



THESIS TITLE

Influence of WASH Interventions by JAMUNA Project on Hygiene Practices:
Exploration of Adoption of Hygiene Practices, Availability and Accessibility to WASH Facilities
among Climate Vulnerable Char Communities of Bogura, Bangladesh
using Mixed-Methods Implementation Research

Submitted by:

Ye Naing Oo

Student ID: 25167019

Academic Session: 21st Cohort

A thesis submitted to the BRAC James P Grant School of Public Health in partial fulfilment of the
requirements for the degree of
Master of Public Health

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Declaration

I, Ye Naing Oo, hereby declare that this thesis entitled "Influence of WASH Interventions by JAMUNA Project on Hygiene Practices: Exploration of Adoption of Hygiene Practices, Availability and Accessibility to WASH Facilities among Climate Vulnerable Char Communities of Bogura, Bangladesh using Mixed-Methods Implementation Research" is an original work submitted in partial fulfilment of the requirements for the degree of Master of Public Health (MPH) at the James P. Grant School of Public Health (JPGSPH), BRAC University, Dhaka, Bangladesh.

I further declare that this work has not been submitted previously, in whole or in part, for any other degree or examination at this or any other university or institution.

All sources used in this thesis have been duly acknowledged and cited. Any assistance received has been mentioned in the acknowledgements section.

I have also added a separate declaration on GenAI use at the end of this work.

Ye Naing Oo

Date: 2 June 2026

Approval

The thesis/project titled “Influence of WASH Interventions by JAMUNA Project on hygiene practices: Exploration of adoption of hygiene practices, availability and accessibility to WASH facilities among climate vulnerable char Communities of Bogura, Bangladesh using mixed-methods implementation research” submitted by

1. Ye Naing Oo, 25167019

Of 2026 has been accepted as satisfactory in partial fulfilment of the requirements for the degree of Master of Public Health.

Humayra Binte Anwar

Supervisor:

Humayra Binte Anwar
Senior Lecturer, Assistant Director
Centre of Excellence for Science of Implementation and
Scale-Up,
BRAC James P Grant School of Public Health

Departmental Head:

Santhia Ireen
Deputy Director, Education and Research
BRAC James P Grant School of Public Health

Ethics Statement

Ethical approval was obtained from the institutional review board (IRB) of James P Grant School of Public Health, BRAC University with a reference number (MPH-2025-019) on 22 February 2026. All participants were informed about the purpose of the study, the procedures involved, potential risk and benefits, their right to refuse participation and their right to withdrawal from study at any point during data collection. Written informed consent was obtained from all participants before data collection. For participants who were unable to provide signature, a fingerprint or a signature of a first-degree relative was obtained. An information sheet containing contact details of the principal investigator and the IRB was also provided to the participants.

Participation in the study was entirely voluntary and refusal to participate did not affect access to any interventions provided under the JAMUNA Project. To protect participants' privacy, no identifiable data was collected and all collected data were stored securely with password protection. The confidentiality of participants and their information was maintained throughout the study, including during data analysis and reporting.

Abstract

Background: Access to safe water, sanitation and hygiene (WASH) services is a basic human right and fundamental for improving public health. Despite improvements in WASH services in Bangladesh, consistent hygiene practices and equitable access to WASH facilities remained challenging in disaster prone char areas. The JAMUNA Project implemented by Bangladesh Red Crescent Society aimed to improve WASH conditions and hygiene practices in vulnerable populations of Sariakandi Upazila, Bogura District.

Objectives: To explore accessibility, adoption and accessibility of hygiene related WASH interventions and their influences on hygiene practices at the community level

Methods: A concurrent mixed-methods implementation research study was conducted in two unions of Sariakandi Upazila covered by the JAMUNA Project using CFIR framework. The study population included adult married men and women for the quantitative survey, and adult beneficiaries who had received WASH infrastructure support or were exposed to WASH interventions for the qualitative component. The sample size for the quantitative data collection was 85 participants, while qualitative data were collected through 8 IDI and 2 FGDs. Systematic random sampling method was applied for the survey data collection while purposive sampling was used for the qualitative data collection. The analysis was conducted using STATA MP 17.0 version for the quantitative and qualitative data were analyzed using framework thematic analysis.

Results: Most households had access to improved sanitation facilities and improved water sources. However, inconsistent handwashing with soap at key times was observed. Handwashing after toilet use was more commonly practiced than before food preparation and eating. Access to a tube well did not ensure the presence of a functional handwashing facility. Limited space was identified as a main barrier to establishing handwashing facilities and participants described perception of maintaining the presence of soap and water availability at the facilities. Several households reported soap inside the latrine and soap availability at the handwashing facilities which facilitated handwashing practices. Practical demonstrations during courtyard sessions were identified as a facilitator for improving handwashing behaviours. In contrast, financial constraints such as initial

procurement costs for latrine construction materials and delayed reimbursement were identified as key barriers, particularly among household with poor income.

Conclusions: The study found high reported access WASH facilities and variable hygiene practices in the study areas. The JAMUNA Project interventions were perceived to support hygiene related practices, although gaps in consistent handwashing practices and access to basic handwashing facilities remained limited. The provision of soap or promotion of soap availability based on the community perceptions and existing practices, should be incorporated in future implementation. The reimbursement process should be revised to better reach the households with low income.

Keywords: Water, sanitation, and hygiene (WASH); handwashing; hygiene practice; sanitation; mixed-method study; Bangladesh

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List of Acronyms

Acronyms	Full Form
BDRCS	Bangladesh Red Crescent Society
CFIR	Consolidated Framework for Implementation Research
DRR	Disaster risk reduction
FGD	Focused group discussion
IDI	In depth interview
IRB	Institutional review board
JAMUNA	Joint Actions for Mitigating Climate Uncertainties & Natural Adversities (JAMUNA) Project.
JMP	Joint Monitoring Programme for water supply, sanitation and hygiene
LMICs	Low- and Middle-Income Countries
MICS	Multiple Indicator Cluster Surveys
PI	Principal investigator
SDG	Sustainable Development Goals
SRC	Swiss Red Cross
UNICEF	United Nations Children’s Fund
WASH	Water, sanitation and hygiene
WHO	World Health Organization

Chapter 1: Introduction

1.1 Background and Rationale

Access to safe water, sanitation, and hygiene (WASH) is a basic human need and right for health and well-being. The United Nations has committed to improving WASH access by 2030 and tracks progress through Sustainable Development Goal 6 (SDG 6). According to the 2025 World Health Organization (WHO) and United Nations Children's Fund (UNICEF) Joint Monitoring Programme (JMP) report, global access to basic sanitation service (use of improved latrine without sharing with other households including hygienic design separating excreta from human contact), basic water services (water from an improved source within 30 minutes collection time including queuing) and basic hygiene services (handwashing facility at home with soap and water) has increased globally in recent years. However, 354 million people worldwide are still practicing open defecation and 7% of the global population have no access to handwashing facilities, highlighting inequalities in access to WASH services (JMP, 2025). In addition, climate change has major consequences on WASH services, particularly in South Asia, the Middle East, and sub-Saharan Africa (Bastable et al., 2025). Increasing extreme weather events, such as climate-driven flooding, make it harder to maintain hygiene practices by limiting water availability and destroying latrines, thereby halting progress toward the elimination of open defecation (UNICEF and Global Water Partnership, 2022).

Bangladesh has made substantial progress in WASH services, with 68% basic sanitation coverage (up from 50% in 2015) and 72% basic handwashing station access by 2024 (JMP, 2025). However, these national averages mask geographical disparities. Rural households have less access to basic handwashing facilities than urban households. This difference is more evident in char (island in a river) areas that are highly susceptible to flooding, river bank erosion, and drought. In char areas, open defecation exceeds 15% (Islam et al, 2013; Islam 2021) compared to less than 1% nationally, with very low handwashing practice at critical times (e.g. after toilet use, before eating). Multiple determinants influence WASH access and hygiene practice, including household wealth, education, gender of household head (Hossain et al., 2021), and soap availability (Parveen et al., 2018). Yet, almost all existing research has focused on mainland rural or urban settings, leaving char communities severely understudied. In addition, there are limited applications of implementation science in the complex WASH sector (Setty et al., 2019).

