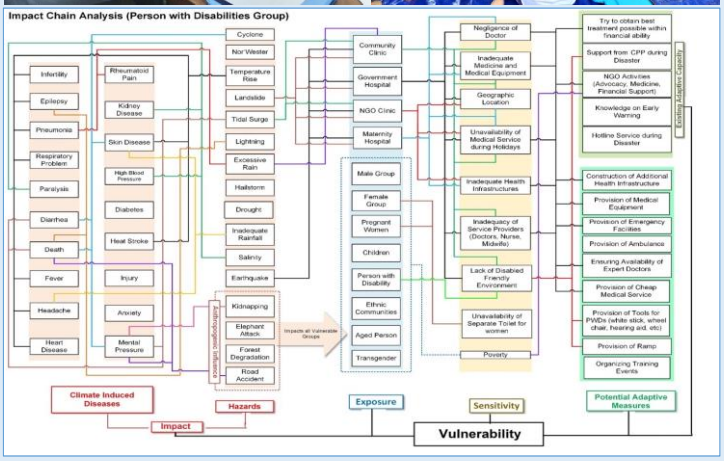

Final Report

Inclusive Impact Chain Analysis for Risk-Informed Development Planning for Healthcare Sector in Bangladesh, (ICA & RID)

Understanding the impacts of climate change hazards and strengthening the resilience of critical (health) infrastructure in Teknaf Municipality and Baharchara Union of Teknaf Upazila in Cox's Bazar District by operationalizing the methodology of impact chain analysis for identifying vulnerable critical infrastructure in the healthcare sector of Bangladesh

FINAL REPORT

Inclusive Impact Chain Analysis for Risk-Informed Development Planning for Healthcare Sector in Bangladesh, (ICA & RID)

Submitted To

Centre for Disability in Development (CDD)

Submitted By

Centre for Climate Change and Environmental Research (C3ER)

BRAC University

Dhaka, November 2023

DISCLAIMER

This report was produced at the request of CDD. It was prepared independently by the study team of C3ER, BRAC University. The views expressed in this report are those of the author(s) and do not necessarily reflect the position of CDD or any other party nor do these entities accept any liability for claims arising from the report's content or reliance on it.

FOREWORD

The Center for Disability in Development (CDD) is actively engaged in the implementation of the **"Inclusive Impact Chain Analysis for Risk-Informed Development Planning for Healthcare Sector in Bangladesh (ICA & RID)"** project in the Teknaf Municipality and Baharchara Union of Teknaf Upazila, Cox's Bazar District, Bangladesh. This project's primary objective is to enhance the resilience of vital healthcare infrastructure by empowering communities to make informed decisions regarding risks and vulnerabilities. The initiative receives funding from the Global Initiative on Disaster Risk Management (GIDRM), commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ), and executed by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

In line with these efforts, the Centre for Climate Change & Environmental Research (C3ER) at BRAC University has undertaken a project with the same title to conduct the "Inclusive Impact Chain Analysis for Risk-Informed Development Planning for Healthcare Sector in Bangladesh (ICA & RID)." This study aims to comprehend the impacts of climate change-induced hazards and bolster the resilience of critical health infrastructure in the Teknaf Municipality and Baharchara Union. The project operationalizes the concept of impact chain analysis to identify vulnerable critical healthcare infrastructure in Bangladesh. Employing a multi-participatory community-based appraisal approach, the study established impact chains associated with disasters and climate vulnerabilities within the healthcare Critical Infrastructure (CI) domain.

C3ER, BRAC University, is pleased to announce the completion of the final report, which we anticipate will be of significant value to decision-makers in relevant Ministries and Departments of the Bangladesh Government, CDD officials, researchers, practitioners, and development partners. The report provides a comprehensive overview of the current status of critical health infrastructure, highlights priorities for adaptation and infrastructure investments, and integrates the recommended solutions and proposals to enhance the risk situation for the most vulnerable critical infrastructure components determined in the study.

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ACKNOWLEDGEMENT

The study, entitled **"Inclusive Impact Chain Analysis for Risk-Informed Development Planning for Healthcare Sector in Bangladesh, (ICA & RID)"** was carried out by the Centre for Climate Change and Environmental Research (C3ER) team at BRAC University. In addition to an extensive review of pertinent literature, national and international policy documents, and prior and ongoing projects, the study team collected primary data through field visits, including multiple focus group discussions, key informant interviews, consultations, and validation workshops. The support and cooperation of CDD management officials, experts, and project focal points during data collection and the final report's preparation were indispensable, and we express our gratitude to them for their invaluable contributions and time dedicated to enriching this report.

We extend our heartfelt appreciation to Dr. Ainun Nishat, Adviser at C3ER, BRAC University, for his invaluable guidance and unwavering support at every stage of the report's development. We are equally grateful to all the experts for their valuable insights and guidance throughout the entire study and report preparation process.

Lastly, we wish to acknowledge the indispensable contributions of all the study team members, the technical expert group, and the field survey team, as well as the local government and administration, whose input was crucial in refining the final version of the report. Our gratitude also extends to the local residents of the study area, particularly those with disabilities, whose enthusiastic participation was integral to documenting and finalizing the study findings.

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ACRONYM AND ABBREVIATION

AD	Assistive Devices
Asdelphi	Adelphi offers a comprehensive tool for conducting regular vulnerability assessments
AOI	Area of Interest
AR5	Fifth Assessment Report
AR6	IPCC's Sixth Assessment Report
AusAID	Australian Agency for International Development
BA	Bachelor of Arts
BBS	Bangladesh Bureau of Statistics
BccGAP	Bangladesh Climate Change and Gender Action Plan
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BCCT	Bangladesh Climate Change Trust
BDP 2100	Bangladesh Delta Plan 2100
BMZ	German Federal Ministry for Economic Cooperation and Development
BNBC	Bangladesh National Building Code
BoB	Bay of Bengal and Ocean (BoB)
BSC	Bachelor of Science
C3ER	Centre for Climate Change & Environmental Research
CBF	Climate Bridge Fund
CBL	Chalan Beel and Low-lying Area of the North-Western Region (CBL)
CBO	Community Based Organization
CC	Community Clinic
CCHPU	Climate Change and Health Promotion Unit
CDD	Centre for Disability in Development
CDMP	Comprehensive Disaster Management Programme
CI	Critical Infrastructure
CIDA	Canadian International Development Agency
CPP	Cyclone Preparedness Program
CPRD	Center for Participatory Research and Development
CRA	Community Risk Assessment
DBA	Drought Prone and Barind Areas (DBA)
DCF	Disabled Child Foundation
DDM	Department of Disaster Management (DDM)
DFID	Department for International Development
DGFP	Directorate General of Family Planning
DGHS	Directorate General of Health Services
DiDRM	Disability-inclusive Disaster Risk Management
DoE	Department of Environment (DoE)

