment; and (c) permit quantification of diverse contexts.[30, 31]. The concept

of individual holistic preparedness indicates 'a state of readiness for a constructive response and rigorous recovery from a hazardous incident' [22]. The preparedness is shaped by six interconnected components: knowledge (being aware of potential hazards and effective response strategies); subsistence (having access to necessary resources during emergencies); loss minimisation (proactive measures to reduce the effects of hazards); social integration (community networks and social support systems); technology integration (leveraging technology to enhance preparedness); and mental and physical adaptive capacity (physical and psychological condition to withstand and recover from disasters) [17, 30]. It also makes the model highly relevant for assessing the preparedness of vulnerable marginalised groups, including those of the Manta in coastal Bangladesh. Our primary objective was to use the HIPM model to assess the individual cyclone preparedness condition of the water nomads of southern Bangladesh known as Manta and examining their indigenous knowledge and strategies.

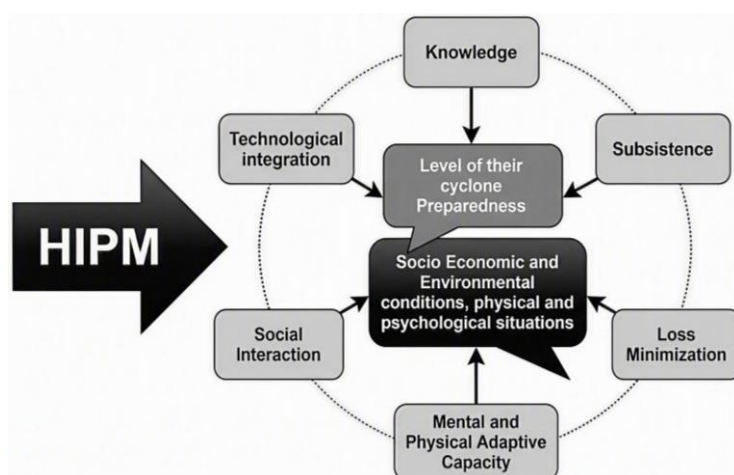


Figure 2. Holistic Individual Preparedness Model Adapted from Jensens' Model [24].

2.4. Questionnaire and Measurement

The questionnaire was developed based on the study objectives and adapted from the previous research on community preparedness assessment using the HIPM framework [16, 19, 25, 26]. The questionnaire included five sections: sociodemographic information, cyclone perception, and the six HIPM components (knowledge, subsistence, loss minimisation, social integration, technological integration, and mental and physical adaptive capacity). The questionnaire was developed using Kobo toolbox [27]. A pilot survey was conducted among 10 participants before the main study to assess the clarity, relevance, and feasibility of the questionnaire; data from the pilot survey were excluded in the final analysis. Internal consistency across each dimension was assessed using

Cronbach's alpha in R software. The reliability analysis produced a raw Cronbach Alpha value of 0.68, and a standardized Alpha value of .068. It indicates the study is in acceptable range of internal consistency for field work. Therefore, the revised questionnaire was used for main study. The sociodemographic information in the study consists of age, gender, marital status, education level, occupation status, household size, monthly household income, HIPM components. For HIPM components, the response was converted into a numerical score. Responses were coded as Yes = 1, Maybe = 0.5., and No = 0. Score for each component was calculated by summing the items scores under that component.

The collected data was reviewed carefully to ensure data integrity and consistency. Missing responses were excluded from the analysis. Data cleaning, processing, descriptive analysis, and graphical presentation were performed using R programming version 4.6.1. Cyclone preparedness was measured

using the six components of the Holistic Individual Preparedness Model (HIPM): knowledge, subsistence, loss minimisation, social integration, information/technology integration, and mental and physical adaptive capacity. As the number of items varies across inventories, the average score for each component was calculated by dividing the total score of that component by the number of items included in that component.