The Jamuna chars are the most impoverished and isolated areas of Bangladesh and are regularly affected by monsoon flooding (Marks, 2010), which destroys latrines, contaminates water sources, and limits hygiene practices. In response to these vulnerabilities, the Joint Actions for Mitigating Climate Uncertainties & Natural Adversities (JAMUNA) Project, named after the Jamuna River starting from Teesta in the north to the Ganges in the south, targets about 167,000 people across nearly 40,000 households (4.175 family members per household). Since 2025, this project has been implemented by Bangladesh Red Crescent Society (BDRCS) with support of Swiss Red Cross (SRC) in 4 districts, including hardware construction support (e.g., tube well, latrines) and software components (e.g., hygiene promotion) to improve community resilience and climate adaptation. The project provides courtyard sessions on various topics covering hand hygiene, personal hygiene, and provides cash transfer to the beneficiary who is selected to receive latrine construction (a flush latrine with pit). The aim was to increase adaptation of hygiene practices, including the self-set up of handwashing facilities, and to replicate a flush latrine with a pit, a type of improved latrine, in the community.

This study addressed a critical evidence gap in char areas, where context-specific evidence on WASH remains limited despite the availability of national and global WASH data. It also applied an implementation research lens to the WASH sector in char settings. By using the Consolidated Framework for Implementation Research (CFIR), this study generates insights to improve program design, guide resource allocation, strengthens climate-resilient WASH strategies, and informs public health policies targeting the most marginalized populations. Findings would help different levels of stakeholders adapt interventions to overcome bottlenecks barriers to reach the most needed community in the char community.

1.2 Problem Statement

Though Bangladesh has achieved a good national progress in WASH coverage, char communities remain disproportionately affected by poor sanitation and hygiene practices, with open defecation exceeding 15% and very low handwashing practice at key times. These communities face recurrent and intensified climate-induced hazards, such as flooding and river bank erosion, which destroy WASH infrastructure and undermine hygiene behaviors.

The JAMUNA Project is currently implementing a community-based WASH and disaster risk reduction (DRR) intervention in the char communities. However, there is no systematic evidence on the implementation outcomes and barriers and facilitators affecting hygiene practice and reach of the hygiene promotion activities in this context. Critical knowledge gaps exist on how household characteristics, community factors, implementation process, and intervention strategy can influence the uptake of hygiene behaviors, and the availability and accessibility to WASH facilities in char communities. Therefore, this research aims to identify the uptake of hygiene practice, availability, and accessibility to WASH infrastructures including exploring implementation barriers and facilitators by using CFIR framework, ultimately informing evidence-based improvements to WASH programming and policy.

1.3 Research Questions

What is the adoption of hygiene practice, availability, and accessibility to hygiene-related WASH interventions among climate-vulnerable char communities, and how do they influence hygiene practices?

1.4 Study Objectives

1.4.1 Overall Objective

To explore accessibility, adoption, and accessibility of hygiene-related WASH interventions and their influences on hygiene practices at the community level

1.4.2 Specific Objectives

The specific objectives of this study are:

1. To assess hygiene practices (self-reported handwashing practice at key times) at the household level
2. To determine the availability and accessibility to WASH facilities at the household and community level
3. To explore barriers to practicing hygiene at the household level following WASH interventions
4. To explore barriers and facilitators to accessing hygiene promotion activities by JAMUNA Programme

1.5 Structure of the Thesis

This thesis is organized into six chapters. Chapter 1 provides an introduction, including the background, context, rationale, and study objectives. Chapter 2 presents a comprehensive review of existing literature, drawing on key findings from international, regional, and national studies. It synthesizes common findings, highlights differences across regions or districts, and incorporates recent evidence from the latest research and reports. Chapter 3 outlines the methodology used in this study, covering study design, study setting and population, sample size, sampling methods, data collection, and data analysis. In addition, the ethical consideration is provided at the end of Chapter 3. Chapter 4 presents the results, reporting both quantitative and qualitative findings. Chapter 5 provides a discussion and interpretation of the results, drawing comparisons and contrasts with findings from other contexts that share similarities with char communities. Chapter 6 concludes the thesis by summarizing key conclusions and offering evidence-based recommendations for policy and practice.

Chapter 2: Literature Review

Water, sanitation, and hygiene (WASH) services are key determinants of health and are fundamental to human dignity and well-being. The Joint Monitoring Programme (JMP) 2025 reported improvements in WASH sectors globally, including access to basic drinking water, sanitation, and hygiene within a decade. However, achieving the SDG target of 99% access by 2030 remains a significant challenge. Low-income and low-middle-income countries (LMICs), in particular, have been left behind in this progress. The difference persists across regions, for example, the global rate of open defecation is 4% in 2024, however, it remains higher in Sub-Saharan Africa (15%) and has increased in Oceania from 13% to 15% (JMP, 2025).

Hygiene practices, such as handwashing with soap at key times and access to basic WASH infrastructure are important in the prevention of communicable diseases and improvement of overall wellbeing. Evidence shows that handwashing with soap reduces the risk of diarrhea by 30% (Wolf et al., 2022) and respiratory tract infections in LMICs by 16% (Ross et al., 2023). Similarly, improvements in sanitation have substantial health benefits. A systematic review by Shang et al. (2022) reported that enhanced sanitation interventions in rural China decreased the risk of diarrhea (60%) and soil-transmitted helminths (65%) compared to no intervention.

To effectively interrupt the transmission of pathogens, the WHO and UNICEF recommend five key times for handwashing in the community. These key times include before preparing food, before eating or feeding/breastfeeding others, after using the toilet or handling feces, after coughing, sneezing, and nose blowing, and when hands are visibly dirty. In addition to handwashing, access to improved latrines and proper use are essential for preventing communicable diseases and are positively associated with handwashing practice and an inverse relationship with open defecation.

Despite the proven benefits, the adoption of optimal hygiene practices remains uneven, largely due to multiple interrelated factors. At the most fundamental level, access to WASH infrastructure strongly influences behavior. The presence of handwashing facilities with soap and water at the household level influences handwashing practices, increasing handwashing two times after fecal contact and 2.6 times before food contact (Wolf et al., 2018). Similarly, access to a clean

handwashing station is positively correlated with good handwashing practice (Benja et al., 2013). However, the lack of a regular water supply at the handwashing station reduces the practice of handwashing with soap (Tamene et al., 2023). Additionally, the distance between WASH facilities (toilets and handwashing facilities) matters, with a greater distance reducing the likelihood of handwashing after using the toilet (O'Brien et al., 2025). Globally, handwashing practice remains suboptimal, with only 26% of people washing their hands after potential fecal contact in 2015 (Wolf et al., 2018). Such practices are less prevalent in resource-poor settings where there is no soap or poor access to water (Gizaw et al., 2023; Parveen et al., 2018; Tamene et al., 2023).

Beyond infrastructure, household and demographic characteristics play a significant role. Evidence suggests that the availability of a latrine in a household and the presence of a handwashing station was associated with larger family size (four members or more) and receiving information from community health volunteers (Belachew et al., 2018). Similar findings have been reported in Ethiopia, where household-level factors such as wealth index influence the presence of a basic handwashing facility (Odo et al., 2021).

Socioeconomic inequalities further contribute to disparities in WASH access and practices. Nguyen et al. (2025) found that household wealth and the education level of the household head play a role in the adoption of WASH-related practices in India. This study reported that female-headed households, and households belonging to tribes and scheduled castes faced constraints in adopting WASH practices. In India, shared latrines in slum communities are common among poor families and are associated with a higher likelihood of open defecation because they are too dirty to use compared with basic household latrines (Heijnen et al., 2015). In Ethiopia, households with improved latrines are two times likely to have a handwashing facility, highlighting the interconnected nature of WASH components (Odo et al., 2021).

Additionally, climate change, along with extreme weather events and hazards, affects the availability and accessibility of WASH services, thereby hindering hygiene practices in communities. Climate change directly impacts water resource infrastructure, water availability and quality of water, sanitation, and hygiene services (UNICEF and GWP, 2022). The report also mentions that a reduction in water availability makes hygiene practices more challenging and reduces the

effectiveness of behavioral change communication (UNICEF and GWP, 2022). Evidence shows that water insufficiency during the dry season in Nepal limited water use, leading to reduced bathing frequency, increased use of grey water for toilet flushing, and the need to purchase drinking water (Kharti and Shrestha, n.d.).

Similar patterns are observed in the Bangladesh context. The progress of Bangladesh in WASH services is evident, with 68% of households having access to basic sanitation and 72% to basic handwashing facilities by 2024 (JMP, 2025). However, the report mentions that rural households have 14% less access to basic handwashing facilities than urban households reaching 80%. The difference is more pronounced in char (island in a river) areas, with reports that only half of households have handwashing facilities (Islam, 2021). Although open defecation is reported to be below 1% nationally in WHO/UNICEF Joint Monitoring Programme, studies conducted in char communities by Islam et al. (2013) and Islam (2021) found substantially higher prevalence rates exceeding 15%. In addition, the practice of handwashing after using the toilet and before eating a meal is very low (47%) in char communities (Islam, 2021).