DPHE	Department of Public Health Engineering
DRM	Disaster Risk Management
DRRA	Disabled Rehabilitation and Research Association
EC	European Commission
ENT	National Institute of Ear Nose and Throat
EURAC	European Academy of Bozen (EURAC), offers a comprehensive tool for conducting regular vulnerability assessments
FIVBD	Friends in Village Development Bangladesh
FPE	Rivers, Floodplains, and Erosion Prone Areas (FPE)
FYP	Five Year Plan
GAVI	Global Alliance for Vaccine and Immunization
GDP	Gross Domestic Product
GED	General Economics Division
GFATM	Global Fund to Fight AIDS, Tuberculosis, and Malaria
GIDRM	Global Initiative on Disaster Risk Management
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoB	Government of Bangladesh
HCF	Health Care Facilities
HCM	Harvard Case Method
HFF	Haor and Flash Floods Areas (HFF)
Hib	Haemophilus influenzae type b
HNPP	Health, Nutrition, and Population Programme
HNPSP	Health, Nutrition, and Population Sector Program
HPNSDP	Health, Population, and Nutrition Sector Development Program
HPSP	Health, and Population Sector Programme
HPV	Human Papillomavirus
ICA	Impact Chain Analysis
ICDDRB	International Centre for Diarrhoeal Disease Research Bangladesh
ICT	Information and Communication Technologies
IEC	Information Education and Communication
INGOs	International Non-Governmental Organizations
IPC	Infection Prevention and Control
IPCC	Intergovernmental Panel on Climate Change
IPV	Inactivated Polio Vaccine
JE	Japanese Encephalitis
JICA	Japan International Cooperation Agency
KFW	Kreditanstalt für Wiederaufbau
KII	Key Informant Interviews
LGED	Local Government Engineering Department

LGI	Local Government Institution
MCH	Maternal and Child Health
MCPP	Mujib Climate Prosperity Plan
MCWC	Maternal and Child Welfare Center
MoDMR	Ministry of Disaster Management and Relief
MoEFCC	Ministry of Environment, Forestry, and Climate Change
MoHFW	Ministry of Health and Family Welfare
MoSW	Ministry of Social Welfare
MoWCA	Ministry of Women and Children Affairs
Mri	Magnetic Resonance Imaging
NAP	National Adaptation Plan
NAPA	National Adaptation Program of Action
NDC	Nationally Determined Contribution
NGOs	Non-Governmental Organizations
NICVD	National Institute of Cardiovascular Diseases
NIKDU	National Institute of Kidney Diseases & Urology
NIMH	National Institute of Mental Health
NIO	National Institute of Ophthalmology
NITOR	National Institute of Traumatology & Orthopedic Rehabilitation
NNW	Northern, North-Western Region (NNW)
NPDM	National Plan for Disaster Management
NTP	National Tuberculosis Control Program
OPD	Organizations of Persons with Disabilities
PCV	Pneumococcal Conjugate Vaccine
PDO	Project Development Objective
PHN	Population Health and Nutrition
PTSD	Post-Traumatic Stress Disorder
RID	Risk-Informed Development
SDGs	Sustainable Development Goals
SFDRR	Sendai Framework for Disaster Risk Reduction
SHGs	Self Help Groups
SIDA	Swedish International Development Cooperation Agency
SMS	Short Message Service
SoD	Standing Orders on Disaster
SPSS	Statistical Package for Social Sciences
SROCC	Special Report on the Ocean and Cryosphere in a Changing Climate
TB	Tuberculosis
ToR	Terms of Reference
TV	Television
TWG	Technical Working Group
UDG	Universal Design Guideline
UH&FWC	Upazila Health and Family Welfare Centre

UHC	Upazila Health Complex
UHFWC	Union Health & Family Welfare Center
UMIC	Upper Middle Income
UN	United Nations
UNAIDS	Joint United Nations Program on HIV/AIDS
UNCPRD	United Nations Convention on the Rights of Persons with Disabilities
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
UNICEF	United Nations International Children's Emergency Fund
UNO	Upazila Nirbahi Officer
URB	Urban Areas
USAID	United States Agency for International Development
UTIs	Urinary Tract Infections
VPDs	Vaccine-Preventable Diseases
VRP	Vulnerability to Resilience to Prosperity
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WMO	World Meteorological Organization

EXECUTIVE SUMMARY

Bangladesh has been at the forefront of national and international climate change discourses, given its extreme vulnerability to the impacts of climate change. The country features one of the world's largest deltaic systems with a 710 km long coastal stretch, exposing approximately 40 million people to frequent cyclones and associated surges, floods, droughts, and sea-level rise. Research shows a significant increase in the overall frequency, intensity, and variance of these disasters over the past decade. In the coastal regions, disaster risk has heightened due to poorly planned and managed urban expansion, environmental degradation, deforestation, rapid settlement, and poor governance.

Center for Disability in Development (CDD) has implemented a project titled "Inclusive Impact Chain Analysis for Risk-Informed Development Planning for Healthcare Sector in Bangladesh, (ICA & RID)" at the Teknaf Municipality and Baharchara Union of Teknaf Upazila, Cox's Bazar District, Bangladesh. This initiative was funded through the Global Initiative on Disaster Risk Management (GIDRM), an initiative commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The project has been awarded to the Centre for Climate Change & Environmental research (C3ER), BRAC University, which conducted a rigorous and inclusive Impact Chain Analysis (ICA) in the study locations. The specific objective of this study was to operationalize the concept of impact chain analysis as a method for identifying vulnerable Critical Infrastructure (CI) in the healthcare sector of Bangladesh.

This cross-sectional assessment employed a mixed approach, integrating both quantitative and qualitative research methodologies. The study incorporated various qualitative and quantitative methods, such as literature review, household surveys, national and local level workshops, Key Informant Interviews (KIIs), and Impact Chain Analysis (ICA) of Critical infrastructure and vulnerable populations in the study locations. The utilization of the relatively newer ICA method provided valuable insights, enabling a comprehensive understanding of climate change vulnerability among various stakeholders and helps in the identification of suitable adaptation measures.

The ICA concept facilitated the identification of climate change impacts on health and healthcare infrastructures, along with potential adaptation measures encompassing all vulnerable population groups within a single impact chain. Additionally, impact chain diagrams illustrated clear relationships between each component (Hazards, exposure, sensitivity, vulnerability, etc.), aiding the formulation of appropriate adaptation measures and recommendations to mitigate climate change risk and vulnerability. Furthermore, the application of ICA in the study locations facilitated community engagement in identifying climate risks and vulnerabilities related to human health and healthcare infrastructures, enabling better-informed decisions to minimize these risks.

Following the collection of data and information related to the household survey and impact chain, the study team conducted data analysis using MS Excel and SPSS (data analysis software). The findings of the household survey were visually presented using different types of diagrams and charts, while the impact chain analysis diagram was illustrated using MS Visio.

The study's overall findings highlight the extreme vulnerability of the study area to climate change-induced events, particularly cyclones, storm surges, and landslides, etc., and the exacerbating impact of non-climatic or anthropogenic factors such as wild elephant attacks and kidnapping. The majority of the population in the study area grapples with poverty and illiteracy, with limited knowledge about the trends of climate change-induced disasters.

The impact of climate change on human health was clearly delineated, with vector-borne (Dengue), water-borne (Diarrhea, Dysentery), and heat-related (Stroke) diseases identified as the major climate change-induced health issues among respondents. Alongside physical health concerns, the study highlighted numerous mental health issues, including frustration, depression, and stress. The vulnerability of healthcare infrastructure and services to climate change impacts was also emphasized, with the study revealing a disparity in the man-hospital ratio and the compromised health-seeking behavior of the populace due to the inadequate number of health infrastructures. Furthermore, the study shed light on the lack of inclusivity for persons with disabilities and other vulnerable groups in most healthcare infrastructures, exacerbating the challenges during the disaster period.

