ORIGINAL ARTICLE

Predictors of Knowledge, Awareness and Preventive Practice toward Dengue Fever among Disaster-Affected Riverine Dwellers in Bangladesh: A Cross-sectional Study

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ABSTRACT

BACKGROUND: ***Though Dengue Fever (DF) has reemerged as a major public health concern, little is known about public knowledge, awareness and preventive practice of DF in Bangladesh, especially in disaster-prone areas. We examined the knowledge, awareness and preventive practice and its predictors regarding DF among disaster-affected areas in Bangladesh.***

METHODS: A quantitative cross-sectional study utilizing a simple random sampling technique was conducted with a close-ended questionnaire. Using SPSS version 25 software, descriptive statistics, chi-square test and logistic regression analysis were performed for the study variables.

RESULTS: 92.3% of respondents were knowledgeable about DF, and 80.4% were aware of DF. Majority respondents believed that DF is treatable (92.8%) and got DF-related information from TV/Radio (65.5%). Males were 2.41 times (95% CI: 1.88-4.77; p<0.001) more knowledgeable on DF than females. Younger adults (18-30 years old) were 1.47 times (95% CI: 1.59-3.68; p=0.002) more knowledgeable on DF than others. Males were 1.99 times (95% CI: 1.23-3.21; p=0.005) more likely to be aware of DF than females. Young people (18-30 years old) were 2.01 times (95% CI: 1.89-3.19) more likely to be aware than others. Respondents whose family members worked in healthcare were 2.09 times (95% CI: 1.23-3.02; p=0.031) more likely to be aware than others.

CONCLUSION: Males and younger adults had better awarness and knowledge about DF. Tailored educational programs and awareness campaigns should focus on females, and older individuals.

KEYWORDS: Dengue fever; Infection; Disaster; knowledge, practice, Bangladesh

INTRODUCTION

Dengue Fever (DF), a mosquito-borne viral disease, is prevalent across many tropical and subtropical regions of the world. It is caused by four distinct serotypes of the dengue virus (DENV-1 to DENV-4) and transmitted primarily by Aedes mosquitoes (1-3). Over the past several decades, dengue has become increasingly widespread, with cases reported to the World Health Organization rising from 505,430 in 2000 to 5.2 million in 2019 (34). Approximately 70% of global dengue cases originate in Asia, where the disease is most concentrated (34). Each year, around 400 million people are infected with dengue (35), and epidemics frequently occur in countries such as Sri Lanka, Thailand, Indonesia, Myanmar, and India (34, 39). The disease presents a broad spectrum of clinical manifestations, ranging from mild febrile illness to severe and potentially fatal forms, including dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). In the absence of specific antiviral treatments, prevention remains the most effective strategy to mitigate the impact of dengue (2-5).

In recent years, Bangladesh has experienced a sharp increase in dengue outbreaks (6-8). During the 2019 outbreak alone, the country reported an alarming 101,354 cases and nearly 200 deaths (8, 9). As of November 2023, the Ministry of Health and Family Welfare of Bangladesh recorded more than 300,000 laboratory-confirmed cases and over 1,400 dengue-related fatalities (10). Effective prevention of dengue requires adequate knowledge, awareness, and appropriate practices among the population. When individuals are well-informed and aware, preventive actions such as reducing mosquito exposure, eliminating breeding sites, promoting community engagement, and implementing health education programs can be more effectively carried out (35).

Several studies have assessed the Knowledge, Attitudes, and Practices (KAP) of the Bangladeshi public regarding dengue. For example, a study among university students in Dhaka City revealed moderate levels of knowledge (66.72%), highly positive attitudes (89.28%), and satisfactory preventive practices (68.32%) concerning dengue fever. However, the study also identified notable gaps in understanding, including misconceptions about the disease's transmission, limited awareness of Aedes mosquito breeding sites, unawareness of the possibility of multiple infections, and insufficient knowledge of the risks of dengue infection during pregnancy (11). Most such studies, however, have focused on urban and relatively affluent populations in Bangladesh and other parts of Asia (11-13).