$$\text{Average score of the component} = \frac{\sum Si}{n}$$

where Si represents the score of the i th item, and n represents the total number of items in that component. The component scores were calculated as follows:

$$\text{Knowledge Score (KS)} = \frac{\sum Si}{n}$$

$$\text{Subsistence Score (SS)} = \frac{\sum Si}{n}$$

$$\text{Loss Minimisation Score (LMS)} = \frac{\sum Si}{n}$$

$$\text{Social Integration Score (SIS)} = \frac{\sum Si}{n}$$

$$\text{Technology Integration Score (TIS)} = \frac{\sum Si}{n}$$

$$\text{Mental Adaptive Score (MAS)} = \frac{\sum Si}{n}$$

After calculating the six component scores, the overall HIPM-based cyclone preparedness score was calculated by averaging the six component scores:

$$\text{HIPM Score} = \frac{\sum KS + SS + LMS + SIS + TIS + MAS}{6}$$

A higher HIPM score indicates better cyclone preparedness among the respondents, while a lower score indicates weaker preparedness. Descriptive statistics, including frequency, percentage, mean, and standard deviation, along with graphical representations, were used to summarise the findings. Inferential analyses were computed using R programming (version 4.6.1). Multilinear regression was used to examine the association between sociodemographic factors and the overall HIPM score-based cyclone preparedness.

2.5. Ethical Considerations

The study obtained approval from the ethical clearance committee at the Bangladesh University of Professionals. Informed consent was obtained from participants before administering the questionnaire, and no incentives were offered to encourage participation in the survey. The field data was collected, maintaining a respectful attitude towards the community's culture and beliefs. The study also obtained approval from the local government representatives, the Upazila Nirbahi Officer, before approaching the community. The study maintained the respondent's confidentiality and anonymity clause, concealing the identifying information.

3. Materials and Methods

3.1. Sociodemographic Profile of Sample Population

The final sample consisted of 113 adult respondents. 16 respondents aged below 18 years were excluded to align with the adult eligibility criterion described in ethical clearance.

Table 1. Sociodemographic characteristics of respondents ($n = 113$).

Component	Category	Frequency	Percentage
Age	18-25	19	16.81
	26-35	29	25.66
	36-45	24	21.24
	46-55	22	19.47
	Above than 55	19	16.81
Boat Type	Engine-driven boat	57	50.44
	Wooden boat	55	48.67
	Landless	7	6.19
Boat/Land Ownership	Own boat and/ land	72	63.72
	Rented boat	33	29.20

Component	Category	Frequency	Percentage
Education Level	No formal education	71	62.83
	Primary education	38	33.63
	Secondary or higher	4	3.54
Gender	Female	42	37.17
	Male	70	61.95
Marital Status	Married	88	77.88
	Single	24	21.24
	Widowed	1	0.88
Occupation	Day laborer	1	0.88
	Fishing	106	93.81
	Housewife	3	2.65
	Other/Student	3	2.65
Household Size	5 or less	74	65.49
	More than 5	39	34.51

BDT = Bangladeshi Taka (currency) and 1 USD = 122.86 BDT

(Table 1) shows the sociodemographic characteristics of the sample population of Manta Community in Bauphal, Patuakhali. The result shows that the respondents are fairly distributed across various sociodemographic factors. The large fraction of respondents are aged 26-35 years (25.66%), followed by the age group of 36-45 years (21.24%), 46-55 years (19.47%), and 18-25 years (16.81%). This income status signifies the economic vulnerability of the Manta. Access to education remains severely restricted due to their highly mobile lifestyle. 62.83% of the respondents are completely illiterate, and 33.63% of them received only primary education, leaving the remaining 3.54% of the respondents with a secondary or higher secondary degree. Occupation data clearly dictates that the community is heavily (93.81%) dependent on single income sources such as fishing. Their living condition is influenced by the ownership of assets like land and / boats. 62.73% of the respondents own land and/boat. Living in boats increases their risks to hazards like cyclones and storm surges. Their marital status demonstrates that most of the sample population are married (77.8%). Most of the respondents (65.49%) reported on having a family of 5 or fewer members.

3.2. Disaster-related Information

This study evaluates the extent of cyclone preparedness within the manta community in the remote areas of Bauphal Upzila. Our research demonstrates that 68.14% of the participants had previous experience of facing a cyclone (Table 2). However, there is a substantial vulnerability due to a lack of cyclone preparedness. Only 53.10% of the sample population

receives cyclone early warning. In comparison, 69.91% receive information via local leaders or networks and 60.18%. Participants responded to receive reliable warnings via technology. Although the Cyclone Preparedness Programme (CPP) of Bangladesh has been working relentlessly for decades to ensure the coastal community receives the information in time, the study finds otherwise in the case of Manta [4]. 46.02% of the respondents know how to protect their household items from cyclones.