Adaptive measures suggested by most respondents included the need for increased public education and awareness on climate change impacts and associated adaptation measures through participation in awareness-raising campaigns, training events, and workshops. The study highlighted the heavy reliance of the community on self-funding for adaptation to increased disaster impacts, with minimal external support.

The major recommendations proposed encompass the revision and effective implementation of existing policy and legislative frameworks, ensuring easy accessibility of health services/facilities, initiatives to reduce community vulnerability, provision of capacity-building training and awareness-raising sessions, and ensuring inclusive health and other services for vulnerable communities. The findings and recommendations of this study aim to guide the government, non-governmental organizations, relevant authorities, and policymakers in implementing necessary initiatives to minimize the impacts of climate change-induced disasters and associated vulnerability.

Furthermore, the study presents the advantages and disadvantages of implementing the ICA method, underscoring its potential for identifying and analyzing the impacts of climate change on different sectors. This introduces the possibility of employing ICA in other sectors to conduct similar research and take necessary steps to minimize sectoral risks.

1 INTRODUCTION

Bangladesh stands as one of the world's most vulnerable countries to the ramifications of global climate change. The escalation of global disasters in recent decades has further exacerbated the challenges faced by local communities, particularly those in the coastal regions where multiple hazards such as cyclones, tidal surges, coastal floods, flash floods, and landslides pose a constant threat. The compounding issues of environmental vulnerability, low socio-economic status, and inadequate infrastructure in these areas amplify the adverse impact of climate change on the lives of the indigenous people and other residents.

In this context, Risk-Informed Development (RID) emerges as a crucial mechanism for safeguarding sustainable development, ensuring that decision-making processes integrate comprehensive risk assessments. Within this framework, safeguarding critical infrastructure (CI), especially within the healthcare sector, is imperative, given its susceptibility to natural hazards. A holistic, inclusive, and equity-oriented assessment approach is required, one that evaluates the current system's conditions and the needs of the population, offering a strategic entry point for mitigation activities to enhance the resilience of the healthcare sector.

Critical infrastructure (CI) encompasses vital facilities, networks, services, and assets, the disruption or destruction of which would significantly impact the health, safety, security, economy, social well-being, or overall functioning of societies. Assessing the vulnerability of these CIs serves as a fundamental prerequisite for the systematic development of protective or adaptive strategies, constituting a core strategy in national disaster risk management and planning processes. Employing an impact chain or cause-effect chain assessment facilitates a comprehensive understanding of the critical components of risk, breaking down its complexity into manageable components.

To address these concerns, the Center for Disability in Development (CDD) has implemented a project titled "Inclusive Impact Chain Analysis for Risk-Informed Development Planning for Healthcare Sector in Bangladesh, (ICA & RID)" in the Teknaf Municipality and Baharchara Union of Teknaf Upazila, Cox's Bazar District. The project is financially supported by the Global Initiative on Disaster Risk Management (GIDRM), initiated by the German Federal Ministry for Economic Cooperation and Development (BMZ), and executed by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The primary objective of the project was to bolster the resilience of critical (health) infrastructure, empowering communities to make informed decisions that account for potential risks.

In this regard, the Centre for Climate Change & Environmental Research (C3ER) at BRAC University has spearheaded the comprehensive and participatory Impact Chain Analysis (ICA) in the designated study locations. The study emphasized a participatory approach, facilitating workshops and consultations, and tailored communication materials that were accessible and inclusive. This process enabled community members to actively engage in identifying climate change risks and implementing informed decisions to minimize their impact on health and healthcare infrastructure. The insights gleaned from this study will play a crucial role in

informing government policies, guiding non-governmental organizations, and aiding relevant authorities and policymakers in implementing necessary measures to mitigate these risks.

1.1 OBJECTIVES OF THE STUDY

1.1.1 Overall Objective

The main objective of the study was to add value to strengthening the resilience of critical (health) infrastructure by empowering local communities to make better, risk-informed decisions. It is achieved through establishing impact chains related to disaster and climate vulnerability of Critical Infrastructure (CI) related to the healthcare sector, adopting a multi-participatory community-based appraisal approach. The development of impact chains forms the basis for determining priority decision areas for adaptation measures in the risk management process.

1.1.2 Specific Objectives

The specific objective of this study is to operationalize the concept of impact chain analysis as a method for identifying vulnerable CI in the healthcare sector of Bangladesh. Based on a participatory engagement approach to form an evidence-based understanding of disaster and climate change impact, aiming to:

- Provide a hands-on example of building impact chains as a participatory, community-based, and gender-responsive approach. Analyze the current state of critical infrastructure regarding the components of disaster risk (hazard, exposure, vulnerability, coping, and adaptive capacity) under changing climatic conditions.
- Establish connections, dependencies, and interrelations between the identified building blocks (components of the ICA). Understand the relationship between causes and effects within the CI and its dependent population. Identify current priorities for adaptation and infrastructure investments in the planning process of the local government.
- Provide recommendations for actions and propose solutions for improving the risk situation for the determined most vulnerable critical infrastructure components (including adaptation measures, a list of prioritizations with rationale, and adequate reasoning for decision-making and investment planning

2 METHODOLOGICAL FRAMEWORK

The team conducted the research activities using quantitative and qualitative approaches. In line with this, several qualitative and quantitative methods, i.e., literature review, household survey, national and local level workshops, and Key Informant Interviews (KIIs), were applied to carry out the Impact Chain Analysis of Critical infrastructure and vulnerable populations in the study locations. After collecting the data and information related to the impact chain, the study team analyzed the data and information using MS Excel and SPSS (data analysis software). The findings of the household survey were illustrated using different types of diagrams and charts, and the impact chain analysis diagram was illustrated using MS Visio. The following methodological framework accomplished the activities to attain the study's primary and specific objectives:

2.1 TEAM MOBILIZATION

Under the direct supervision of a Team Leader, an expert team (including a disability expert, climate change expert, gender and inclusion expert, data science expert, public health expert, infrastructure expert, anthropologist, community mobilization expert etc) led the research process. Some team members engaged in the field to collect primary data to provide valuable input in the assessment. Under their guidance, a field team was developed to survey the targeted areas, including experts from various disciplines, i.e., Sociology, Water Resources Engineering, Civil Engineering, Economics and Environmental Science, etc.

2.2 INITIAL MEETING

An initial meeting was conducted between the C3ER and the CDD Project team to share the background and objectives of the project. In addition, both groups discussed the proposed methodological framework and overall operation of the project.

2.3 DETAILED ACTIVITY

2.3.1 Activity 1: Designing a Methodological Concept to Conduct the Impact Chain Analysis

2.3.1.1 Desk Review

Under this initiative, an extensive desk review was conducted to grasp the overarching context and objectives of the project. This allowed the research team to effectively plan and develop the research process, subsequently culminating in the preparation of a comprehensive review report. Additionally, a thorough examination of various national and international documents pertaining to impact chain analysis and risk-informed development planning within the healthcare sector was instrumental in crafting the questionnaire, guidelines, and checklists used in data collection, including household surveys, ICA workshops, and key informant interviews.