Multiple factors affect the availability of handwashing facilities, handwashing practice, and improved household sanitation facilities in Bangladesh. Hossain et al. (2021) stated that female-headed households have a lower likelihood of having basic handwashing facilities due to lower incomes. A study by Parveen et al., (2018) described that mothers of neonates usually use water only due to a lack of soap availability in Bangladesh. In addition, household wealth and the education level of households are significant determinants of access to combined WASH facilities (Mondal et al. (2025). The richest households have the highest improved latrine ownership and better latrine cleanliness (Bangladesh Bureau of Statistics, 2020). In rural Bangladesh, households using shared improved latrines who were dissatisfied with their facilities were more likely to practice open defecation than households who were satisfied with their shared sanitation facilities (Nelson et al., 2014). Previous evidence reported that mothers who received monthly courtyard sessions had higher knowledge and practice scores (48% and 89%, respectively) related to handwashing after using the toilet compared to the knowledge and practice of mothers (33% and 79%, respectively) in control groups (Siddiqua et al., 2023). A study in an urban informal settlement

in Dhaka found that people who did not properly adhere to handwashing had higher odds of developing communicable diseases (Nabi et al., 2025).

Despite the availability of evidence at global, regional, and national levels, there is limited application of implementation science in the WASH sectors. Given the multiple layers of implementation, different actors, and contextual factors, the use of implementation science can help evaluate and scale evidence-based interventions (Haque and Freeman, 2021). This study assessed the adoption of hygiene practice, availability, and accessibility to WASH facilities at the household and community level following interventions supported by the JAMUNA Programme, using the consolidated framework for implementation research (Damschroder et al., 2009). In addition, it explored the barriers to practicing hygiene at the household level and barriers and facilitators to hygiene promotion activities under the project.

2.2 Conceptual/Theoretical Framework

Consolidated Framework for Implementation Research (CFIR)

This implementation research study applied the Consolidated Framework for Implementation Research (CFIR) (Damschroder et al., 2009). The CFIR is used for this study because it provides a comprehensive framework to understand how climate-resilient WASH interventions are implemented, adopted, and influenced by individual, community and contextual factors in char communities. It allows systematic exploration of barriers and facilitators affecting hygiene practices beyond measuring outcomes alone. There are 5 domains: intervention or innovation characteristics, individual characteristics, implementation process, outer and inner settings. The innovation is the intervention being delivered. Hygiene awareness sessions and climate-resilient WASH interventions, such as construction support for latrine, tube well renovation, and DRR tube well, are innovations in this project. Outer settings are the things directly not influenced by the project or household, such as climate change, policy, cultural norms, and infrastructure in the community. Hygiene practice and water availability will be affected by seasonal variations and interventions supported by other organizations. The inner setting refers to internal conditions related to the household that directly affect implementation. Household income, education of household head, access to media and knowledge, and existing WASH infrastructures are within the

inner setting. The role and characteristics of individuals play an important part in the implementation outcome. Individuals from high socioeconomic status will have more knowledge of the benefits of hygiene practice. Lastly, the implementation process domain refers to the process, including activities and strategies reached by the community. The community engagement before selecting a household for latrine support, timing for awareness sessions, and reimbursement system can influence the outcome.

Intervention Characteristic	Outer setting	Inner setting	Characteristic of individual	Implementation process
WASH interventions (Hygiene promotion, DRR tube well construction, tube well renovation, latrine construction)	Settings directly not influenced by household (climate change, extreme weather event, policies, inflation, cultural norms)	Household level factors (education level of household head, income, existing WASH infrastructure)	Individual has the capacity to improve good hygiene practice (knowledge, income, education perception and belief)	Implementers follow the guideline throughout the process (Engagement with community, reimbursement process)

Chapter 3: Methods

3.1 Study Design

This study employed a cross-sectional mixed methods triangulation design to assess implementation outcomes including barriers and facilitators of hygiene practice related to the interventions. This concurrent approach enabled the integration and triangulation of findings, thereby enhancing the validity and comprehensiveness of the results. The use of mixed methods allowed for both numerical measurement of outcomes and in-depth exploration of participants' experience and perceptions.

3.2 Study Area and Setting

This study was conducted in char areas of Bogura district in the Rajshahi Division of Bangladesh. Although the project has been implemented in four districts, Bogura district was purposively selected because it represented climate-vulnerable char settings where JAMUNA supported WASH interventions were actively implemented. In addition, feasibility of access, time and availability of study resources were considered during selection. The study area was purposely selected as this research focused on implementation outcome of a project carried out by BDRCS with support from SRC in char communities. The study was conducted in six villages across two unions of Sariakandi Upazila. These villages were selected based on criteria such as remoteness, travel time, population size and the extent of intervention supported by the project. Char areas are geographically isolated and highly vulnerable to flooding and river erosion, which can significantly affect access to water, sanitation and hygiene services, making them a relevant setting for this study.

3.3 Study Period

The study was conducted over a three-month period, from March 2026 to May 2026. This period covered all phases of research, including tool development, data collection, data validation and report writing.

3.4 Study Population

3.4.1 Study Population

The study population consisted of married men and married women living in char communities along the Jamuna River in Bogura. These groups were purposely selected due to their distinct roles and responsibilities within the household and income generation such as farming, fishing which are relevant to hygiene practices. Married men were selected because of their engagement in outdoor income generation activities such as farming and day labour (Islam et al., 2013), which may increase the likelihood of exposure to environmental contaminants and the potential transmission of pathogens into the household. In addition, married women are selected because they are primarily responsible for domestic work, including cooking, childcare, and caregiving (Islam & Sharma, 2021), all of which are closely linked to household hygiene practices. Including both groups allowed for a more comprehensive understanding of their roles and influence on hygiene behaviour within the household context.

3.4.2 Inclusion and Exclusion Criteria

Inclusion criteria:

- Participant has been living in the intervention area at least one year from date of data collection
- Aged 18 years old and above
- Married male or female participant
- Willing to participate and provide written informed consent

Exclusion criteria:

- Participant who moved to another area for more than 3 months within one year from date of data collection
- Participant with chronic bed bound conditions or mental health conditions
- Individuals unable to communicate

3.5 Sample Size Calculation

For the quantitative component, the sample size for the survey was determined using a cross-sectional design to estimate the proportion of self-reported hand washing practices at key times. The sample size was calculated using the single proportional formula $n = (Z^2 \times p(1-p)) / d^2$ where n is the required sample size, Z is the standard normal confidence interval at a 95% (1.96), p is the estimated prevalence of the outcome and d is the margin of error. In this study, a prevalence of 70% for handwashing practice was assumed on the recent baseline assessment, with a margin of error 10% and a 95% confidence interval. Additionally, 5% non-response rate was considered to account for potential incomplete or missing response. Based on these assumptions, the final sample size after calculation was 85.

For the qualitative portion, in-depth interviews (IDIs) and focused group discussions (FGDs) were conducted to explore participants' perception, experience and contextual factors influencing hygiene practice. A total of 8 participants were included in the IDIs to gain detailed individual perspectives. In addition, two FGDs (one male FGD and one female FGD) were conducted, each having 8-10 participants, to capture community-level insights and shared experiences. The sample size for the qualitative component was guided by the principle of data saturation where the data collection continued until no new themes emerged.

3.6 Sampling Technique

For the quantitative survey, a systematic random sampling method was applied to select households from the study areas. A sampling frame in the selected villages was first prepared with the support of local project staff from BDRCS, BDRCS volunteers and community members. The total number of households was divided by the required sample size to determine the sampling interval (k). A random starting point was then selected within the first interval and every k th household was subsequently included in the survey until the required sample size was obtained. Within each selected household, eligible respondents (either a married man or married woman) were interviewed based on availability.

For the qualitative, purposive sampling was applied to select participants for IDIs and FGDs. Participants for IDIs were chosen based on receiving latrine construction support or tube well

support or both from the BDRCS or have been to courtyard sessions conducted by BDRCS to ensure that they can provide relevant and deeper insight related to the interventions. Participants for FGDs were chosen from the village which received disaster risk reduction tube well support from BDRCS.