3.3. Individual Cyclone Preparedness

Table 2 shows Manta communities, households, and cyclone preparedness. The respondents from the Manta community show a positive response to having previous experience with cyclones. A substantial proportion (46.02%) demonstrate knowledge of household asset protection. Another crucial finding of the study indicates 59.02% of the respondents cannot differentiate between different cyclone signals. This specific finding, coupled with the inability to identify early cyclone signs, threatened their safety during the cyclone. Lack of early warning leaves the families with little time to prepare or evacuate, which led to the loss of lives and assets [28]. The findings reveal that despite being vulnerable to such coastal disasters, the community is yet to receive any cyclone preparedness drill, according to 66.37% of participants.

Our research also shows that the majority (68.14%) do not have any alternative livelihood options. Just a few of them (22.12%) responded to having some medical supplies. The

study shows moderate preparation for financial recovery during a disaster. A mere number of the respondents reported to store food and water for emergency situations. For a community that lives their whole lives aboard boats, it is apparent

from their response (42.8%) that protecting their boats remains a high priority.

Table 2. HIPM item-level responses organised by dimension (n = 113).

Dimension	Question	Re- sponse	Fre- quency	Per- centage
Knowledge	Do you have previous experience of facing a cyclone?	May be	19	16.81
		No	17	15.04
		Yes	77	68.14
	Do you know how to protect important household items before a cyclone?	May be	29	25.66
		No	32	28.32
		Yes	52	46.02
	Do you know the early signs of an approaching cyclone?	May be	22	19.47
		No	12	11.50
		Yes	78	69.03
	Do you know the location of the nearest cyclone shelter?	May be	25	22.12
		No	37	32.74
		Yes	51	45.13
	Do you know the meaning of different cyclone warning signals?	May be	22	19.47
		No	32	28.32
		Yes	59	52.21
Subsistence	Have you participated in cyclone preparedness drills or training?	May be	21	18.58
		No	75	66.37
		Yes	17	15.04
	Do you have additional livelihood income to support your family after disasters?	May be	20	17.70
		No	67	59.29
		Yes	26	23.01
	Do you have basic medical supplies at home for emergency use?	May be	26	23.01
		No	62	54.86
		Yes	25	22.12
	Do you have savings or emergency cash for disasters?	May be	25	22.12
		No	58	51.33
		Yes	30	26.55
	Do you keep clean drinking water reserved for emergencies?	May be	28	24.78
		No	50	44.25
		Yes	35	30.97
	Do you store dry food for use during cyclones?	May be	20	17.70
		No	63	55.75

Dimension	Question	Re- sponse	Fre- quency	Per- centage
Loss Minimization	Do you minimize the loss of your boat during cyclones?	Yes	30	26.55
		May be	24	21.24
		No	41	36.28
	Do you receive cyclone early warning messages?	Yes	48	42.48
		May be	27	23.89
		No	26	23.01
Social Integration	Do you shift your family to a cyclone shelter during cyclone events?	Yes	60	53.10
		May be	22	19.47
		No	62	54.87
	Do you have close relatives or friends nearby who can help during a cyclone?	Yes	29	25.66
		No	39	34.51
		Yes	74	65.49
Technological Integration	Do you receive cyclone information through local leaders or social networks?	No	34	25.56
		Yes	79	69.91
		No	31	27.43
	Do you think strong social relationships help you recover faster after a cyclone?	Yes	82	72.57
		No	28	24.78
		Yes	85	75.22
Mental and Physical Adaptive Capacity	Do you trust local information sources more than outside media?	May be	24	21.24
		No	21	18.58
		Yes	68	60.18
	Can you receive reliable, timely cyclone warnings via technology?	May be	43	38.05
		No	20	17.69
		Yes	50	44.25
Technological Integration	Do you have a reliable way to contact family after a cyclone?	May be	31	27.43
		No	45	39.82
		Yes	37	32.74
	Is mobile network available in your area during the cyclone?	May be	46	40.71
		No	23	20.35
		Yes	44	38.94
Mental and Physical Adaptive Capacity	Do you believe you and your family have the inner strength to recover from cyclone damage?	May be	43	38.05
		No	18	15.93
		Yes	52	46.02
	Do you feel calm and capable of making good decisions when a cyclone warning is announced?	May be	36	31.86
		No	25	22.12
		Yes	52	46.02
Mental and Physical Adaptive Capacity	Does the memory of past cyclones make you feel fearful about future storms?	No	25	22.12
		Yes	52	46.02

