

Original Article

## HOUSEHOLD VULNERABILITY IN DRINKING WATER AND DIARRHEAL DISEASE AMONG CHILDREN IN COASTAL VILLAGES

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### ABSTRACT

**Background:** Access to safe drinking water is vital for health, but coastal populations frequently encounter challenges in obtaining this essential resource. The absence of a reliable drinking water supply is a significant concern for individuals living in coastal areas. To explore the connection between household vulnerability in accessing drinking water and its correlation with diarrheal diseases among children in coastal villages, we conducted a cross-sectional study.

**Methods:** In this study, 255 households with at least one child under 18 years of age were selected using a multistage sampling technique. Respondents, mainly mothers or caregivers, were chosen based on permanent residence. Demographic data, covering education, gender, and religion, were collected. The study used both primary and secondary data for a thorough analysis, recording information on ownership of drinking water sources, types of water used, water-fetching practices, sanitation facilities, and water purification methods.

**Results:** A substantial portion of households (71%) lacked ownership of a drinking water source, with 65.9% relying on deep tube well water. Various water sources, including shallow tube wells and rainwater harvesting, were used by other households. During natural disasters, 49% faced a crisis in safe drinking water, but 55% addressed it by saving rainwater, and 50% sought nearby safe water sources. The prevalence of diarrhea among the 255 households was 22.7% (58 cases). Statistically significant associations were observed between household vulnerability and factors like ownership of drinking water source, per capita household monthly income, household size, type of latrine used, and maternal wash behavior.

**Conclusion:** The study emphasizes a significant connection between household vulnerability in obtaining drinking water and the increased occurrence of diarrheal diseases among children in coastal villages. To address this issue, suggested efforts include resolving ownership challenges, improving water-fetching practices, enhancing sanitation facilities, and promoting water purification methods like fitkari or boiling water to decrease the prevalence of diarrheal diseases in vulnerable households.

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**Key Words:** Household Vulnerability, Drinking Water, Diarrheal Disease, Children in Coastal Villages, Bangladesh

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### INTRODUCTION

The importance of safe and accessible water for overall health is emphasized, impacting drinking, domestic use, food production, and sports. Improved water supply, sanitation, and water resource management contribute to economic growth and poverty reduction. The UN General Assembly in 2010 recognized the universal right to water and sanitation, with Sustainable Development Goal 6.1 aiming for universal and equitable access to safe and affordable drinking water. World Water Day on March 22 serves as a reminder of the critical role of water, especially for those lacking a reliable source, which poses health risks and exacerbates vulnerabilities, particularly during crises like natural

disasters. In 2017, 5.3 billion people globally had safely managed drinking water services, with 2.2 billion lacking such services. Vulnerabilities persist due to geographical, sociocultural, and economic disparities, affecting rural and urban areas. Contaminated water and poor sanitation contribute to diseases like cholera and diarrhea, which are preventable. Vulnerability is multifaceted, encompassing physical, social, economic, and environmental factors. Coastal regions, such as those in Bangladesh, face challenges due to geomorphology, natural hazards, and climate change. Cyclonic storm surges and tidal events expose drinking water sources to inundation. Adapting to water scarcity involves living

harmoniously with limited resources. The Coastal Vulnerability Index identifies deltas, like Bengal and Red River, as highly vulnerable. Bangladesh's low-lying coastal areas are prone to salinity intrusion, impacting freshwater sources and exacerbating water scarcity. The coastal belt of Bangladesh, encompassing 76 Thanas, struggles with complex hydrogeological conditions and adverse water quality, leading to acute water scarcity. Climate change intensifies salinity intrusion, rendering tube wells ineffective. Access to clean water significantly influences health, with contaminated water contributing to diarrheal diseases, particularly affecting marginalized populations. A study in *The Lancet* highlights the impact of water quality, sanitation, and healthcare on disease incidence, emphasizing the role of women in water-fetching tasks. Despite improvements, diarrhea remains a significant cause of global disease burden, particularly in low-income countries. Factors such as the continuity of water supply, affordability, and distance to water sources influence household reliance on less safe sources, impacting water consumption and health outcomes. Addressing these challenges is crucial for achieving sustainable and equitable access to safe drinking water and reducing vulnerabilities.<sup>1-3</sup> Human survival is heavily dependent on a sufficient supply of clean drinking water, as the human body is composed of over 70% water. Various sources, including public water systems, private wells, and filtered water, contribute to the availability of drinking water. Understanding the source, treatment, and safety of drinking water is crucial. Contaminated drinking water or inadequate water availability can lead to diarrheal diseases due to poor personal, domestic, or community hygiene. Factors like supply continuity, costs, and distance to water sources may drive households to rely on less safe sources, compromising hygiene practices and diverting resources from essential needs like food. In the South-South-East (SSE) region, over 50% of the drinking water demand is met by groundwater, with rural areas relying on hand-pumped tube wells. Coastal populations facing high salinity use multiple sources, including harvested rainwater, communal tanks, and surface water ponds, making them susceptible to inundation. In rural areas, conflicts arise between meeting economic and social water needs. Scarce water leads to compromises on personal hygiene, reducing the ability to access water for washing, bathing, and sanitation, making communities vulnerable to water-related diseases. The study aims to assess household vulnerability in drinking water and its correlation with diarrheal diseases in coastal villages. The results are expected to inform policymakers, facilitating appropriate measures and contributing to the health development of the country.<sup>4-6</sup>