In densely populated and resource-limited settings like Bangladesh, dengue remains a significant public health concern. As a low-lying deltaic nation, Bangladesh is particularly vulnerable to the effects of climate change and natural disasters, which often create favorable conditions for mosquito breeding. Among the populations at greatest risk are disaster-affected riverine communities, whose living conditions and limited access to healthcare increase their susceptibility to dengue infection. Furthermore, displacement and disruption resulting from disasters can diminish the knowledge and awareness of vulnerable populations, including riverine dwellers (14, 15, 40). Given that the intersection between dengue fever and the vulnerability of disaster-affected riverine populations in Bangladesh remains underexplored, this study seeks to address this gap by examining the knowledge, awareness, and preventive practices of this group regarding dengue fever.

MATERIALS AND METHODS

Study design and settings: Bangladesh consists of 56 large and 226 small riverine islands, locally known as chars, which together cover an estimated area of 7,200 km². These islands are highly prone to recurrent flooding, riverbank erosion, and other climate change-related disasters, making their inhabitants especially vulnerable. It is estimated that approximately 4–5% of Bangladesh's total population resides in char regions (36), with around 65% of them inhabiting the chars located along the Jamuna River (14-16).

This study was conducted in four selected char (island) areas—Sontosa, Gosaibari, Betil, and Koijuri—within Belkuchi Upazila (sub-district) of Sirajganj district, Bangladesh. A simple random sampling technique was employed to select respondents from these areas. The study followed a cross-sectional quantitative design, and the

preparation of this manuscript adhered to the STROBE checklist guidelines (38).

Study sample: A cross-sectional survey was carried out among adult residents of the selected riverine areas. Individuals aged 18 years and above who were permanent residents of the selected chars were included in the study. Those who were not local residents or were unwilling to participate were excluded. The sample size was determined using the standard formula (37):
n=Z2pqd2n = \frac{{Z^2pq}}{{d^2}}n=d2Z2pq, where n represents the desired sample size, Z = 1.96 for a 95% confidence interval, p = 0.5 (population proportion, assuming 50%), q = 1 – p, and d = 0.05 (precision level). The design effect was set at 2.0, and a 10% addition was made to account for non-response. The final calculated sample size was approximately 847, which was rounded to 852 participants.

Measures: Data were collected using a structured, closed-ended questionnaire adapted from previously published studies (7, 11, 12, 13, 17). The questionnaire was initially developed in English and then verbally translated into Bangla by trained bilingual data collectors to ensure comprehension among respondents. It consisted of three sections.

The first section gathered socio-demographic information, including gender (male, female), age (18–30 years, 31–45 years, above 45 years), marital status (married, divorced, single), educational attainment (illiterate, primary, secondary and above), monthly income (<10,000 BDT, 11,000–20,000 BDT, above 20,000 BDT), and whether any family member worked in the healthcare sector (yes, no). The second section assessed knowledge, awareness, and preventive practices related to dengue fever through 17 questions. Knowledge was assessed with the question "Have you heard about dengue fever?" (7), awareness with "Are you aware of dengue fever?" (7), and preventive practice with "How do you take steps to protect yourself from dengue fever?" (7). Responses for knowledge and awareness were coded as "yes" (1) and "no" (0). Preventive practices included responses such as "keep windows and doors closed," "maintain cleanliness of surroundings," "use mosquito coil," "use mosquito net," and "do nothing." The third section included four questions related to dengue fever treatment practices (12, 13, 17, 18).

Study procedure: Data were collected through face-to-face interviews conducted from June 19 to July 10, 2023. Four trained data collectors were recruited and briefed on the study objectives and procedures before data collection began. Written informed consent was obtained from all participants prior to the interviews. Data collectors ensured that all questions were explained clearly in the local language. To protect participant privacy, identities were kept anonymous, and all information was treated confidentially. Participants were informed that their involvement was voluntary and that they could withdraw from the study at any stage without providing any reason.

Data analysis: Data were processed and analyzed using Microsoft Excel (version 2013) and IBM SPSS Statistics (version 25). Descriptive statistics, including frequencies and percentages, were used to summarize all study variables. The Chi-square test was applied to examine associations between demographic characteristics and participants' knowledge and awareness of dengue fever. Binary logistic regression analysis was performed to identify the predictors of knowledge and awareness. In these analyses, "knowledge about dengue fever" and "awareness about dengue fever" were considered dependent variables, while demographic characteristics were treated as independent variables. Odds ratios (ORs) and their corresponding 95% confidence intervals (CIs) were calculated, and a p-value of less than 0.05 was considered statistically significant.