The study respondents (65.49%) show a greater social support system of friends and relatives, as they (72.57%) believe having strong social bonding enables them to recover faster. Risk communication via electric media is a positive response; the CPP and government are focusing on it right now [29]. Having an effective option to connect with their family is considered a challenge since mobile network disruption is common during stormy weather. Having a strong social support system expedited the recovery from the traumatic experience of cyclones. Even though the memory of previous experience with cyclones makes the community fearful, it is reported by 46.02% of the respondents that they can take sound decisions hearing a cyclone warning.

The reliability test of HIPM dimensions using Cronbach's

alpha shows consistency across the six HIPM dimensions (Table 2). The subsistence ($\alpha = 0.79$) and technological integration ($\alpha = 0.70$) both show good reliability. Social integration ($\alpha = 0.69$) and knowledge ($\alpha = 0.61$) were at an acceptable level. On the other hand, mental adaptation showed moderate reliability ($\alpha = 0.55$). One component within the mental adaptation dimension, 'Does the memory of past cyclones make you feel fearful?' was kept in its original non-reverse-coded direction as it correlated positively rather than negatively with the other two items in the dimension. The loss minimisation dimension shows the least consistency ($\alpha = 0.20$), as its three items capture largely independent behaviours rather than single one.

Table 3. Mean and standard deviation of HIPM dimensions ($n = 113$).

Dimension	Mean	SD
Knowledge	0.60	0.23
Subsistence	0.37	0.31
Loss Minimisation	0.51	0.26
Social Integration	0.71	0.33
Technological Integration	0.65	0.31
Mental Adaptation	0.62	0.28
Overall HIP	0.58	0.16

The mean score (Table 3) of different dimensions on a scale of 0-1 ranged from 0.37 (subsistence) and 0.71 (social integration). It shows an overall mean HIP score of 0.58 ± 0.16 . Notable is the social integration, which was the most strongly developed dimension, followed by technological integration ($M = 0.65$). Next is the technological integration ($M = 0.65$), closely followed by mental adaptation ($M = 0.62$). Among the six dimensions score, subsistence indicated the weakest dimension, followed by loss minimisation ($M = 0.51$). The findings indicate that the Manta community was better equipped in social and psychological dimensions compared to subsistence.

3.4. Relationships among HIPM Dimensions

Our analysis (Table 4) shows a moderate to strong correlation

among all six dimensions and with the HIP score (Spearman's $r = 0.42-0.63$), which is consistent with HIP being their composite score. However, the internal correlation between each dimension showed a weaker and uneven connection compared to previous HIPM studies [16, 17, 18, 25]. The subsistence dimension shows a negative correlation with social integration, and technological integration ($r = -0.05$), ($r = -0.04$), and near-zero correlation with mental adaptation scoring ($r = 0.03$). The findings suggest that rather than representing a single underlying trait, the material, psychological, and social preparedness functions as a separate independent unit. The follow-up analyses, which modelled subsistence (Anova, $p = 0.007$). This pattern was explained by the boat and/land ownership status later. However, the subsistence showed no relation with the social integration, technological integration, and mental adaptation dimensions despite scoring $p > 0.35$.

Table 4. Spearman correlation matrix among HIPM dimensions and overall HIP score ($n = 113$).