## **METHODS**

This cross-sectional study focused on household vulnerability in drinking water and diarrheal diseases among children in coastal villages of Pirojpur Sadar Upazila, Bangladesh. The study area, within the Pirojpur district of the Barisal division, covers 278.37 km<sup>2</sup> with a population of 163,470 (BBS). Pirojpur Sadar, one of the seven sub-districts, is surrounded by Baleshwar, Kaliganga, Katcha River, and Jujkhola Canal. It comprises seven unions, totaling 167 km<sup>2</sup> with a population density of 980.1/km<sup>2</sup>, 38,017 households, and an average size of 4.25 members.<sup>7</sup> The study included permanent residents in coastal villages with at least one child under 18 years. Respondents, mainly mothers or caregivers, were chosen based on permanent residence. With a calculated sample size of 668, limited by a 17-day data collection period and COVID-19 constraints, the sample was adjusted to 255. Pirojpur Sadar Upazila was purposively selected, and a multistage sampling technique was used. Three unions were randomly selected, and two wards from each union were chosen, totaling 85 households from each ward. The final sample included households from various villages in the selected unions, chosen through convenient sampling. After developing the relevant resource instrument and determining the study location and sample size, primary data collection occurred at the study site. The researchers made repeated visits, engaging with respondents to establish effective communication. They introduced themselves, explained the study's purpose, and provided brief instructions, obtaining informed written consent and ensuring confidentiality. Secondary data on climate, aridity, drought proneness, and resource vulnerability were obtained from the Bangladesh Meteorological Department in Barisal. The research instruments included a semi-structured questionnaire covering socio-demographic characteristics, household water supply and usage, and factors related to WATSAN vulnerability and diarrheal disease. Additionally, a WATSAN Vulnerability Index was employed. At the end of each data collection day, questionnaires were reviewed for completeness, and immediate data entry into SPSS version 26 software followed, including thorough checks and edits for quality assurance. The analysis categorized data, including age, education, household income, house ownership, number of children, type of house, and time of fetching water. The WATSAN Vulnerability Index, composed of six sub-indices, was employed for both descriptive and inferential statistics using SPSS. Multiple regression explored relationships between selected independent variables and the dependent variable, with results presented through concise tables and figures. The study protocol received approval from the Protocol Approval Committee of NIPSOM, and ethical clearance was

sought from the Institutional Review Board (IRB) of NIPSOM. Written informed consent was obtained from all participants, with a strict adherence to privacy and confidentiality. Participants were granted the right to withdraw from the study, and they were assured of the absence of any harm during the research, as no invasive procedures were applied.

## RESULTS

The study surveyed 255 households in a region with a population of 19-80 years old, with a mean age of 31.41. The majority of respondents were female, with a primary level of education and a majority of households having a primary level of education. The majority of mothers were married, with 95.3% of mothers of children being married (Table 1).

**Table 1:** Distribution of respondent by socio-demographic characteristics

Characteristics	Respondents	Frequency	Percentage
Gender	Male	11	4.3
	Female	244	95.70
Age group(years)	≤30	150	58.8
	31-60	102	40.0
	≥ 61	3	1.2
	Muslim	220	86.3
Religion	Hindu	35	13.7
	Boatman/fisherman/day laborer	187	73.3
Main Occupation of the household head	Businessman/Service holder	50	19.6
	Crop production with irrigation	14	5.5
	Housewife/Household work	4	1.6
	Illiterate	9	3.5
	Primary	166	65.1
Level of education	Secondary/Dakhil	57	22.4
	Married	250	98.3
Marital status of mother	Widowed	5	1.7

Out of 255 households, 96.5% had experienced natural disasters, with 49.00% facing a drinking water crisis. The majority addressed the crisis through rainwater harvesting, collecting water from safe sources, using fitkari for water purification, and

boiling water. Water sharing was also common during crises. Sanitation was a concern for 44.7% of households, with 42.4% repairing toilets and 0.4% using nearby toilets (Table 2).

**Table 2:** Distribution of household by experience of natural disaster (flood, cyclone, tidal bore) from when residing here and water crisis during this time

Experience of natural disaster		f %	
Experience of natural disaster (flood, cyclone, tidal bore) from when residing her	Yes	246	96.5
	No	9	3.5
Faced crisis of safe drinking water	Yes	125	49.00
	No	130	51.0
How overcome this water crisis	Rain water saving	55	21.6
	Boiling	12	4.7
	Using fitkari for water purification	19	7.5
	From nearby safe drinking water source (cyclone center, tube well)	50	19.7
Water sharing during crisis	Yes	5	2.00
	No	250	98
Face crisis of sanitation	Yes	114	44.7
	No	141	55.3
How overcome this sanitation crisis	Repair the toilet	108	42.4
	Use nearby toilet	5	2.0
	Open air defecation	1	0.4

Hygiene practices among caregivers of children were 97.6% washing their hands before eating,

while 92.5% caregivers wash their hand before cooking, 97.3% before preparing food, and 100% after defecation (Table 3).