3.7 Variables

3.7.1 Dependent Variable(s)

There are three major outcome variables related to accessibility and availability to WASH facilities. They were based on the WHO/UNICEF Joint Monitoring Programme (JMP):

1. Basic handwashing facility refers to the presence of a handwashing station at the household with soap and water available, whether the facility is mobile or fixed. The variable was measured by self-reported presence of handwashing facility followed by observation of soap and water availability.
2. Basic sanitation service refers to a household's access to an improved latrine that is not shared with other households. This variable was measured by respondent answers and verified by observation according to the JMP.
3. Basic water service refers to a household having access to an improved water source within 30-minutes of round-trip including queuing. This was measured based on self-reported water resource and observation of distance between home and water resource to estimate the water collection time.

In addition, this study includes outcomes related to self-reported handwashing practices. According to UNICEF, there are five key times for handwashing in the community. In this study, considering the char context, two additional key moments were included. They are handwashing after taking care of sick patients and handwashing after handling or caring for animals which are common in rural areas. Handwashing practice was assessed by asking participants to identify their usual times for handwashing and multiple responses were recorded. Based on these responses, subsequent questions were asked related to soap use at their mentioned times. Handwashing practice was measured through self-reported behavior by assessing the frequency of soap use at

the specific key times. It was categorized as usually, sometimes or never based on participants' reported frequency of using soap.

The outcomes related to the reach of the project were assessed via two variables. The first one was participants' awareness of hygiene promotion activities conducted by BDRCS and the second one was participants' awareness of DRR tube well. Awareness of hygiene promotion activities and DRR tube wells was measured as a binary variable (yes/no) based on participant responses.

3.7.2 Independent Variables

The independent variables include participants' socio-demographic characteristics. Socio-demographic characteristics included gender, age, education level, family size, number of children under 5 years, education level of household head and household income.

3.7.3 Operational Definitions

Basic Handwashing Facility: refers to the presence of a handwashing station at the household with soap and water available, whether the facility is mobile or fixed. Based on the context, soap availability is recorded when the participants can show soap even not in the presence at the facility. Limited refers to a handwashing facility with either soap or water presence and no facility refers to there is no handwashing facility in the household.

Improved latrines: refers to flush/pour flush toilets that flush water and waste to a piped sewer system, septic tank, pit latrine, or unknown destination, ventilated improved pit (VIP) latrines, pit latrines with slabs and composting toilets.

Unimproved latrines: refers to use of pit latrines without a slab or platform, hanging latrines, or bucket latrines.

Basic Sanitation Service: refers to a household access to an improved latrine that is not shared with other households. Limited means a household having an improved latrine that is shared with other households. Unimproved means a household having access to unimproved latrine. Open defecation means the disposal of human feces in fields, bushes or river banks.

Improved Water Source: refers to piped into dwelling/yard/plot, piped to neighbor, public tap or stand pipe, tube well or borehole, protected spring, rainwater, tanker truck/cart with small tank and bottled water.

Basic Water Service: refers to a household having access to an improved water source within 30-minutes of round-trip including queuing. Limited means drinking water from an improved water source while the collection time including queuing is more than 30 minutes. Unimproved refers to drinking water from unprotected dug wells or unprotected springs. Surface water refers to drinking water directly from a river, dam, lake, pond, stream or canal.

Key times for handwashing: a moment to practice handwashing to interrupt the transmission of pathogens. There are 5 key times according to UNICEF. They are before preparing food, before eating or feeding/breastfeeding others, after using the toilet or handling feces, after coughing, sneezing and nose blowing, and when hands are visibly dirty. In addition, two additional moments for handwashing were assessed based on the context. They are handwashing after taking care of sick patients and handwashing after handling or caring for animals.

3.8 Data Collection

3.8.1 Data Collection Tools

Data were collected using both quantitative and qualitative tools. For the survey component, a structured questionnaire was developed in English followed by translation into Bengali for field data collection. The questionnaire included three sections focusing on socio-demographic characteristics, hygiene practices (handwashing at key times) and availability and accessibility to WASH facilities, and exposure to WASH interventions. In addition, observation of handwashing facilities using a checklist was integrated in the questionnaire. The data collection for the survey was conducted using a Kobo toolbox which decreased carbon emission as less paper was used and increased the data quality and real-time monitoring.

For the qualitative component, semi-structured interview guidelines for IDIs and FGDs were developed first in English followed by translation into Bengali.

3.8.2 Pretesting

Pretesting of the questionnaire could not be conducted due to time and resource constraints. Data collection time took place during the Ramadan period, and training for the field research assistant was completed one day prior to the field data collection.

3.8.3 Data Collection Procedure

Data were collected using both quantitative and qualitative methods following a concurrent mixed-methods approach. For the quantitative component, structured surveys were conducted using a questionnaire in the Bengali version. Data collectors were recruited based on prior field experience, education and familiarity with local context, and received a one-day training on the study objectives, questionnaire content, ethical considerations, and interview techniques. In addition, the training included photos of latrine, water source and handwashing facility to ensure data quality of the outcomes. The training also included practical sessions of using the Kobo collection tool using mobile tablets and role-plays to ensure consistency in data collection.

During data collection, trained data collectors visited selected households and conducted face-to-face interviews with eligible respondents after obtaining informed consent. Field supervision was carried out by the principal investigator (PI) to ensure adherence to the protocol and to address any issues encountered during data collection. A WhatsApp group was created for the inquiry of any possible questions encountered during interviews and the PI provided in time response. Daily debriefing sessions were conducted to review progress, clarify challenges, and maintain data quality. Completed questionnaires were checked regularly for completeness and consistency.

For the qualitative component, in-depth interviews (IDIs) and focus group discussions (FGDs) were conducted using semi-structured interview guides. These guides were developed based on the study objectives and included open-ended questions with relevant probes to explore participants' experiences, perceptions, and practices related to hygiene and the intervention. All IDIs and FGDs were conducted by trained facilitators in the local language (Bengali) in a private and convenient setting to ensure participants' comfort and confidentiality. With participants' consent, interviews and discussions were audio-recorded to ensure accurate data capture. The principal investigator

closely discussed with the interviewers to ensure the qualitative data collection process to have consistency, depth, and adhere to the study objectives.

3.9 Data Management and Quality Assurance

For the quantitative data, since data collection was conducted by KoboToolbox, completed forms were submitted to the server at the end of each day. The data were reviewed daily by the principal investigator to check for completeness and consistency. Any inconsistencies or errors identified by the PI were discussed with the field research assistants. If revisions or adjustments were required, they were made after confirmation with the field team or by revisiting participants where possible. All data corrections requirements were documented in a field notebook. All electronic data were stored in password-protected files, with access restricted to the research team.

For the qualitative data, audio recordings from IDIs and FGDs were transcribed followed by translation into English by experienced transcribers. The PI checked the accuracy of the transcripts with the support of local MPH students by cross-checking them against the audio recordings. The randomly selected 3 transcripts were listened to for about 5 to 7 minutes to check the accuracy.

Prior to analysis, transcripts were organized and prepared for coding. A coding framework was developed based on the study objectives and the CFIR framework. Data quality was ensured through regular team discussions, review of transcripts, and iterative refinement of codes. All qualitative data were anonymized by removing personal identifiers to ensure confidentiality.

Both quantitative and qualitative data were securely stored, and all ethical standards regarding data protection and participant confidentiality were strictly maintained throughout the study.

3.10 Data Analysis

The data analysis was performed separately for quantitative and qualitative data followed by triangulation at the finding stage.

The quantitative data were analyzed using STATA MP 17.0 version. Descriptive, univariate and bivariate analyses were conducted to examine the distribution of variables and association

between independent and dependent variables. A significance level of $p < 0.05$ was considered statistically significant.

First, descriptive analysis of participants' socio-demographic characteristics was conducted. These included gender, age group, education level, family size, number of children under five years, education level of the household head and monthly household income.

Secondly, univariate analysis was performed to describe the distribution of key variables including availability and accessibility to WASH facilities (basic handwashing facility, basic sanitation service or types of latrines, basic water source), handwashing practices at key times with frequency of soap use and reach of the project (awareness of BDRCS activities, awareness of DRR tube well). All these variables were presented with frequencies and percentages.

Finally, bivariate analysis was conducted to assess the association between independent variables and outcome variables. The relationship between handwashing facilities and handwashing practice with frequency of soap use at each key time was assessed. In addition, some analyses of interest were conducted. The first analysis was the association between distance from the handwashing facility to the toilet and the frequency of soap use after using the toilet or handling feces. The second one was between the distance from the handwashing facility to the kitchen and the frequency of soap use before food preparation. These bivariate analyses were conducted using Fisher's exact test.