Ethical approval: Ethical approval for the study was obtained from the Institutional Ethical Review Committee, Faculty of Humanities and Social Science, Daffodil International University, Dhaka-1212, Bangladesh (Protocol No. Ethics/Salman (4)/2022). All procedures followed the ethical principles outlined in the World Medical Association Declaration of Helsinki (38).

RESULTS

In this study, half of the participants were male (50.1%), while the remaining half were female. The majority of respondents (59.4%) were between 18 and 30 years of age, and more than half (57.6%) were single. Regarding education, 40.14% of participants had completed primary-level schooling. Half of the respondents (50%) reported a monthly household income of less than 10,000 BDT. Additionally, nearly one-fifth of the participants (19.1%) indicated that at least one family member was employed in the healthcare sector (Table 1).

Table 1: Demographic characteristics of study participants (N=852).

Variables	Number	Percent
Gender		
Male	427	50.1
Female	425	49.9
Age		
18-30 years old	506	59.4
31-45 years old	290	34.0
Above 45 years old	57	6.6
Marital status		
Married	337	39.6
Divorced	24	2.8
Single	491	57.6
Educational status		
Illiterate	257	30.17
Primary	342	40.14
Secondary and above	253	29.69
Income status		
<10,000 BDT	426	50.0
11,000-20,000 BDT	298	35.0
20,000< BDT	128	15.0
Any family members are working in healthcare sector		
Yes	163	19.1
No	689	80.9

Knowledge, awareness, and preventive practice: Knowledge, awareness, and preventive practices regarding dengue fever (DF) among riverine island residents are presented in Table 2. Overall, 92.3% of respondents had heard about dengue fever. Among them, 61.6% correctly identified mosquito bites as the mode of transmission, while 11.6% mistakenly believed that dengue spreads through contaminated drinking water. Nearly one-fifth of the participants (19%) did not know how dengue fever is transmitted. Less than half (46%) were aware that the Aedes mosquito serves as the carrier of the dengue virus. Slightly more than one-third of respondents (38.38%) knew that mosquito bites typically occur during sunrise and sunset, whereas a similar proportion (38.4%) were unaware of the mosquito biting period. Likewise, 39.79% of respondents recognized summer as the season when dengue fever is most prevalent, while more than one-fourth (27%) identified the rainy season as the peak period for dengue occurrence.

Table 2: Knowledge, awareness, and preventive practice towards Dengue fever.

Questions	Number(%)
Knowledge about dengue fever	
Yes	786 (92.3)
No	66 (7.7)
Dengue fever spreading methods	
Dirty drinking water	99 (11.6)
Mosquito's bite	525 (61.6)
Others	66 (7.7)
Don't know	162 (19.0)

Table 2: Continued…

Carrier of dengue fever	
Aedes	392 (46.0)
All type of mosquito	34 (4.0)
Don't know	426 (50.0)
Biting time of mosquito	
Afternoon	132 (15.5)
Night	74 (8.7)
Sunrise/sunset	319 (38.4)
Don't know	327 (38.4)
Prevalent times of dengue fever	
Summer	339 (39.8)
Winter	78 (9.2)
Rainy season	230 (27.0)
Don't know	229 (26.9)
Dengue is transmissible	
Yes	391 (45.9)
No	461 (54.1)
Dengue transmission system	
Blood transfusion	356 (41.8)
Human to human contact	32 (3.8)
Don't know	464 (54.5)
Breeding place of Aedes mosquito	
In clean water	229 (26.9)
In unclean water	562 (66.0)
Don't know	61 (7.2)
Signs and symptoms of dengue fever	
Diarrhea	32 (3.8)
High fever	260 (30.5)
Nausea and vomiting	32 (3.8)
Red spots on the body	70 (8.2)
All of the above	231 (27.1)
Don't know	227 (26.6)
Awareness about dengue fever	
Yes	685 (80.4)
No	167 (19.6)
Taking measures after noticing any symptoms of fever	
Taking medicine with prescription	520 (61.0)
Taking medicine without prescription	100 (11.7)
Wait few more days to observe health condition	168 (19.7)
Do nothing	64 (7.5)
Dengue fever causes death without treatment	
Yes	624 (73.2)
No	98 (11.5)
Don't know	130 (15.3)
Knowledge of dengue fever prevention methods	
Yes	457 (53.6)
No	395 (46.4)

A small proportion of respondents (9.15%) believed that winter is the most common season for dengue fever. Almost half of the participants (45.9%) believed that dengue is a transmissible disease. Among them, 41.8% and 3.8% were aware that dengue can be transmitted through blood transfusion and human-to-human contact, respectively. However, more than half of the respondents (54.5%) reported having no knowledge about the modes of dengue transmission. Nearly two-thirds (66%) of participants knew that Aedes mosquitoes can breed in unclean water.