**Table 3:** Distribution of caregiver of children according to their hand washing practice

Topics	Responses	Frequency	Percent
Washing hand before eating	Yes	249	97.6
	No	6	2.4
Washing hand before cooking	Yes	236	92.5
	No	19	7.5
Washing hand before preparing food for children	Yes	248	97.3
	No	7	2.7
Washing hand after defecation	Yes	255	100.0
	Yes	249	97.6
Practicing hand wash after handling animal	No	3	1.2
	Household don't have any animal	3	1.2
Washing hand after cleaning stool of baby	Yes	255	100.0
	Yes	248	97.3
Washing hand with soap	No	5	2.0
	Sometimes	2	0.8
Children having loose motion in last 7 days	Yes	58	22.7
	No	197	77.3

The WATSAN Vulnerability Score categorizes households as highly vulnerable, medium vulnerability, and low vulnerability. The majority of households (99.2%) fell into the medium vulnerability category, with a small percentage classified as high vulnerability. A one-way between-groups analysis of variance was performed to assess

the relationship between household water and sanitation vulnerability scores and diarrheal disease among children. The results indicated no significant association between household vulnerability in drinking water and diarrheal disease among children (Table 4)

**Table 4:** Distribution of children according to household water and sanitation vulnerability score

	Frequency	Percentage
High vulnerability	2	0.8
Medium vulnerability	253	99.2
Total	255	100.0

#### HWSV score

History of diarrhoeal disease	Mean±SD	Mean Difference	Significance
Yes (60)	3.9841±.28410	-.05195	F= .006
No (195)	4.0361±.28851		p=0.940

## DISCUSSION

The study, conducted in Pirojpur Sadar Upazila, involved 255 households to assess household vulnerability to drinking water and diarrheal diseases in coastal villages. Cross-sectional in nature, primary data were collected through face-to-face interviews, supplemented by secondary data from the Bangladesh meteorological department. Participants, mostly from Shankar pasha, Tona, and Shrikala unions, exhibited a positive response to the

questionnaire, reflecting their willingness to participate. Demographically, the majority were females (95.70%) with a mean age of 31.41. Most respondents were Muslim (86.3%) and engaged in occupations like boatman, fisherman, or day laborer (73.3%). Educationally, 65.1% had a primary level, while 49.8% belonged to joint families. Concerning housing, 72.2% had kuccha houses, and the monthly income varied from 1800 to 70000 taka. Regarding water sources, a study it was found diverse access, with 29% having their water source. Tube wells

(65.9%) and surface water (17.6%) were the primary sources<sup>8</sup>. Long-distance water collection was a significant challenge in coastal areas, as reported in another study<sup>9</sup>. Household practices included water purification using fitkari (79.2%) and boiling (4.4%). The mean time for water collection was 10.72 minutes, and 30.6% had sanitary latrines. Natural disasters impacted 96.5% of households, with 49% facing drinking water crises. Mitigation strategies included rainwater saving (21.6%) and using fitkari (7.5%). Diarrheal disease prevalence among children (<18 years) was 22.75%. Data on 446 children indicated varying frequencies, and handwashing practices showed a significant association with disease prevalence. The vulnerability analysis revealed that 99.2% of households were in medium vulnerability, with no significant differences based on respondent sex. Household size and per capita monthly income significantly influenced vulnerability, as did ownership of drinking water sources.<sup>10-12</sup> Sanitation practices, alternative water sources, and their distances significantly influenced vulnerability.<sup>13-15</sup> The association between vulnerability and diarrheal disease among children was not statistically significant. In summary, the study sheds light on the complex interplay between household characteristics, water-related practices, and vulnerability in coastal areas, emphasizing the need for targeted interventions.

## CONCLUSION

This cross-sectional study, involving 255 households in coastal Bangladesh, found a lack of individual drinking water sources, with most relying on tubewell water. Housewives were the main water collectors. Sanitation practices included ring latrines, and 96.5% experienced natural disasters, leading to safe water crises. Most households were categorized as medium vulnerability. The prevalence of diarrheal disease among children was 22.75%. Handwashing practices were satisfactory, potentially influenced by COVID-19 awareness. Statistical analysis revealed a significant link between water and sanitation vulnerability and ownership of a drinking water source. While no direct link was found between household vulnerability and child diarrheal disease, a significant association was identified between diarrhea prevalence and the type of latrine used by households. Overall, the study sheds light on water, sanitation, vulnerability, and health in coastal communities.

## Declaration

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