Furthermore, an exhaustive review of pertinent policies, plans, and programs concerning disaster management and climate change adaptation, particularly those addressing health issues, was carried out. This exercise aimed to gain insights into the policy and legislative framework governing the subject matter of the analysis within the Bangladeshi context. The resulting policy gap analysis facilitated the development of specific checklists for data collection and informed the formulation of recommendations for future initiatives.

Moreover, a safeguarding guideline was developed to identify strategies for mitigating any safeguarding issues that might arise during the data collection process. This guideline was devised based on the review of relevant literature and international documents, ensuring the protection and well-being of vulnerable stakeholder groups. Throughout the data collection phase, the study team meticulously adhered to the safeguarding guideline. For ease of reference, the safeguarding guideline is provided in the annexure accompanying this report.

2.3.1.2 Information on Study Areas and Stakeholders

As outlined in the Terms of References (ToR), Teknaf Municipality and Baharchara Union of Teknaf Upazila, located in Cox's Bazar district, were chosen for the assessment. Several literature reviews corroborated the high vulnerability of the study area (Teknaf and Baharchara) to climate change-induced disastersdisasters (Moniruzzaman, 2013) (Khanam, 2017) (Nath, Aziz, & Inoue, 2014) (Goosen, et al., 2018). The National Adaptation Plan (NAP) also identified Teknaf as one of the most susceptible coastal areas in Bangladesh, prone to various climate change-induced disasters such as cyclones, storm surges, tidal surges, landslides, and nor 'westers. Hence, Teknaf Municipality and Baharchara were selected for this study.

The ICA process prioritized community engagement throughout, with active involvement from relevant ministries and government departments. The Ministry of Health and Family Welfare (MoHFW) played a pivotal role in the survey. Additionally, the following stakeholders were engaged:

- Ministry of Disaster Management and Relief (MoDMR)
- Ministry of Environment, Forest, and Climate Change (MoEFCC)
- Local Government Engineering Department (LGED)
- Ministry of Social Welfare (MoSW)
- Department of Public Health Engineering (DPHE)
- Ministry of Women and Children Affairs (MoWCA)
- Relevant Local Government Institutions (LGIs)
- Health practitioners (Doctors, Quacks, Kabiraj, etc.)
- Health service providers (Shebika, Midwife, etc.).

This study also ensured the inclusivity and participation of ethnic communities, persons with disabilities, youth groups, the elderly, and other disadvantaged groups, including transgender individuals.

2.3.2 Activity 2: Conducting Community-based Workshops and Developing Individual Impact Chains and Identifying the Vulnerable Hotspots of the CI

2.3.2.1 Infrastructure Assessment

In this step, a rigorous literature review along with workshop, consultation, and KIIs with the community and LGI officials[1] was conducted to identify current priorities for adaptation and infrastructure investments in the communities, municipalities, and the planning process of the local government, before conducting the impact chain analysis. In line with this, a detailed infrastructure assessment (of the most vulnerable components of government health infrastructure, private clinics, specialized hospitals, etc.) with LGI officials, experts, health practitioners, and the community was conducted, while conducting workshops and consultations considering the abovementioned issues.

2.3.2.2 Identification of Community Vulnerability

Household surveys were conducted to collect quantitative information on hazards, risks, vulnerability, and impact from the community. Before completing the household survey, the study team prepared Information, Education, and Communication (IEC) materials (infographics, flyers, leaflets, brochures, posters, etc.). Thus, these were used while organizing the orientation for the respondents on ICA and other terminologies. The household survey used the snowball sampling method, while ensuring the representation of the most vulnerable population groups (women, ethnic people, persons with disabilities, the elderly, and other disadvantaged people, etc.).

The household sample size for this study was calculated at a 95% confidence interval using the following formula:

$$n = \frac{N}{1 + Ne^2}$$

Here, “n” represents the sample size, “N” is the total slum population, and “e” is the margin of error, which is ±5%. Additional samples were taken to conduct the household survey to ensure data accuracy.

Table 2.1: Sampling for the Household Survey

Location	Population*	Total population*	Tentative Sample Size	Final Sample Size, n
Teknaf Municipality	25,056	44,738	381	389
Baharchara Union	19, 682			

[1] Town Mayor, Upazila Nirbahi Officer (UNO), Ward Councilor, Pouro Officer, Panel Mayor, Union Parishad Chairman, Union Parishad Member, PIO, etc.

Source: BBS 2011

The household survey, Consultation Workshops, and Key Informant Interviews (KIIs) were organized to validate the quantitative information and identify the impact, adaptation measures, capacity needs assessment, and future adaptation strategies. The Consultation Workshops and KIIs included the following population and stakeholder groups:

- Male and Female
- Persons with Disabilities
- Ethnic/other disadvantaged groups
- Health Service Providers/ Practitioners
- Local Government Institutions (LGI)
- Private Sector/NGO/INGO
- Organizations of Persons with Disabilities (OPD)
- Other

The IEC materials were also used while conducting the workshops and consultations with the participants to provide the participants with a basic understanding of climate change and its impacts and introduce them to the terminology, so that they can contribute to preparing the impact chain analysis diagrams.

2.3.2.3 ICA Methodology Finalization for Conducting Impact Chain Analysis

Before conducting ICA in the study locations, the study team familiarized experts, practitioners, policymakers, and community members with the methodological concept. This was accomplished through local and national level workshops where stakeholders were introduced to the theoretical concept of ICA. These workshops served to contextualize the ICA methodology from a country perspective. A total of one national level workshop and five local level workshops were conducted to finalize the methodology.

The national level workshop saw the participation of experts from various ministries and departments of the Bangladesh government, including the Ministry of Health and Family Welfare (MoHFW), the Ministry of Environment, Forest, and Climate Change (MoEFCC), the Ministry of Disaster Management and Relief (MoDMR), the Climate Change and Health Promotion Unit (CCHPU), the Department of Environment (DoE), the Department of Disaster Management (DDM), and the Bangladesh Climate Change Trust (BCCT). Additionally, representatives from several non-governmental organizations such as the Center for Participatory Research and Development (CPRD), the Disabled Child Foundation (DCF), the Disabled Rehabilitation and Research Association (DRRA), among others, were also in attendance. Members from both the C3ER and the CDD project team actively participated in the national workshop.

The five local level workshops were held at Baharchara Union and Teknaf Municipality, with the involvement of local government officials and community members, including individuals of various genders and persons with disabilities. These workshops were organized to

introduce the impact chain analysis procedure and key priority areas, while also incorporating suggestions from the community to finalize the methodological approach.

Table 2.2: Workshop List for Finalizing the ICA Methodology

Workshop Title*	Stakeholder Group	Participants	Total
National Workshop on Finalizing the ICA Methodology with the Experts and the Policy Makers	Government Officials	12	43
	Research Organization and Others	11	
	Study and Project Team Members	20	
Local Workshop with Local Government Institutions, Community, and Teknaf Municipality for Finalizing the ICA Methodology	Local Government Institutions (LGIs)	17	17
	Teknaf Municipality Group	19	19
	Female Group	18	18
	Persons with Disabilities Group	18	18
	Male Group	16	16

**Inclusive and Gender Sensitive*[2]

2.3.2.4 Conducting Workshops for Collecting Information on Impact Chain

Once the ICA methodology was finalized, a comprehensive checklist was developed to streamline information collection during the community workshops. The checklist was tailored to ensure gender and disability inclusiveness, as outlined in Figure 2.2. Subsequently, the team conducted community-based workshops, where they formulated individual impact chains for the male group, the female group, and the persons with disabilities group.