Dimension	Knowledge	Subsistence	Loss Min.	Social Int.	Tech Int.	Mental Adapt.	HIP
Knowledge	1.00	0.37	0.14	0.27	0.20	0.15	0.56

Dimension	Knowledge	Subsistence	Loss Min.	Social Int.	Tech Int.	Mental Adapt.	HIP
Subsistence	0.37	1.00	0.26	-0.05	-0.04	0.03	0.42
Loss Minimization	0.14	0.26	1.00	0.23	0.24	0.37	0.63
Social Integration	0.27	-0.05	0.23	1.00	0.20	0.22	0.57
Technological Integration	0.20	-0.04	0.24	0.20	1.00	0.26	0.57
Mental Adaptation	0.15	0.03	0.37	0.22	0.26	1.00	0.57
Overall HIP	0.56	0.42	0.63	0.57	0.57	0.57	1.00

Note: Subsistence shows near-zero or negative correlation with Social Integration, Technological Integration, and Mental Adaptation, discussed further next sections.

3.5. Factors Predicting Each HIPM Score and Overall HIP Score

Before interpreting the regression's findings, the model assumptions for the overall HIP score were analysed (Table 6).

The variance inflation factors (VIF) for all predictors ranged from 1.15 to 1.74, showing no multicollinearity [30]. Model residual did not notably deviate from normality Shapiro-Wilk, ($W = 0.989$, $p = 0.496$). The Breusch-Pagan test revealed zero evidence of heteroscedasticity ($BP = 13.03$, $df = 15$, $p = 0.600$). These results supported the validity of the multiple linear regression shown in our study.

Table 5. Associated variables with the six HIPM dimensions and overall HIP score ($n = 113$).

Variable	Category	Knowledge	Subsistence	Loss Minimization	Social Integration	Technological Integration	Adaptive Capacity	HIP
Age	18-25 Years	Reference	Reference	Reference	Reference	Reference	Reference	Reference
	26-35 Years	-0.05	-0.01	0.09	0.03	-0.07	0.02	0
	36-45 Years	-0.11	0.01	0.09	-0.13	-0.13	-0.01	-0.04
	46-55 Years	-0.1	0.23*	0.18*	0	0.08	0.13	0.09
	More than 55 Years	-0.07	0.05	-0.01	-0.08	-0.3**	-0.03	-0.07
Gender	Female	Reference	Reference	Reference	Reference	Reference	Reference	Reference
	Male	-0.01	-0.02	-0.06	0.02	0.06	-0.02	-0.01
Marital Status	Married	Reference	Reference	Reference	Reference	Reference	Reference	Reference
	Single	-0.03	-0.06	-0.16**	0.1	-0.14	-0.08	-0.06
Education Level	No formal education	Reference	Reference	Reference	Reference	Reference	Reference	Reference
	Primary	0.02	0.12	0.03	0	0.01	-0.05	0.02
	Secondary or Higher	0.02	0.32*	0.24	0.17	0.1	-0.02	0.14
Occupation	Day laborer	Reference	Reference	Reference	Reference	Reference	Reference	Reference
	Fishing	-0.41	-0.37	0.09	0.69	0.44	-0.24	0.03

Variable	Category	Knowledge	Subsistence	Loss Minimization	Social Integration	Technological Integration	Adaptive Capacity	HIP
Household Size	Housewife	-0.41	-0.39	-0.1	0.85*	0.05	-0.57	-0.09
	Other/Student	-0.68*	-0.51	-0.44	0.37	0.18	-0.54	-0.27
	Household Size	0.02	-0.03	-0.06*	0.02	0.05	-0.03	-0.01
	Landless	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Boat and/Land Ownership	Own Boat/Land	0.13	0.29*	-0.05	-0.22	0.15	-0.14	0.03
	Rented Boat/Land	0.12	0.31*	-0.09	-0.22	0.11	-0.12	0.02
Boat Type	Engine-driven boat	Reference	Reference	Reference	Reference	Reference	Reference	Reference
	Wooden Boat	-0.01	0.08	0.04	0	0.04	-0.03	0.02

β = Beta (Coefficient); * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Multivariate regression analysis showed which sociodemographic information significantly influences the six HIPM dimensions as well as the overall HIP score. The study analyses indicated no individual predictors showed statistical significance (all $p > 0.05$) in the overall HIP score. However, despite zero statistical significance by predictors, the overall model showed a statistical significance ($F = 1.83$, $p = 0.034$, adjusted $R^2 = 0.095$). This indicates that the variables were collectively predictive rather than being independently dominant.