Qualitative data were analyzed using framework thematic analysis, as this approach provides systematic and clear steps for managing and summarizing qualitative findings (Gale et al., 2013). First, audio recordings from the interviews were transcribed followed by direct translation into English. The transcripts were then read multiple times to familiarize the researcher with the data and overall context. A coding framework was developed based on the Consolidated Framework for Implementation Research (CFIR). Coding of the transcripts was conducted and developed a matrix. After independently reviewing the initial transcripts, the researchers discussed and agreed upon a common set of codes, which was subsequently applied to the remaining transcripts to ensure consistency in coding. Following coding, a final framework matrix was developed to organize and

index the data according to the agreed codes and themes. Finally, the researchers interpreted the findings by identifying key themes, patterns, barriers, and facilitators related to the implementation of WASH interventions in the study areas.

Followed by the triangulation of quantitative and qualitative data during interpretation and discussion stage. Findings from both qualitative and quantitative were compared and interpreted together to reach a comprehensive understanding of hygiene practices and WASH interventions in the community.

3.11 Ethical Considerations

Ethical approval for this study was obtained from the institutional review board (IRB) of James P Grant School of Public Health, BRAC University (Reference number: MPH-2025-019) on 22 February 2026, prior to data collection.

Informed consent was obtained from all participants after explaining the purpose of the study, potential risk or discomfort and confidentiality of response, right to refuse and termination of participation at any time. Written consent was obtained from participants who were able to provide signatures, while a finger print or signature from close relative (first degree relative) was obtained for participants who were unable to sign.

Participation in the study was purely voluntary. Refusal to participate in the study did not affect access to any services supported under the JAMUNA Programme. The information related to the study was provided in the information sheet which included contact details of the PI and the IRB for any concern or inquiry.

Data were collected using codes and no name and personal private identifier had been used and the confidentiality of collected data was maintained. The confidentiality of all collected data was strictly maintained throughout the study.

Chapter 4: Results

The CFIR framework was used to inform the development of data collection tools, identification of implementation-related concepts and interpretation of the findings. However, for clarity and alignment with study objectives, the findings are presented according to the research questions and thematic areas rather than being organized under individual CFIR domains.

4.1 Socio-demographic characteristics

A total of 89 participants from two unions of Sariakandi Upazila were included in the study. Among them, 49 were male, and 40 were female. The mean age of the respondents was 35 years, with the youngest and oldest participants aged 18 and 80 years, respectively. The 18-30 years group accounted for the highest proportion of participation, while the 51-60 years group and the 61 years and above group had the fewest participants. Regarding educational attainment, 53% of respondents had below-primary education, while 20%, 16%, and 11% had completed primary, secondary, and higher education, respectively. The average family size was 5.5, and 58% of participants lived in households with fewer than five family members. Approximately 50% of participants' households had one child under five years old, 17% had two children, and 35% had no child under five. The majority of household heads had below-primary education, while the lowest proportion had higher education. In terms of wealth status, 46% of participants belonged to the lowest category, 36% to the middle category, and 18% to the upper category. Additionally, 65% of participants were from the Kazla union, and 35% were from the Chaluabari unions (Table 1).

Table 1: Socio-demographic characteristics of study participants (n=89)

Variables	Class/Category	Frequency	Percentage
Area	Kazla	58	65%
	Chaluabari	31	35%
Gender	Male	49	55%
	Female	40	45%
Age Group	18 to 30	37	42%
	31 to 40	32	36%
	41 to 50	10	11%

	51 to 60	5	6%
	61 and above	5	6%
Education Level	Below Primary	47	53%
	Primary Complete	18	20%
	Secondary Complete	14	16%
	Higher	10	11%
Family Size	Less than 5	52	58%
	More than 5	37	42%
Number of U5 Children	0	31	35%
	1	43	48%
	2	15	17%
Education Level of Household Head	Below Primary	68	76%
	Primary Complete	8	9%
	Secondary Complete	8	9%
	Higher	5	6%
Monthly Household Income (Taka)	Low (<12,500)	41	46%
	Middle (12,501 to 21,500)	32	36%
	Upper (>21,500)	16	18%

4.2 Hygiene awareness session:

Regarding the project's reach in the community, 24% of participants reported knowing about BDRCS activities, while 76% reported not knowing about them. Among people who knew about BDRCS activities (n=21), only 52% participated in courtyard sessions, women, children and older adults being the most common among them. Adult men participated less frequently because they were often reported to be occupied with farming and livelihood activities during the session times. Of those who participated, 64% reported that messages delivered during the courtyard sessions were easy to understand, while the others reported them as somewhat understandable (Table 2).

Table 2: Awareness, participation, and perceived understanding of BDRCS activities among participants

Variables	Class/Category	Frequency	Percentage
Knew about BDRCS activities (n=89)	Yes	21	24%
	No	67	75%
	Don't know	1	1%
Participation in courtyard session (n=21)	Yes	11	52%
	No	10	48%
Perceived understanding of hygiene messages during courtyard session (n=11)	Difficult to understand	-	-
	Somewhat understandable	4	36%
	Easy to understand	7	64%

4.3 Awareness and utilization of DRR tube well:

A total of 29% of participants reported being aware of DRR tube wells, while 71% were unaware. Of those who were aware, about 58% reported having used the DRR tube well. Of them, 33% reported difficulty in reaching and using the DRR tube well (Table 3). This is supported by the qualitative interviews where participants reported difficulty to go to the well during floods.

"...it was difficult for me to go there for water.... it was a bit tough to reach there during the flood. We used to go there by boat or boats made of banana trees." (IDI male 01)

Table 3: Awareness, utilization, and reported difficulties related to DRR tube wells among participants

Variables	Class/Category	Frequency	Percentage
Awareness of DRR tube well (n=89)	Yes	26	29%
	No	63	71%
	Don't know	-	-
Use of DRR tube well among those aware (n=26)	Yes	15	58%
	No	11	42%
Reported difficulties among DRR tube well users (n=15)	Difficult	5	33%
	Fair	5	33%
	No problem	5	33%

4.3 Availability and accessibility to WASH facilities

4.3.1 Availability and perception regarding sanitation facility:

The majority of participants used pit latrines with a slab (76%), followed by flush-to-pit latrines (20%), which are promoted by BDRCS. These latrines were mostly owned and not shared, accounting for 89% and 85%, respectively. Most pit latrines with slabs were located within the household yard (91%), and 44% of flush latrines with a pit were located inside the dwelling. Over the last 15 months from the day of the data collection, 21 new latrines were constructed. Of these, 9 were built with the support by BDRCS cash support with partial contribution from the beneficiary or local government providing materials, and the remaining built their latrines using their own money. All supported latrines were flush latrines with pits, of which 55% received support from BDRCS and 45% received support from the local government. (Table 4).

Table 4: Household Sanitation Facility Types by Ownership, Location, and Source of Support

Variables	Class/Category	Types of latrines			
		Flush with pit, n (%)	Pit latrine with slab, n (%)	Flush to open drain, n (%)	Pit latrine without slab/open pit, n (%)
Ownership and share status (n=88)	Shared latrine	2 (11%)	2 (3%)	-	-
	Owned, shared	-	8 (12%)	1 (100%)	-
	Owned, not shared	16 (89%)	57 (85%)	-	2 (100%)
Location (n=88)	In own dwelling	8 (44%)	-	-	-
	In own yard	7 (39%)	61 (91%)	1 (100%)	2 (100%)
	Elsewhere	3 (17%)	6 (9%)	-	-
Received support for construction (n=21)	Yes	9 (90%)	-	-	-
	No	1 (10%)	11 (100%)	-	-
Source of support (n=9)	BDRCS	5 (55%)	-	-	-
	Local government	4 (45%)	-	-	-

The findings from the qualitative study highlighted perceived improvements in sanitation facilities and a sense of community demand for this kind of latrine due to its benefits and ease of maintenance. In addition, these were perceived to enhance their well-being and maintain access to sanitation facilities during extreme weather events. A participant who received latrine support from BDRCS described this;

"Now we have a good toilet, ...the previous one was unclean, the smell inside and in this, that is not there anymore". (IDI female 03).

4.3.2 Water source and storage:

All participants had access to a tube well/borehole. Among them, 47% had a tube well/borehole within their own dwelling, 44% within their own yard, and 9% outside of their home or yard. While 81 participants reported that it took them 30 minutes or less to access water from the closest tubewell, 8 could not report the time. Within the last 15 months, 15 (17%) participants out of 89 reported that they rehabilitated their tube well. Of them, only 2 received support related to materials from the local government and the rest used their money to rehabilitate or construct tube wells (Table 5).