Regarding symptoms, most respondents (30.52%) identified high fever as a symptom of dengue fever, whereas more than one-fourth (26.6%) were unaware of any signs or symptoms of the disease. A small percentage recognized diarrhoea (3.8%), nausea and vomiting (3.8%), and red spots on the body (8.22%) as symptoms of dengue fever. Overall, 80.4% of respondents reported being aware of dengue fever.

In terms of health-seeking behaviour, a majority of participants (61%) stated that they took medication with a prescription after experiencing fever symptoms. In contrast, 11.7% reported taking medicine without a prescription, and 19.7% preferred to wait a few days to observe their health condition before taking any medication. A small fraction of respondents (7.5%) reported taking no action. Most participants (73.2%) believed that dengue fever could lead to death if left untreated.

Table 3 presents the preventive practices of respondents against dengue fever. Almost half (46.7%) reported using mosquito nets as a protective measure against mosquito bites, while 22.8% used mosquito coils. However, 7.5% of respondents did not take any protective measures at all. Regarding sources of information, the majority (65.5%) reported receiving dengue-related information from television or radio (Figure 1).

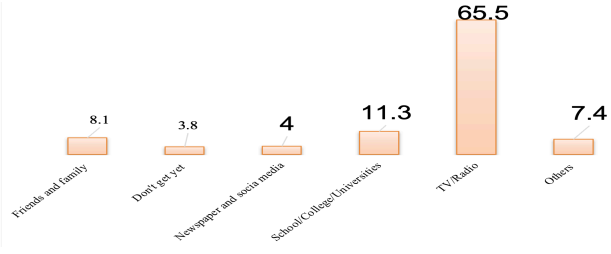

***Figure 1**: Different sources of information on dengue fever.*

Additionally, 11.3% cited schools, colleges, or universities as their information sources, 8.1% mentioned friends and family, 4% obtained information from newspapers and social media, and 7.4% from other sources. Only 3.8% of respondents reported not receiving any information about dengue fever from any source.

Table 3: Preventive practice of respondents.

Questions	Number (N)	Percent
Protecting yourself against bite of mosquito		
Keep closed windows and doors	32	3.8
Keep neat and clean of surrounding	164	19.2
Use mosquito coil	194	22.8
Use mosquito net	398	46.7
Do nothing	64	7.5

Perception of dengue fever treatment: The perception of DF is described in Table 4. A total of 92.8% of the respondents believed that DF is treatable. Most respondents (73%) did not know about the primary treatment of fever without taking any medicine. 65% of respondents did not know about tests that are required to diagnose dengue fever. 42.6% of them did a test after a few days, and only 4% of respondents did a test after getting a serious condition. Only 3.8% of respondents did not do any test.

Table 4. Dengue fever treatment related variables in Bangladesh.

Questions	Number	Percent
Dengue fever is treatable		
Yes	791	92.8
No	32	3.8
Don't know	39	3.4
Knowledge about primary treatment of fever without taking any medicine		
Yes	230	27.0
No	622	73.0
Knowledge about some tests which are required to diagnose dengue fever		
Yes	298	35.0
No	554	65.0
Test after suffering from fever		
After a few days	363	42.6
After getting serious condition	34	4.0
Immediately	65	7.6
Don't face yet	358	42.0
Never do test	32	3.8

Association between knowledge and awareness of dengue fever: The association between demographic variables and knowledge and awareness of dengue fever (DF) is presented in Table 5. Gender ($p<0.001$), age ($p=0.043$), educational status ($p=0.43$), and having family members employed in the healthcare sector ($p<0.001$) were significantly associated with knowledge of DF. Similarly, gender ($p=0.002$), age ($p<0.001$), educational status ($p=0.042$), and having family members working in the healthcare sector ($p=0.02$) showed significant associations with awareness of DF.