Employing a participatory approach, the study team systematically constructed the impact chain during the workshops, drawing on various steps from the Harvard Case Method (HCM). These steps included participant engagement through reflective exercises, allowing for interactive and practice-oriented learning. The HCM approach emphasizes active participant involvement, with facilitators assuming a less dominant role.

The team meticulously crafted a participatory framework for conducting the workshops and consultations, emphasizing the development of communication materials in a formal yet accessible manner, incorporating visual aids, simplified language, and inclusive strategies.

[2] The study team tried to ensure the representation of vulnerable group members (female, elderly people, persons with disabilities, ethnic communities, etc.) in every workshop to make the workshops inclusive and gender sensitive.

Additionally, gender and disability considerations were integrated at each stage of the impact chain analysis diagram development.

Under the guidance of the lead facilitator, the study team executed the impact chain analysis exercise, adhering closely to the process outlined in the accompanying figure below.

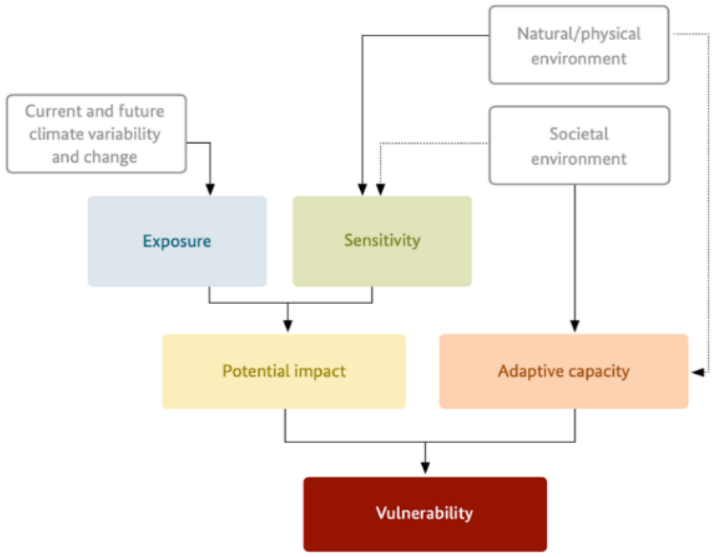


Figure 2-1: Building Blocks of an Impact Chain Analysis Diagram (Kerstin, et al., 2014)

Table 2.3: Community Level Workshop for Developing Impact Chain Analysis Diagram

Workshop Title*	Stakeholder Group	Participants
Community Level Workshops to Develop Impact Chain Analysis (ICA)	Female Group	25
	Persons with Disabilities Group	18
	Male Group	11

*Inclusive and Gender Sensitive

During the ICA workshops, the study team identified both climatic and non-climatic hazards, as well as anthropogenic factors that heightened the vulnerability of the community and its healthcare infrastructure. Additionally, they pinpointed the factors contributing to the increased sensitivity of the community to these hazards. The exposure of the health infrastructure and the vulnerable community to these risks were also determined. Participants were prompted to share information about their current adaptive measures aimed at reducing vulnerability, and potential community-driven measures were highlighted.

Through ICA, the study team meticulously recorded the factors - including hazards, exposure, sensitivity, and existing adaptive capacity - that contributed to the growing vulnerability of the community in the face of climate change.

Following the data collection for ICA, the study team developed schematic diagrams (See in Result and Findings section) for each stakeholder group (Table: 2.3) to illustrate how

climate change-induced hazards impact health and healthcare infrastructure in the study location. Subsequently, a comprehensive ICA diagram was created, amalgamating findings from the individual diagrams. The diagram showcased the interconnectedness between hazards, their impacts on health and infrastructure, the effects of the hazard on health infrastructure (exposure), the vulnerable community's susceptibility to the hazard (exposure), the factors exacerbating these vulnerabilities (sensitivity), existing strategies to address vulnerability, and potential adaptive measures.

The analysis revealed that a single hazard could heighten the vulnerability of multiple infrastructures and impact health in various ways. Several factors were identified as exacerbating the situation and increasing overall vulnerability. The study emphasized that the healthcare infrastructure and the vulnerable community can mitigate vulnerability by implementing various adaptive strategies.

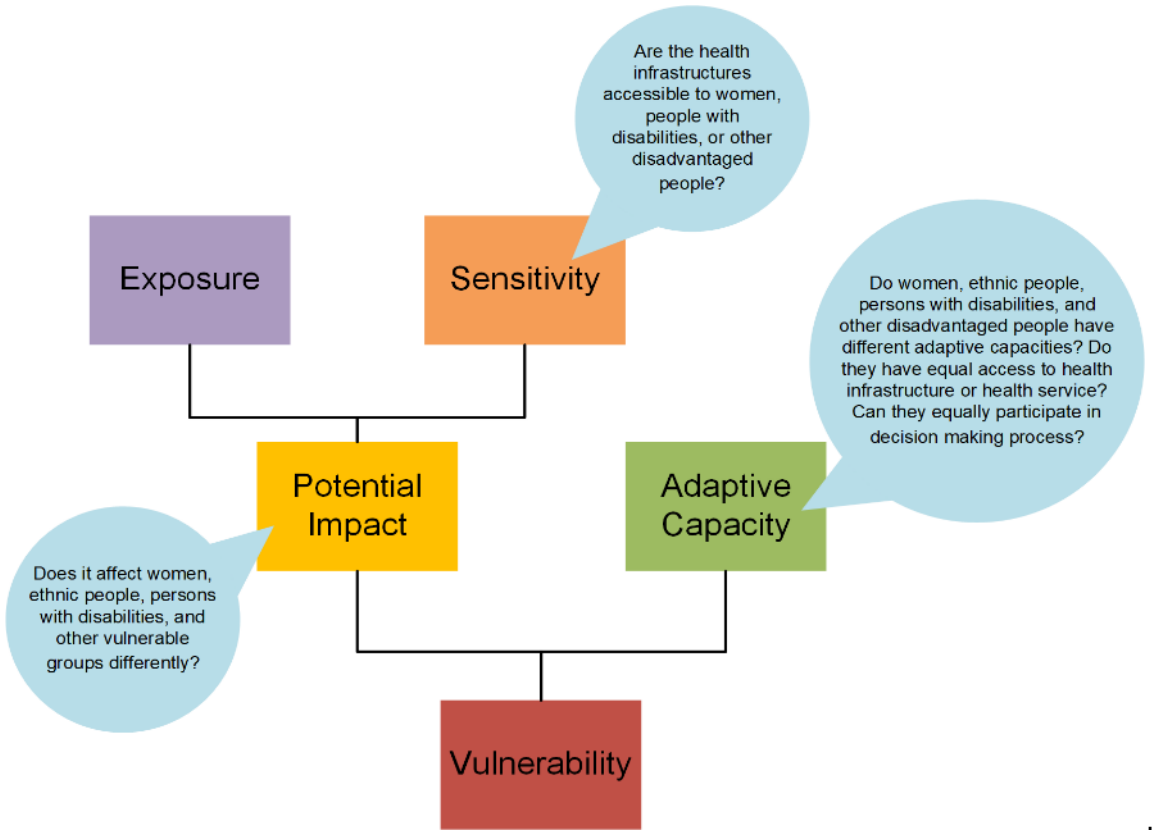


Figure 2-2 Including Gender in Impact Chains (considering age specific and other vulnerable groups, like persons with disabilities, the elderly, ethnic groups, etc.), adopted from adelphi/EURAC 2014

2.3.2.5 Benefits of using ICA Methodology over Other Methods

Impact Chain Analysis (ICA) forms a solid basis for conducting qualitative vulnerability assessments. This approach delineates the cause-effect relationships among elements contributing to the outcomes of specific hazard-exposed scenarios. Developing impact chains through the use of impact chain diagrams renders these relationships visible (RESIN, 2017).