Table 5: Household Tube Well/borehole by Location, Source of Support and time required to collect water among participants

Variables	Class/Category	Frequency	Percentage
Location of tube well/borehole (n=89)	In own dwelling	42	47%
	In own yard	39	44%
	Elsewhere	8	9%
Time required to collect water including queuing time (n=89)	≤30 minutes	81	91%
	> 30 minutes	-	-
	Unknown	8	9%
Received support for construction (n=15)	Yes	2	13%
	No	13	87%
Source of support (n=9)	BDRCS	-	-
	Local government	2	100%

Although tube wells were the primary source of water for cooking, drinking and other domestic use, qualitative findings reported that using alternative water sources for certain activities was due to convenience and reduced effort.

"I use another source of water (pond or river) for washing hands and clothes as it takes less labor"
(IDI male 02)

The qualitative findings found that sharing tube wells among neighbors was a common practice within the community. This practice helped maintain access to water and supported hygiene practices during periods when household tube wells were non-functional or inaccessible. One participant in the FGD shared community practice of water collection;

"People whose houses are in low-lying lands, cannot pump water from their tubewell during floods. They go to other's houses for water." (Respondent 3, male FGD)

Regarding water storage, 24% of participants stored water in containers at home, while the rest did not store water. Participants mentioned that they did not store water because they could easily collect water from their water sources and used excess water for animals. In contrast, some community members stored water in covered containers to prevent contamination from flies, keep the water clean and allow sediments to settle before cooking and drinking. Among those who stored water, 33% used containers with lids, 33% used containers without lids, and 33% used containers both with and without lids (Table 6).

Table 6: Household practices related to water storage and storage methods

Variables	Class/Category	Frequency	Percentage
Storage of water in the household (n=89)	Yes	21	24%
	No	68	76%
Method of storage (n=21)	Container with lids	7	33%
	Container without lids	7	33%
	Container with and without lids	7	33%

The participants perceived that tube well renovation improved the safety and cleanliness of water. They believed that plastering around the tube well helped prevent contamination from germs, dirty water, and harmful substances by reducing direct contact between the water source and

surrounding soil or stagnant water. A female participant who received tube well rehabilitation support from the BDRCS described;

"They plastered the floor of the tubewell. No bacteria or diseases are coming. If it wasn't plastered, there must be some poison reaching the floor. It is free from arsenic." (IDI female 01)

4.3.3 Availability of Handwashing facility:

In the qualitative interviews, the participants described handwashing facilities not as fixed physical structures, but as a system involving the availability of water and the convenient placement of soap, with or without a designated basin:

"See, we have a mug to collect water. We wash our hands every time by collecting water in that mug." (IDI female 01)

"It (handwashing station) is elevated with bricks, and arrangements have been made to keep soap and stuff." (IDI male 03)

Limited or inadequate space near the tube well was identified as a barrier to establishing a handwashing facility at the household level. One participant with limited space in her tube well described her ideas of handwashing station;

"...if there was a motor pump, there was a basin, we would keep a soap there, then we would wash our hands and face. It would be a great convenience. (IDI female 03)

Around 43% of participants reported having a handwashing facility, while the rest did not. Among those with facilities, 92% were fixed facilities and 8% were mobile facilities. All observed facilities had water available at the time of observation, while soap was available in only 33 facilities. However, when these five participants were asked to show materials they commonly used for handwashing, most showed soap bars and detergents as their major handwashing agent. Therefore, the availability of soap at the facilities was 38. Overall, all observed 38 facilities had both water and soap available at the time of observation.

Table 7: Status of Household Handwashing Facility

Variables	Class/Category	Frequency	Percentage
Presence of handwashing facility (n=89)	Yes	38	43%
	No	51	57%

Types of handwashing facility (n=38)	Mobile	3	8%
	Fixed	35	92%
	No facility observed	-	-
Availability of water at the facility (n=38)	Yes	38	100%
	No	-	-
Availability of soap at the facility (n=38)	Yes	38	100%
	No	-	-

The average distance between the handwashing facility and toilet was reported to be 21 steps. Approximately 34% of participants had a distance of 10 steps or fewer between the toilet and the handwashing facility, while 66% had a greater distance. The minimum and maximum were 3 steps and 50 steps respectively. Similarly, the average distance between the handwashing facility and the kitchen was 21 steps. About 42% of participants had a distance of 10 steps or less between the kitchen and the handwashing facility, while 58% had a greater distance than 10 steps. The minimum and maximum distances were 5 and 150 steps, respectively.

4.4 Handwashing practice at key times

Handwashing practices with soap varied across different key times among the study participants. Nearly all participants (99%, n=88) reported washing hands after using the toilet or handling feces. Among those who reported this practice, 75% indicated that they usually used soap, 16% used soap sometimes, 8% used only water, and 1% did not want to answer.

The next key times when participants reported washing their hands were before preparing food (88%) and before eating or feeding (86%). However, among those who reported handwashing before preparing food or feeding 49% and 34% did so at these times respectively. The lowest proportion of reported handwashing was found to be after coughing, sneezing, or nose blowing (27%), and among those who did, only 16% usually used soap. (Table 8).

Table 8: Handwashing practice at key times and frequency of soap use among study participants

Key Time	Practice, N (%)	Usually, n (%)	Sometimes, n (%)	Never, n (%)	Don't want to answer, n (%)	Don't know, n (%)
Before preparing food	78 (88%)	38 (49%)	29 (37%)	9 (12%)	1 (1%)	1 (1%)
Before eating or feeding	76 (86%)	26 (34%)	31 (41%)	19 (25%)	-	-
After using the toilet/ handling feces	88 (99%)	66 (75%)	14 (16%)	7 (8%)	1 (1%)	-
After coughing, sneezing and nose blowing	24 (27%)	4 (16%)	7 (30%)	13 (54%)	-	-
When hands are visibly dirty	50 (56%)	11 (22%)	26 (52%)	13 (26%)	-	-
After handling of sick patients	38 (43%)	10 (26%)	20 (53%)	7 (18%)	1 (3%)	
After handling of animals	44 (49%)	25 (57%)	10 (23%)	9 (20%)	-	-

***Variables used in this table has multiple responses**

Percentages in the first column are based on the total sample (N=89). Percentages for frequency (usually, sometimes, never) are calculated among those who reported practicing handwashing at each critical time.

In the qualitative findings, the study highlighted the practice and reasons for keeping soap inside the latrine to facilitate handwashing after toilet use. One participant described the usual practice of keeping soap in common locations where handwashing was needed;

"2 places, near the tube well and inside the toilet, there is a soap case to keep soap... there is a bucket to keep water": (IDI male 01)

"Many times, soap becomes small after long use. ... there is a risk of dropping small soap. If you stick it to the walls, then it doesn't waste." (Respondent 4, male FGD)

4.4.1 Factors associated with handwashing practice at key times

Table 9 shows the association between the availability of handwashing facilities and the frequency of soap use at key times. Statistically significant associations were observed for “after using the toilet or after handling feces” ($p=0.048$), “after coughing, sneezing or blowing nose” ($p=0.017$) and “after handling of animals” ($p=0.018$). A borderline association was found for “before preparing food” ($p=0.057$). Having a handwashing facility was associated with increased use of soap at those key times and reduced the frequency of use of water alone. Before food preparation, 89% of participants without access to a handwashing facility practiced handwashing using water only while only 11% of participants with access to a basic handwashing facility practiced using water only. No statistically significant associations were found at the remaining key times, including before eating or feeding ($p=0.157$), after handling of sick patients ($p=0.504$), and when hands are visibly dirty ($p=0.138$).

Table 9: Association between availability of handwashing facilities and frequency of soap use at key times

Key time	Type of Handwashing facility	Frequency of soap use					p-value
		Usually, n (%)	Sometimes, n (%)	Never, n (%)	Don't know, n (%)	Don't want to answer, n (%)	
Before preparing food	No facility	17 (45%)	15 (52%)	8 (89%)	-	1 (100%)	0.057
	Basic	21 (55%)	14 (48%)	1 (11%)	1 (100%)	-	
Before eating or feeding	No facility	10 (38%)	15 (48%)	13 (68%)	-	-	0.157

	Basic	16 (62%)	16 (52%)	6 (32%)	-	-	
After using toilet/handling feces	No facility	33 (50%)	10 (71%)	7 (100%)	1 (100%)	-	0.017
	Basic	33 (50%)	4 (29%)	-	-	-	
After coughing	No facility	3 (75%)	1 (14%)	9 (69%)	-	-	0.048
	Basic	1 (25%)	6 (86%)	4 (31%)	-	-	
When hands are visibly dirty	No facility	1 (9%)	9 (35%)	6 (46%)	-	-	0.138
	Basic	10 (91%)	17 (65%)	7 (54%)			
After handling of sick patients	No facility	2 (20%)	3 (15%)	3 (43%)	-	-	0.504
	Basic	8 (80%)	17 (85%)	4 (57%)	1 (100%)	-	
After handling of animals	No facility	4 (16%)	2 (20%)	6 (67%)	-	-	0.018
	Basic	21 (84%)	8 (80%)	3 (33%)	-	-	

Table 10 shows there was no statistically significant association between the distance from the handwashing facility to the toilet and the frequency of soap use after using the toilet or handling feces ($p=0.582$). Similarly, there is no statistically significant association between the distance from

the handwashing facility to the kitchen and the frequency of soap use before food preparation ($p=0.756$).