Males were found to be 2.41 times more knowledgeable than females (OR: 2.41; 95% CI: 1.88–4.77; p<0.001). Respondents aged 18–30 years demonstrated 1.47 times higher knowledge (OR: 1.47; 95% CI: 1.59–3.68; p=0.002) compared to those aged above 45 years. Illiterate and primary-educated respondents were 4% (OR: 0.96; 95% CI: 0.67–0.97; p=0.009) and 25% (OR: 0.75; 95% CI: 0.76–0.91; p=0.007) less knowledgeable, respectively. Additionally, respondents with family members working in the healthcare sector were 1.06 times more knowledgeable (OR: 1.06; 95% CI: 1.01–1.11; p=0.028) than those without such family connections.

Table 5: Association between demographic factors and knowledge and awareness of dengue fever.

Variables	Knowledge of dengue fever				Awareness of dengue fever			
	Chi-square analysis			Logistic regression analysis	Chi-square analysis			Logistic regression analysis
	Yes	No	p-value	AOR (95% CI, p-value)	Yes	No	p-value	AOR (95% CI, p-value)
				Gender				
Male	93.5%	6.5%	**<0.001**	**2.41 (1.88–4.77, <0.001)**	79.5%	20.5%	**0.002**	**1.99 (1.23 – 3.21, 0.005)**
Female	44.6%	55.4%		-	62.8%	37.2%		-
				Age				
18-30 years old	91.9%	8.1%	**0.04**	**1.47 (1.59-3.68, 0.002)**	90.1%	9.9%	**<0.001**	**2.01 (1.89-3.19, 0.004)**
31-45 years old	82.9%	17.1%		1.46 (0.56-3.87, 0.434)	65.8%	34.2%		1.25 (0.75- 2.10, 0.396)
Above 45 years old	70.1%	29.9%		-	60.6%	39.4%		-
				Marital status				
Married	55.5%	45.5%	0.78	0.90 (0.62–1.58, 0.970)	65.5%	34.5%	1.56	1.80 (0.97-3.62, 060)
Divorced	49.2%	50.8%		0.42 (0.44-1.34, 0.562)	61.9%	38.1%		1.11 (0.55-1.51, 0.776)
Single	62.7%	37.3%		-	58.6%	41.4%		-
				Educational status				
Illiterate	48.8%	51.2%	**0.043**	**0.96 (0.67-0.97, 0.009)**	49.6%	50.4%	**0.042**	**0.99 (0.44-1.12, <0.001)**
Primary	65.9%	34.1%		**0.75 (0.76-0.91, 0.007)**	55.5%	44.5%		0.82 (0.46-1.67, 0.893)
Secondary and above	88.3%	11.7%		-	73.2%	26.8%		-
				Income status				
<10,000 BDT	76.3	23.7	0.45	1.16 (0.63 – 2.16, 0.630)	90.0%	10.0%	0.98	1.26 (0.43-2.47, 0.701)
11,000-20,000 BDT	80.1%	19.9%		1.42 (0.73 – 2.80, 0.304)	93.3%	6.7%		1.11 (0.69-1.51, 0.813)
20,000< BDT	83.0%	17.0%		-	88.5%	11.5%		-
				Family members working in healthcare sector				
Yes	95.1%	4.9%	**<0.001**	**1.06 (1.01 – 1.11, 0.028)**	80.4%	19.6%	**0.02**	**2.09 (1.23-3.01, 0.031)**
No	70.4%	29.6%		-	59.8%	40.2%		-

Association between Knowledge and Awareness of Dengue Fever: Males were found to be 1.99 times more aware of dengue fever (DF) than females (OR: 1.99; 95% CI: 1.23–3.21; p=0.005). Respondents aged 18–30 years were 2.01 times more aware (OR: 2.01; 95% CI: 1.89–3.19; p=0.004) than those above 45 years of age. Illiterate respondents demonstrated 1% lower awareness (OR: 0.99; 95% CI: 0.44–1.12; p<0.001) compared to those with secondary education or higher. Participants with family members working in the healthcare sector were 2.09 times more

aware (OR: 2.09; 95% CI: 1.23–3.01; p=0.031) than others. Marital status and income were not significantly associated with knowledge or awareness of DF.

DISCUSSION

In this study, we evaluated the knowledge, awareness, and preventive practices related to dengue fever among residents of the riverine regions of Bangladesh. The findings revealed that most participants had heard about DF and demonstrated satisfactory levels of knowledge and awareness. However, gaps remained in understanding specific aspects of the disease, such as transmission routes, symptoms, and preventive measures. Moreover, several demographic factors were found to be associated with knowledge and awareness levels.