Regardless of subsistence showing a close to zero or negative correlation with other dimensions, owning a boat and/lands significantly predicted subsistence in both 'own' and 'rented' categories. Owning or renting a boat and/ land showed comparatively higher scores than the landless reference groups ($\beta = 0.29$ - 0.31 , $p < 0.03$). The age range of 46-55 years ($\beta = 0.23$, $p = 0.023$) and having secondary education or higher education ($\beta = 0.32$, $p = 0.047$) significantly predicted subsistence as well. Loss minimisation was significantly predicted by being in the age group of 46-55 years old ($\beta = 0.18$, $p = 0.038$), being single ($\beta = -0.16$, $p = 0.010$), and household size ($\beta = -0.058$, $p = 0.019$). The findings indicate that having a large family shows lower minimisation scores. Being above 55 years of age significantly ($\beta = -0.29$, $p = 0.006$) yet negatively predicted technological integration. The social integration and mental adaptation showed no significant predictors. Occupation status showed significance; however, the result was based on a subgroup of 3 respondents.

4. Discussion

The dimension pattern that has been observed in this research shows similarity with the findings of another study

conducted on the fishing community of Shah Porir Dwip [16]. Both studies showed comparatively higher scores in knowledge and social integration and a weaker subsistence levels. The two communities share similar occupations, yet demographically distinct characteristics. The relationship between gender and preparedness is predicted to be less consistent, yet another study on HIPM reported a significant correlation between gender role and household preparedness [19]. This distinction suggests that gendered influences on disaster preparedness vary across distinguished hazards and occupations, since Manta's occupational homogeneity (93.8% fishing), regardless of gender, may negate a gender effect on the result. The gender influence on preparedness is apparent at the point of taking active decisions regarding evacuation and shelter use rather than the household-level level knowledge and resource inventories the HIPM measures. A research review of the evacuation behaviours across four major Bangladeshi cyclones documented perpetual gender-specific barriers to cyclone shelter use. These barriers influence the decision to evacuate, not the knowledge score that the HIPM measures beforehand, which may explain why the current study finds little gender effect on evacuation behaviour.

The lower rate of disaster drill participation is not a unique finding, since another study on the fishing population [16] also supports it. This study found that training-based knowledge, such as understanding warning signals, falls short of experience-based knowledge recognising early warning signs. A study by [31] on the evacuation decision behaviour across cyclones Sidr, Aila, and Komen found that the relationship between warning time and evacuation is counterintuitive and non-linear. A comparatively high knowledge mean by the present study ($M = 0.60$) should not be counted as an assurance

of timely and sound evacuation decisions or protective behaviour during a cyclone [31], and it should also validate the community's cyclone information source as an informal community-based channel rather than official meteorological data.

The boat and/land ownership association with subsistence score suggests that owning or renting a boat or land outperformed landlessness. This finding is consistent with another study on AHP-based assessment of fishing community resilience in Hatiya island [32], which found that physical assets such as boats and nets and financial assets are crucial determinants of resilience. The evidence from [33] further indicates that the subsistence is more of a function of access to livelihoods and sustenance rather than a general household resource. So, the intervention focusing on subsistence for fishing communities like Manta should prioritise boat and gear access over cash and food as relief goods. On the age pattern distinguished by dimensions in various literature [17, 19] reported the older participants to be less prepared compared to other age groups. Here, the respondents show higher scores in the two asset-specific (loss minimisation and subsistence dimensions), as middle age comes with maturity, experience, and time to accumulate more resources compared to the younger generation. The negative association between household size and loss minimisation is consistent with another study [16], which reported that smaller households showed comparatively higher subsistence and technological capacity, as larger families leave fewer resources for investment in preparation. Another interesting finding by this study suggested that social integration is not influenced by any sociodemographic subgroups, which is supported by samaj and relevant informal community institutions in coastal communities in Bangladesh [29].