Table 10: Association between the distance between the handwashing facility and the latrine or kitchen and frequency of soap use at two key times

Key time	Distance	Usually, n (%)	Sometimes, n (%)	Never, n (%)	Don't know, n (%)	Don't want to answer, n (%)	p- value
After using toilet or handling feces	Within 10 steps	10 (30%)	2 (50%)	-	-	-	0.582
	More than 10 steps	23 (70%)	2 (50%)	-	-	-	
Before preparing food	Within 10 steps	8 (38%)	6 (43%)	-	1 (100%)	-	0.756
	More than 10 steps	13 (62%)	8 (57%)	1 (100%)	-	-	

4.5 Reasons for not using soap

Table 11 shows the reported reasons for not using soap. The most common reason for not using soap was that participants believed that water alone could clean hands (38%), followed by not considering soap necessary (23%), the cost of soap (18%) and soap not being kept near the handwashing facility (16%).

Table 11: Reasons reported for not using soap always

Reasons (n=60)	Frequency	Percentage
Soap is expensive	23	18%
Soap is not easily accessible (kept in another place)	20	16%
Water alone can clean hands	49	38%
Don't consider it necessary	30	23%
Others	2	2%
Don't want to answer	2	2%
Don't know	2	2%

These findings were supported by qualitative data, where participants described challenges in maintaining soap availability including unaffordability, no designated space to keep soap and their context-based adaption practice.

"Soap is easily wasted in the rain. Wheel(detergent) is kept inside the bottle." (IDI female 1)

"I keep the soap in our room and bring it when needed." (IDI female 02)

"If soap is not there, then what else, we take that (detergent or ash mixed with detergent). ...if there is a soap in the house, we don't use those anymore" (IDI female 03)

One participant mentioned that keeping extra detergent to maintain handwashing practice at his house;

"Wheel is always there... our market is far away, ...extra is brought and kept" (IDI male 04)

4.6 Intervention-related facilitators (qualitative)

4.6.1 Facilitators of handwashing promotion

Certain programmatic approaches were identified as effective in promoting hygiene practices in the qualitative interviews. Practical demonstrations during courtyard sessions, particularly on handwashing, were reported to enhance understanding and encouraged hygiene practices at the household level. One participant mentioned that learning the importance of handwashing after contact with fertilizer and pesticide was particularly useful. In addition, food arrangements during the session were reported as an incentive that encouraged community participation. A participant who joined courtyard session mentioned this;

"Yes, they (BDRCS staff and volunteers) make us try, they make every one of the participants try (handwashing with soap)." (IDI male 01)

4.6.2 Financial aid for latrine construction

Qualitative findings indicate that individuals who received a new latrine support have the capacity to bear the initial cost of procuring materials for constructing a new latrine and contribute a portion of the total cost. BDRCS typically reimbursed the cost after the new latrine was completed. The individuals were required to contribute 2,000 to 5,000 Taka, depending on the materials used in their latrines.

However, there was staff support in the procurement of construction materials for a beneficiary who received a new latrine. The participant described the staff support;

"I bought things from a shop, some I mean BDRCS staff brought using his own money.....he was saying if you don't have money then he will arrange some..." (IDI male 04)

4.7 Intervention-related barriers

4.7.1 Beneficiary selection

Several participants highlighted issues related to the implementation process of WASH interventions in the qualitative interviews. These included lack of follow-up after beneficiary selection and perceived inequities in distribution. Some participants expressed dissatisfaction with the selection process, noting that assistance did not always reach the most vulnerable households.

"We discussed and they visited and noted our name but didn't give anything.....they heard but didn't respond....Once I told them, but they didn't talk to me. What can I say then?" (IDI female 02)

"They have given to some families who didn't need it, and it didn't give to the families who actually needed it" (Respondent 3, male FGD)

4.7.2 Delayed Reimbursement

Due to several implementations of latrine support in the community at the same time, one participant who received latrine construction support mentioned about the delay reimbursement from the BDRCS.

"What happened is they didn't give the money quickly...After spending it they gave me the money two months later." (IDI female 04)

4.7.3 Soap bars only promotion

Two participants during qualitative interviews highlighted that they have become more used to soap, especially soap bars after BDRCS activities such as hygiene awareness sessions and latrine construction support. BDRCS mainly demonstrated the use of soap bars mainly for handwashing. A female participant who received latrine support mentioned this:

"What is being said about soap is that we only used this Wheel and all meaning we used powder and stuff. Later after this came to your Red Crescent sir he further corrected it that hands need to be washed with soap. (IDI female 04)

4.8 Recommendations from community

Participants provided several practical recommendations to improve WASH interventions during qualitative interviews. These included increasing financial support, expanding awareness sessions, constructing public latrines, and ensuring soap and water arrangement inside latrines. Participants also suggested the installation of more DRR tube wells at shared locations for 10 to 30 households.

"If they call for a meeting every month and make people aware, then it will be best. If they conduct meetings in every area...." (IDI female 01)

"If there are ...10 houses together. Then if there is one tube well (DRR tube well) it is good and useful for them during floods." (IDI female 04)

Chapter 5: Discussion

This mixed-method study examined the uptake of hygiene practices, the availability and accessibility of WASH facilities, and the barriers and facilitators to WASH interventions implemented by the JAMUNA Project in two unions of Sariakandi Upazila, Bogura district, Rajshahi division. The findings showed that most households had access to improved sanitation facilities, while all participants had access to improved water sources. However, consistent handwashing with soap at all critical times remained limited. The study also found that handwashing practices were influenced by accessibility to facilities, particularly the availability of water and soap. In addition, the findings indicated the limited reach of the project and identified gaps in the delivery of WASH interventions within the community from beneficiaries' perspectives.

Overall, 96% of participants had access to improved sanitation facilities, 4% used unimproved types and no open defecation practices were observed. Around 76% had pit latrines with slab and 20% had flush with pit system. In contrast, a previous study conducted in a char area by Islam (2021) found that 15% of households practised open defecation and 10% used unimproved latrines. Although only 20% of participants had access to flush sanitation facilities supported by the JAMUNA project or the local government, qualitative findings suggested a positive community perception and potential for increased uptake. Participants described the improved latrine (flush type) as cleaner, less odorous and easier to maintain compared to the previous pit latrine with slab, and many households in the community expressed interest in installing this type of latrine facility in the future. A study in rural Bangladesh reported similar findings of having a flush latrine with a pit bringing positive benefits for households, including convenience, comfort, privacy and improved social status due to latrine ownership (Hussain et al., 2017). However, the upfront cost of approximately 15,000 Taka to purchase construction materials for a new latrine was identified as a major barrier for low-income households.

All participants in the study had access to tube wells/boreholes for water, which was higher than the rural coverage (92%) reported for the Rajshahi division in the MICS 2019 survey. A similar finding was reported in another char area in Rajshahi, where 100% tube well coverage for drinking

water was observed (Rahman et al., 2024). Participants also believed that plastering around tube wells by BDRCS improved water safety by preventing contamination from arsenic and bacteria.

The findings also showed that having a tube well within a household did not guarantee the presence of a handwashing facility. This was evident in the present study, where only 48% of participants reported having access to a basic handwashing facility, a higher proportion than in the JAMUNA baseline assessment report (14%). A similar finding was reported by Islam (2021): more than half of households did not have a handwashing facility, although they had a tube well or deep tube well on their premises. Qualitative findings in the current research further highlighted participants' perceptions of handwashing facilities at the household level. Participants described that a handwashing facility should include both water availability and a convenient system for storing soap, such as a soap case, separate space, or net. This community perception should be considered during future implementation to improve the presence of basic handwashing facilities in the study areas and to promote hygiene practices.