The ICA method aligns with a comprehensive assessment framework in line with the IPCC AR5 climate risk concept. This framework, developed by EURAC Research in collaboration with the German Environment Agency and the German Gesellschaft für Internationale

Zusammenarbeit (GIZ), has found application in nearly twenty national climate risk assessments globally, including countries such as Burundi, Thailand, Vietnam, and Madagascar. Recognized for its efficacy in risk analysis and communication of intricate cause-effect relationships within climate change impacts and risks, the ICA method serves as a valuable tool for identifying entry points for adaptation measures. The terminology and concepts of impact chains are referring to the most recent climate risk concept of the IPCC, introduced within the IPCC AR5 in 2015 and further developed for the 2019 IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC Report) (Abram, 2019).

Contrastingly, other participatory approaches, such as Community Risk Assessment (CRA), engage local stakeholders in the formulation of a collaborative risk reduction strategy (action plan) by identifying, assessing, and analyzing hazards specific to various vulnerable sectors. While the CRA guideline has been implemented by government officials, researchers, and practitioners in Bangladesh over the years, it has not been directly and sufficiently linked with climate change aspects.

Within the context of Bangladesh, the ICA emerges as a critical tool, offering comprehensive insights into climate change vulnerability (i.e., a vulnerability hypothesis) shared by diverse stakeholders and aiding in the identification of suitable adaptation measures. In this study, the ICA concept facilitated the identification of climate change impacts on health and healthcare infrastructure, encompassing all vulnerable population groups in a single impact chain. Additionally, the impact chain diagrams elucidated the interconnectedness between various components (Hazards, exposure, sensitivity, vulnerability, etc.), enabling the study team to formulate appropriate adaptation measures and recommendations to mitigate climate change risks and vulnerabilities.

2.3.2.6 Challenges faced while Conducting ICA

The study team faced some challenges while conducting the ICA, which were addressed using different participatory techniques:

- **Unequal Participation:** Certain participants dominated the discussion in participatory approaches. In contrast, others remained passive or hesitated to share their perspectives which hindered the full engagement of all participants and potentially limited the diversity of ideas and insights brought to the table.
- **Lack of Real-Time Feedback:** In The workshops, decisions and recommendations were made based on the available information during the group discussions. However, participants could not experience the consequences of their decisions immediately, limiting their ability to learn from the feedback loop of real-time decision-making.
- **Instructor Facilitation:** Facilitating conversations among many participants with diverse perspectives and opinions was challenging.

2.3.3 Activity 3: Describing Results and Outcomes at the Validation Workshops

The result and outcomes, i.e., schematic diagram from the participatory workshops and community engagement were presented to the respondents who participated in both ICA

finalizing and ICA development workshops. In order to validate the findings of the study, one combined (male, female, persons with disabilities) validation workshop at the community level and one workshop for the union and sub-district level representatives were organized to share the study findings and gather their feedback. Moreover, the CDD project team also organize a national-level workshop for disseminating the developments and outcomes of the community and union\sub-district levels workshop after summarizing all the feedback and suggestions derived from local level workshops.

Table 2.4: List of the Validation Workshop

Workshop Topics*	Number of Events (s)		
	National Level	Local Level	Total
Validation Workshop with community		1	1
Validation Workshop with LGIs officials		1	1
Final Dissemination Workshop	1		1
Total	1	2	3

**Inclusive and Gender Sensitive*

2.3.4 Activity 4: Providing Recommendations and Proposing Solutions for the Identified Vulnerable Components of CI for Communities and Decision-makers

Based on the overall identified vulnerable CI components, risk drivers and factors, and community feedback and expert opinions, the team developed comprehensive, inclusive, and gender-sensitive recommendations and solutions to increase community resilience.

2.3.5 Activity 5: Preparation of Final Information, Presentation, and Communication Material

The team prepared the following report, presentation, and communication material:

- Communication material (e.g., infographic, fact sheet) containing lessons learned and a summary of the outcomes, recommendations, and proposed solutions for an audience that would not read the final report.
- Digitization and visualization of the final impact chain in a diagram prepared for dissemination.
- A descriptive final report on observed changes in investment planning and decision-making.
- A final presentation to present results and lessons learned.

2.3.6 Activity 6: Contribution to the Technical Working Group (TWG) on the topics of Cause-effect relations (Impact Chain Analysis) within the Healthcare Sector from a Community and Mixed Workshop Perspective

To contribute to the Technical Working Group on the topics of cause-effect relations (impact chain analysis) within the healthcare sector from a community and mixed workshop perspective, the team:

- Participated in selected meetings of the TWG.
- Developed policy brief targeting the relevant Ministries for Policy modifications, development, and implementation.
- Participated and presented the findings of the ICA diagram at national and local level advocacy workshops.

2.4 DATA ANALYSIS AND REPORTING

2.4.1 Data Quality Check

To maintain the data quality, the following actions were taken:

- The Data Manager conducted spot-checking during the time of data collection and reviewed the collected data on a daily basis. The feedback was provided to enumerators as and when needed.
- The C3ER expert team checked data accuracy before analyzing.

2.4.2 Data Management and Analysis

As mentioned earlier, primary data was collected using checklists. After that, MS Excel and SPSS were used to analyze the collected raw data. Moreover, the analysis result was disaggregated by sex, age, geographic coverage, and other relevant diversities as per the research objectives. Finally, the study analyzed collected data and presented findings in an informative and user-friendly manner.

After cleaning and analyzing the collected data, the study team prepared an initial report showing preliminary findings. This report was shared with the CDD project team for review, and for feedback on initial results and suggestions on how to improve quality or address gaps in the study.

2.4.3 Preparation of Draft and Final Assessment Report

After collecting and analyzing primary and secondary data, a detailed assessment of the present condition of health infrastructures was conducted. The study locations' need for resilient critical (health) infrastructures was thoroughly understood. Additionally, the assessment aimed to enable the local communities to make risk-informed decisions regarding climate change-induced disaster vulnerabilities. As mentioned earlier, a national level workshop was organized by CDD, to share and validate the analysis findings, after which the final assessment report was revised accordingly and submitted to CDD.