5. Conclusions

This study used the Holistic Individual Preparedness Model (HIPM) to assess the cyclone preparedness among the river-dependent fishing community residing in Kalaiya Union, Baulphal, Bangladesh, known as Manta. The study used a previously established framework to understand disaster-specific preparedness of a population with divergent settlement and geographical traits in Bangladesh. Although the overall HIPM score was found to be moderate and significant, the regression analysis showed a disconnect between a statistically significant HIPM model and weak demographic predictors. The predictors' significance emerges in each dimension level, implying that the community requires dimension-specific interventions rather than uniform preparedness interventions. The findings point towards two priorities: material support targeting the boat owners and subsistence reserves for the landless population. Formal recognition of the community's existing social network for better disaster response and recovery is crucial. The study is limited by its cross-sectional design, the community's occupational homogeneity, and their mobile lifestyle, which restricted our access to the standard sample size.

Abbreviations

CPP	Cyclone Preparedness Program
HIPM	Holistic Individual Preparedness Model

Supplementary Material

The supplementary material can be accessed at <https://doi.org/10.11648/j.ijsr.20260103.11>

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Author Contributions

Kamrun Nahar Tanni: Conceptualization, Formal Analysis, Methodology, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

Farhana Alam: Conceptualization, Data curation, Methodology, Writing – original draft

Tanzin Nahar Sirin: Conceptualization, Data curation, Methodology, Writing – original draft.

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Conflicts of Interest

The authors declare no conflicts of interest.

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Biography



Kamrun Nahar Tanni is a lecturer at Bangladesh University of Professionals. Department of Disaster Management and Resilience. She completed. Her BSS. And MSS. Degree from Bangladesh University of Professionals. She has worked on multiple projects funded by Bangladesh University of Professionals. Her research area focuses on the human dimension of disaster. She has multiple published articles on disaster preparedness, disaster vulnerability, resilience, and public health. Her current research focus area is on disaster resilience, climate change adaptation, and urban disaster management. She has sound skills of Nvivo, R programming, GIS and remote sensing.



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Tanzin Nahar Sirin is currently pursuing a Master's degree in Disaster Management & Resilience at Bangladesh University of Professionals (BUP), following a Bachelor's degree in Disaster Management & Resilience. Her academic work centers on hazards and disaster theory, with particular focus on water scarcity in Rajshahi division. She is proficient in GIS

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Md Al Shahrier Rabby earned his Bachelor of Social Science (BSS) in Disaster Management and Resilience from Bangladesh University of Professionals (BUP), Bangladesh. His academic and research interests include Disaster Risk Reduction, Climate Resilience, Cyclone Preparedness, Emergency Management, Community Resilience, and Indigenous Knowledge. His research work focuses on disaster vulnerability, preparedness, and resilience of marginalized and climate-vulnerable communities in Bangladesh, particularly in coastal regions. He has academic experience in GIS, Remote Sensing, Disaster Risk Assessment, Research Methodology, and Data Analysis. He is familiar with analytical and research tools including ArcGIS, SPSS, Microsoft Excel. His research interests particularly emphasize community-based disaster risk reduction, coastal hazards, climate adaptation, and indigenous knowledge for disaster preparedness and resilience.



Sadiq Sarker is pursuing his BSS in Disaster Management and Resilience at Bangladesh University of Professionals (BUP). He has experience in field-based data collection, spatial analysis, and disaster risk research. His main technical expertise lies in SPSS for data analysis and ArcGIS for spatial mapping. His primary research interests include Disaster Risk Reduction, Climate Adaptation, and Community Resilience.

Research Field

Kamrun Nahar Tanni: Disaster Management, Public Health, Disaster Preparedness, Climate Change adaptation, Flood vulnerability assessment, Dengue Perception, Disaster Resilience, Multi Hazard Risk Communication

Farhana Alam: Water disaster management, Disaster risk reduction, Community resilience, Coastal disaster management, Urban slum resilience, Early warning systems, Climate change adaptation, Disaster preparedness, Community Based Disaster Management

Tanzin Nahar Sirin: Cyclone preparedness, Coastal disaster management, Community resilience, Disaster risk reduction, Climate change adaptation, Emergency preparedness, Disaster vulnerability assessment, Community-based disaster management

Md Al Shahrier Rabby: Cyclone preparedness, Disaster risk reduction, Early warning systems, Community-based disaster management, Disaster resilience, Climate adaptation, Emergency preparedness

Sadiq Sarker: Disaster preparedness, Climate change adaptation, Community resilience, Disaster risk assessment, Early warning systems, Coastal hazards