Gender showed a significant association with both knowledge and awareness of DF, with males being more knowledgeable and aware than females. This result is consistent with previous studies conducted in Bangladesh and other developing countries (17–20). For instance, a study in Malaysia found that males had better knowledge of DF compared to females (19), and similar findings were reported in Pakistan among 440 adults (20). In contrast, a study among university students in Dhaka reported that females were 1.09 times more knowledgeable than males (11). These findings underscore the importance of implementing gender-specific educational interventions to enhance knowledge and awareness of DF.

Age was another significant demographic factor associated with knowledge and awareness. Younger individuals, particularly those aged 18–30 years, exhibited higher levels of both compared to older individuals. Previous studies have also reported similar trends (21–24). For example, a study in Northern India involving 800 participants from rural and slum communities found that younger age groups had better knowledge and awareness of DF than older groups (21). Likewise, studies in Malaysia reported higher knowledge scores among younger respondents (22, 23). A large-scale study in Bangladesh involving 1,010 participants from nine administrative regions demonstrated that higher educational attainment was associated with better knowledge, attitudes, and practices (KAP) regarding DF (7). Another study in Cyberjaya, Selangor, with 231 participants, found that although knowledge and attitudes were good, preventive practices could be further improved (25). This may reflect greater access to health information and awareness campaigns among younger populations. Overall, these studies highlight an interaction between age and education, suggesting that younger, more educated individuals with greater media exposure tend to have higher KAP scores on DF prevention (21–27).

Educational status was significantly associated with knowledge but not with awareness. Individuals with lower education levels had poorer knowledge compared to those with secondary or higher education, a finding supported by regional studies (25–29). For example, research conducted in Pakistan among medical practitioners demonstrated that higher education correlated with better knowledge scores (26, 27). Similarly, studies from India among hospital patients showed that individuals with higher education levels had greater knowledge and awareness of DF (28, 29). These findings emphasize the importance of developing targeted educational interventions to enhance knowledge among less-educated populations.

Respondents with family members employed in the healthcare sector demonstrated significantly higher knowledge and awareness of DF. This aligns with findings from a study conducted among 334 adults in Togo, where having a healthcare worker in the family was associated with higher knowledge levels (30). Such individuals may have better access to health information and resources, thereby increasing both their knowledge and awareness.

Globally, dengue has emerged as a major public health concern. Countries such as Nigeria, China, India, Guatemala, and Pakistan have actively strengthened their understanding of DF, as reflected in the literature (26–33). Simultaneously, many nations have enhanced their dengue surveillance systems and implemented long-term control programs. Understanding the epidemiological dynamics of DF is essential for developing targeted and strategic public health interventions. By integrating findings from diverse contexts, this study contributes not only to the

understanding of DF within Bangladesh but also to the broader global discourse on dengue prevention and control.

A key strength of this study is that it examined knowledge, awareness, and preventive practices related to DF among a highly marginalized population. To our knowledge, this is the first study conducted among disaster-affected riverine dwellers in Bangladesh, highlighting the demographic and social factors associated with knowledge and awareness of DF. However, some limitations should be acknowledged. The questionnaire used was adapted from previously published studies, and its reliability was not formally assessed. Moreover, while this study explored the association between demographic factors and knowledge and awareness, it did not assess their relationship with preventive practices, as the latter were examined using specific prevention-related questions.

Other limitations include the use of a region-specific sample, which may limit the generalizability of the findings, and reliance on self-reported data, which may introduce recall or social desirability bias. Future studies should aim to include larger, more diverse samples and incorporate validated and reliable instruments to measure knowledge and awareness. Additionally, further research is needed to explore the unique finding that educational status was associated with knowledge but not awareness. Future investigations could also examine dengue prevalence, cost analyses, prevention practices, healthcare access, and information sources among disaster-affected riverine populations in Bangladesh.

In conclusion, this study highlights the need for targeted interventions to improve knowledge, awareness, and preventive practices regarding dengue fever. The results indicate that gender, age, educational status, and family background are key factors associated with knowledge and awareness levels. Tailored educational programs and awareness campaigns should focus on females, older individuals, and those with lower educational attainment. Enhancing knowledge and awareness among these groups could improve preventive behaviors, ultimately contributing to a reduction in the dengue burden.

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