2.5 STUDY LIMITATIONS

The study team faced few challenges while conducting the study. However, the study team managed to overcome these challenges and conducted the assessment successfully. The main challenges faced are as follows:

- **Language Barrier:** The participants and respondents in the workshops, KIIs, and household surveys were local people of the Teknaf area, who use local dialects to communicate. The study team were not familiar with the dialect, as a result, it was difficult for the team members to understand and comprehend the information the respondents were giving. To deal with this problem, several translators were hired who were local people and could understand the local dialect very well. The translators helped translate the information to the field team.
- **Lack of Relevant Literature:** ICA is a comparatively new methodology, and there are not adequate literatures available in the context of Bangladesh and other countries as well. As a result, it was difficult for the study team to gather proper knowledge on ICA due to the inadequate amount of literature and articles. However, the international team of GIZ, who has the experience and knowledge regarding this methodology, helped the study team to conceptualize the ICA concepts. Moreover, the vast experience of the senior experts of C3ER helped to adopt the methodology as per the context of Bangladesh. With their help, the team managed to understand the process and conducted the assessment successfully.
- **Time Constraint:** In order to conduct the ICA and illustrate the results accurately, it often needs to attempt to capture every detail, interconnection and interdependencies, which increases the complexity of the assessment and requires more time and resources. The project was a short duration project, and as a result, the team struggled a little bit to execute the project activities. However, the team members were adept, professional, hardworking, and dedicated, and managed to complete the assessment in the given time.

3 UNDERSTANDING THE CONTEXT

3.1 CLIMATE CHANGE VULNERABILITY IN BANGLADESH

Bangladesh is frequently highlighted as one of the world's most vulnerable countries to the impacts of climate change (Kulp & Strauss, 2019). The 2020 edition of German Watch's Climate Risk Index positioned Bangladesh seventh among countries most affected by climate-related disasters from 1999 to 2018 (Ecksteinn, Künzel, Schäfer, & Winges, 2019). The vulnerability of Bangladesh to climate change is rooted in a combination of geographical factors, such as its flat, low-lying, and delta-exposed topography (Ayers, Huq, Faisal, & Hussain, 2014), and socio-economic factors, including its high population density, prevalence of poverty, and dependence of many livelihoods on climate-sensitive sectors, particularly agriculture and fisheries (Thomas, et al., 2013).

The changing climate patterns and the unique geographical context are placing considerable strain on Bangladesh's economy and progress toward sustainable development. In 2021, Bangladesh incurred approximately $11.3 billion in losses due to climate-related natural disasters (WMO, 2021), equivalent to roughly 2.47 percent of the total GDP for the fiscal year 2021-2022. Despite persistent efforts for climate adaptation, the future is projected to be significantly more extreme and uncertain, as indicated by the IPCC in its Sixth Assessment Report. The report highlights the impacts of climate change, including sea-level rise, groundwater contamination, freshwater scarcity, biodiversity loss, decline in aquaculture, and recurrent flooding in Bangladesh. According to the report, climate-induced disasters led to the loss of around 850,000 households and 250,000 hectares of arable land. The loss of agricultural land also resulted in crop failure, contributing to a 30% increase in the price of rice between 2014 and 2021 in Bangladesh (IPCC, 2022). Another analysis forecasts a decrease in the freshwater river area from 40.8% to 17.1% in the southwest coastal zone of Bangladesh between 2012 and 2050. The resulting freshwater scarcity has and will continue to lead to a high incidence of diarrheal diseases, further exacerbating the disease burden in climate hotspots, potentially resulting in 2.2 million more cases of E. coli[3] in Bangladesh by 2100.

The Bangladesh Delta Plan estimates that the combined effects of climate change could lead to a loss of 1.1 percent of GDP per year under moderate climate change and 2 percent per year under extreme climate conditions. The BDP2100 also predicts a potential impact on overall rice production, forecasting a decline of 17 percent by 2050, which could impede food and nutrition security (GED, 2018).

In addition to other sectors, the health sector in Bangladesh is also experiencing the impacts of climate change, with an increase in respiratory diseases and mosquito-borne illnesses such as dengue, alongside deteriorating psychological health conditions. Direct effects of climate change observed in Bangladesh include morbidity and mortality due to heat stress, cyclones,

[3] Escherichia coli (E. coli) bacteria normally live in the intestines of healthy people and animals.

floods, droughts, and other extreme weather events at various spatio-temporal scales (Rahman, et al., 2019). Moreover, cyclones, floods, and rising sea levels have become more frequent and severe, leading to loss of life, displacement, destruction of homes and infrastructure, and disruption of livelihoods. These traumatic events leave lasting psychological impacts on affected communities, resulting in increased anxiety, depression, post-traumatic stress disorder (PTSD), and other mental health disorders. A recent study found a significant association between climate-related shocks and other stressors and the burden of depression and anxiety in Bangladesh (Wahid, Raza, Mahmud, & Kohrt, 2023).

A multi-hazards risk map for Bangladesh was used in the National Adaptation Plan (NAP) of Bangladesh where the whole country was divided into 11 climatic stress areas. The stress areas, districts under the areas, and major climatic hazards in those areas are presented in the table below.

Table 3.1: Climate Stress Area Coverage and related Hazards (Source: (MoEFCC, 2022))

Climate Stress Areas	Districts	Prominence of Climate Hazards
South-western coastal area and Sundarbans (SWM)	Satkhira, Khulna, Bagherhat, Pirojpur, Barguna, Barisal, Patuakhali, Jhalokhathi, Bhola, Shariatpur, Gopalganj, Jashore, Sundarbans	Rainfall variability, river floods, sea-level rise, salinity, tropical cyclone, storm surges, drought, extreme heat waves, extreme cold, riverbank erosion and lightning
South-east and eastern coastal area (SEE)[4]	Noakhali, Feni, Lakshmipur, Chattogram, Cox's Bazar, Chandpur	Rainfall variability, river floods, sea-level rise, salinity, tropical cyclone, storm surges, drought, extreme heat waves, extreme cold, riverbank erosion, lightning, and landslides
Chattogram Hill Tracts (CHT)	Chattogram Hill Tracts (CHT)	Rainfall variability, flash floods, tropical cyclone, storm surges, drought,
Rivers, floodplains, and erosion prone areas (FPE)	Nilphamari, Kurigram, Lalmonirhat, Gaibandha, Rangpur, Bogura, Sirajganj, Pabna, Rajshahi, Jamalpur, Tangail, Manikganj, Dhaka, Munshiganj, Mymensingh, Sunamganj, Netrokona, Habiganj, Kishorganj, Sylhet, Brahmanbaria, Narsingdi, Narayanganj, Rajbari, Faridpur, Madaripur, Gopalganj, Narail, Sariatpur, Barisal, Patuakhali, Bhola, Jhalokathi, Khulna, Chandpur, Cumilla, Noakhali, Lakshmipur, Cox's Bazar	Rainfall variability, river floods, tropical cyclones, tornado, extreme heat waves, extreme cold, riverbank erosion and lightning
Haor and flash floods areas (HFF)	Sunamganj, Netrokona, Habiganj, Kishorganj, Sylhet, Maulvibazar, Brahmanbaria	Rainfall variability, flash floods, tropical cyclone, tornado, extreme heat waves, intense cold, riverbank erosion, lightning and landslides

[4] Tecknaf municipality and Bahachara union falls under one of the stress areas of NAP like South-east and Eastern coastal area. This zone is vulnerable to different climate change induced disasters.