Compared with the JAMUNA baseline assessment report (Bolte et al., 2024), this study found a higher reported proportion of self-reported handwashing practices. Among the several key times assessed, handwashing with soap after toilet use or handling faeces was the most commonly reported practice in this study (99%), followed by handwashing with soap before food preparation (89%) and before eating (86%) while handwashing after coughing, sneezing or nose blowing was the least commonly practiced (27%). These findings are partially consistent with a study conducted in rural Ethiopia by Gizaw et al. (2023), which reported high levels of handwashing during food-related activities, while handwashing after defecation was less commonly practised compared to the present study. Similar improvements in handwashing with soap after toilet use were also reported higher among mothers of under-five children following hygiene promotion interventions (Siddiqua et al., 2023) and among rural populations in India (Fazeela et al., 2024). In contrast, a previous study conducted in char areas reported that 53% of participants did not wash their hands with soap after defecation (Islam, 2021). The relatively higher levels of handwashing practices observed in the present study may reflect the influence of hygiene promotion activities implemented in the community.

In addition, the percentage of participants who reported usually using soap after using the toilet was highest among these key times (76%). In comparison, the lower level of consistent soap use was reported among mothers of under 5 children in two studies (Agaro et al., 2022, Asefa et al., 2026). The higher level of handwashing after toilet use might be related to easier access to soap. Qualitative findings showed that many households kept soap inside latrine using soap cases, net, or in the wall of the latrine which may improve the accessibility to soap and convenience of soap use. This finding may be explained by a study conducted in Dhaka (Hulland et al., 2013), which found that disgust associated with faeces-related handwashing was found to be a barrier to food-related handwashing when the same handwashing station with soap and water was shared.

Access to a basic handwashing facility was statistically associated with the frequency of soap use after using the toilet, after coughing, sneezing or nose blowing, and after handling of animals, while there was a borderline association with frequency of soap use before food preparation. Similar findings were reported in rural Afghanistan, Kenya and Uganda, where participants having access to handwashing facilities were more likely to practice handwashing at key times compared to those who had no access (Tumwebaze et al., 2025, Murendo et al., 2024). These findings highlight the importance of ensuring access to functional handwashing facilities during WASH intervention implementation.

The present study did not find a significant association between handwashing practices and the distance between the handwashing station and the toilet or kitchen. However, a study in Indonesia reported that having a handwashing facility within 10 steps of the kitchen and toilet increased handwashing practice (Hirai et al., 2016). Similarly, a small trial conducted by Biswas et al. (2017) showed that providing a household with basic equipment of handwashing facility was likely to increase handwashing practice than participants from a household relying on self-developed handwashing facility. However, the study also reported that locally developed handwashing facilities were feasible and effective in increasing handwashing practice.

In addition to the presence of handwashing facilities, the availability of soap at the facility is important in maintaining handwashing practices. The present study identified several reasons for inconsistent soap use among participants, including unaffordability of soap (18%), not easily

accessible at the facility (16%), perception that water alone could clean hands (38%) and the belief that soap is unnecessary (23%). Similar barriers were reported in rural Bangladesh, where mothers could not wash their hands due to the unavailability of soap, unaffordability, and the distance to the handwashing station, which hindered handwashing practices (Parveen et al., 2018). The present study also identified local adaptations, including the use of detergent or detergent mixed with ash as a soap substitute. Burton et al. (2011) found that handwashing with soap was more effective at reducing bacterial loads on hands than handwashing with water alone. Qualitative findings further suggested that perception of people perception towards soap bar usage may have become more positive due to the hygiene awareness session in the community.

Considering the cost of soap in the resource-limited setting, the promotion of soap bars alone may not be sustainable for many households, and the project should encourage reliance on alternative cleansing materials. In this context, soapy water consisting of a mixture of detergent with water in a plastic bottle might be a solution to help increase the frequency of handwashing with soap. Amin et al. (2014) reported that soapy water performed similarly to soap bar in reducing microorganisms on hands compared with water alone in handwashing. Furthermore, Ashraf et al. (2017) found that rural communities in Bangladesh accepted soapy water due to affordability, ease of preparation and convenient placement near tube wells or latrines. This evidence-based practical solution may be considered for future handwashing promotion interventions in char areas.

Regarding project reach and implementation, awareness of the project among participants was limited, with only one in four participants reporting knowing about BDRCS activities while about half of the participants who knew about the BDRCS activities had attended courtyard sessions. This suggests potential low visibility and suboptimal dissemination of project activities in the community. A study conducted by Yeasmin et al. (2021) found that higher participation in group sessions was associated with active community engagement activities such as home visits by community health workers. The findings of the present study also showed that the timing of courtyard session may have influenced participation. Qualitative data indicated that women, children and older people were the major participants in the courtyard sessions while adult male participation was relatively limited due to work-related responsibilities. Evidence from a literature

review by Howell et al. (2023) found that male participation was less in community health education session which was contributed to masculine gender roles, being a minority while the primary attendants were females and time constraints related to fixed session schedule.

The study also identified live demonstration of handwashing practice using soap during courtyard sessions as an important facilitator which promoted the uptake of hygiene practice at the household level. The proof of increased knowledge and practice of handwashing due to health education was found in a school based study conducted by Bieri et al. (2023). However, the study also identified some confusions related to the beneficiary selection process within the community. This issue may negatively affect community trust, participation, and the perceived fairness of project implementation if not addressed appropriately. Therefore, clearer communication and transparent beneficiary selection mechanisms may help strengthen community engagement and improve the effectiveness of future interventions.

There are several limitations of this study. First, the study relied on self-reported handwashing practices which may have introduced social desirability bias, resulted in overreported desirable handwashing behaviors such as handwashing with soap at key times. In addition, recall bias may have occurred because participants were asked to report their usual handwashing practice and exposure to WASH interventions. Secondly, the study was conducted in only two unions of Sariakandi Upazila; therefore, the findings may not be generalizable to all char areas or other rural settings in Bangladesh. Third, due to time and resource limitation, direct structured observation of handwashing was not conducted. As a result, the study could not verify whether reported practices reflected actual behavior. Finally, the cross-sectional nature of the quantitative component limited the ability to establish a causal relationship between WASH interventions and hygiene practice.

Despite these limitations, the study has several strengths. The mixed method design enabled triangulation of qualitative and quantitative findings, allowing numerical data to be complemented by participants' experience and perceptions. Another strength was application of the implementation science and a conceptual framework to explore barriers and facilitators related to WASH interventions which can be applied in the future program implementation. In addition, it also provided context specific evidence on WASH facilities and handwashing practices in the char

areas, which remains underrepresented in the public health research. Lastly, the study explored the community perception regarding handwashing facility and soap accessibility, contributing valuable insights into how local understanding and household practice may influence the uptake of hygiene interventions.

Chapter 6: Conclusion and Recommendations

6.1 Conclusion

This study found that although most households in the study areas had access to improved sanitation facilities and improved water sources. The findings highlighted that having access to a tube well did not ensure access to basic handwashing facilities. In addition, there were certain local perceptions towards handwashing facilities. Handwashing with soap at key times was inconsistent, influenced by several factors, including access to handwashing facilities and soap availability. The findings further suggested that practical hygiene promotion activities supported positive hygiene behaviors within the community.

Regarding the implementation perspective, the study identified several challenges affecting WASH interventions in char communities. The promotion of soap bars alone would not be suitable for resource-limited households, while the high initial investment cost for latrine construction remained a barrier for households with low income. In addition, confusion regarding the beneficiary selection process may affect community trust and participation in project activities. Overall, this study provided valuable insights into hygiene practice, accessibility to WASH facilities and barriers and facilitators related to WASH interventions under the JAMUNA Project in char communities.

6.2 Recommendations

Based on the study findings and literature reviews, these recommendations could be considered in the future WASH implementation in char communities.

- To improve access to basic handwashing facilities, the intervention should include the provision or promotion of materials or methods to keep soap and water available at the handwashing facility.
- Considering the financial constraints in char communities, low-cost alternatives such as soapy water solutions or detergent in a bottle should be promoted to improve the sustainability of handwashing practices.

- Instead of the high initial investment, the reimbursement process based on completion of a new latrine can be considered to reduce the financial burden of the household with low income.
- More community engagement and increased transparency related to the beneficiary selection process should be implemented to increase the community participation.

Declaration of GenAI Use

I, Ye Naing Oo, declare that in preparing this assignment, I used ChatGPT (OpenAI) as a support tool to assist grammar checking and improvement in sentence structure of my writing language in the text that I prepared myself. I did not use GenAI to generate original arguments, interpret results, or produce final academic content. All substantive ideas, judgments, references, and conclusions are my own and have been independently verified in line with JPGSPH academic integrity guidelines.

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