Climate Stress Areas	Districts	Prominence of Climate Hazards
Drought prone and barind areas (DBA)	Naogaon, Chapai Nawabganj, Rajshahi, Bogura, Joypurhat, Rangpur, Dinajpur, Meherpur, Chudanga, Kushtia, Jashore, Magura, Jhenaidah	Rainfall variability, tropical cyclone, tornado drought, extreme heat waves, extreme cold and lightning
Northern, north-western region (NNW)	Panchagarh, Thakurgaon, Nilphamari, Lalmonirhat, Rangpur, Kurigram, Dinajpurs	Rainfall variability, river floods, flash floods, tropical cyclone, tornado, drought, extreme heat waves, extreme cold, riverbank erosion, lightning, and landslides
Chalan beel and low-lying area of the north-western region (CBL)	Pabna, Natore, Sirajganj, Rajshahi, Naogaon	Rainfall variability, river floods, tropical cyclone, tornado, extreme heat waves, extreme cold, riverbank erosion and lightning
Char and islands (CHI)	Nilphamari, Lalmonirhat, Kurigram, Gaibandha, Sirajganj, Jamalpur, Mymensingh, Manikganj, Munshiganj, Shariatpur, Chandpur, Bhola, Patuakhali, Feni, Noakhali, Lakshmipur, Chattogram, Cox's Bazar	Rainfall variability, river floods, sea-level rise, salinity, tropical cyclone, tornado, storm surges, extreme heat waves, extreme cold, riverbank erosion, lightning, higher sea surface temperature and ocean acidification
Bay of Bengal and Ocean (BoB)	Bay of Bengal (maritime boundary)	Rainfall variability, sea-level rise, tropical cyclone, tornado, storm surges, extreme heat waves, lightning, higher sea surface temperature, hypoxy and ocean acidification
Urban areas (URB)	43 cities	Rainfall variability, urban floods, sea-level rise, salinity, tropical cyclone, storm surges, drought, extreme urban heat waves, extreme cold and lightning

The following map illustrates the major climatic stress areas of Bangladesh.

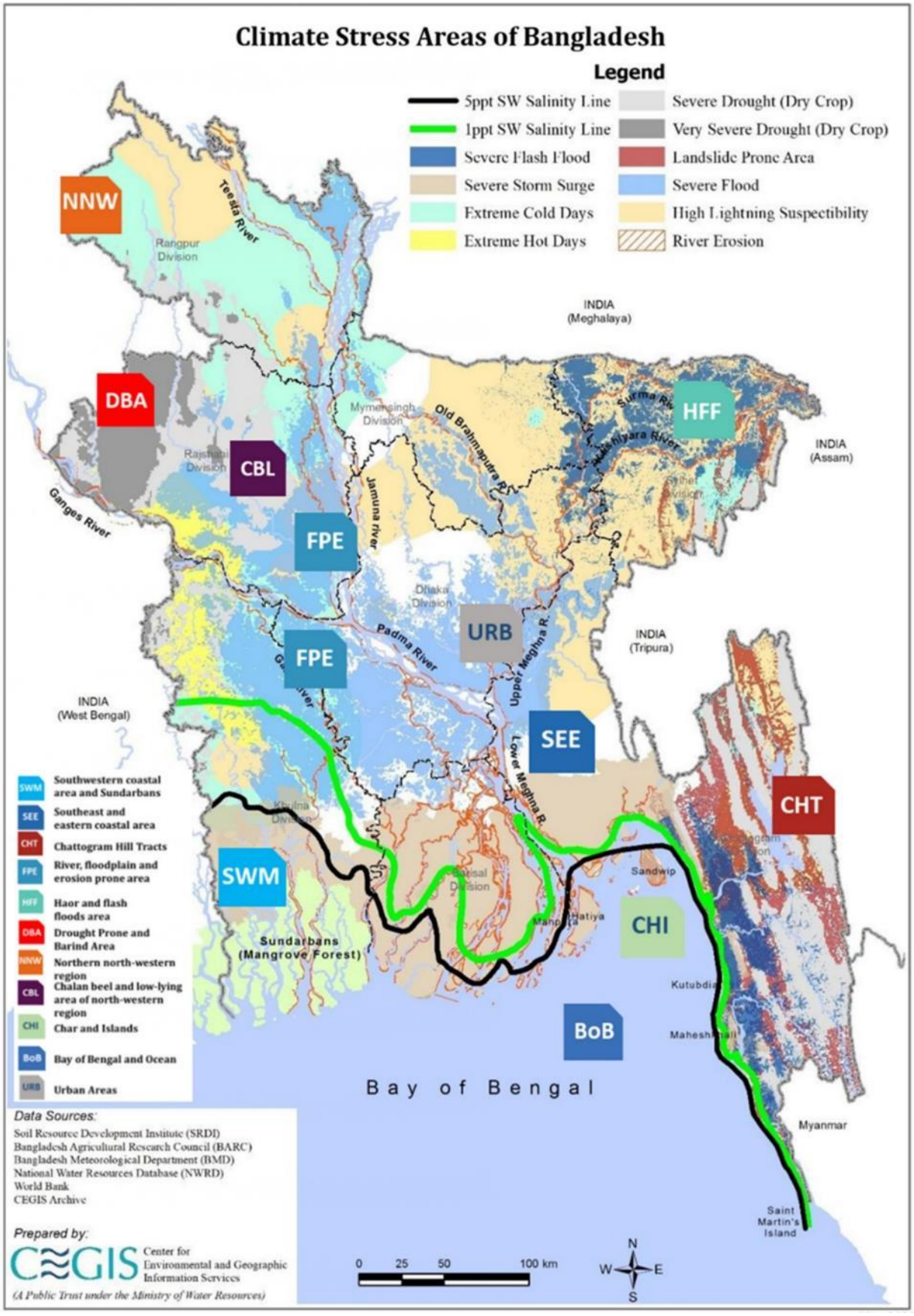


Figure 3-1: Different Climate Stress Ares of Bangladesh (Source: (MoEFCC, 2022))

3.2 HEALTH SECTOR IN BANGLADESH

Bangladesh has advanced significantly in the healthcare sector. A remarkable amount of health infrastructure has been developed. Modern facilities are increasing the number of government medical colleges and universities, private medical colleges, private clinics, private hospitals, district hospitals, rural health centers, and community clinics, while improving quality. Numerous NGOs are also making significant contributions and playing essential roles in enhancing the nation's healthcare delivery system. At present, people are also becoming more aware of health issues. There are ongoing public and private campaigns to support child and maternal health, immunizations, mass deworming, latrines and safe water, handwashing, etc.

According to the Health Bulletin 2020 (published in 2022), 775 hospitals that are part of the Directorate General of Health Services (DGHS) provide significant contributions to Bangladesh's healthcare system. Six tiers of healthcare infrastructure under the DGHS are national, divisional, district, upazila (sub-district), union, and ward levels. Healthcare is provided through government hospitals at the secondary and tertiary levels, hospitals at the upazila and union levels, registered private hospitals and clinics, and private diagnostic centers. There are institutions for specialized tertiary care to patients and postgraduate medical education and training at the national level.

The following table shows the different levels of healthcare facilities provided by Bangladesh's Ministry of Health and Family Welfare (MoHFW).

Table 3.2: Level of Healthcare Facilities Provided by MoHFW

Health Care Level	Facilities
Tertiary Health Care	Medical College Hospitals, Specialized Institutes, and Maternity Hospital Located at different regional level
Secondary Health Care	District Hospitals, General Hospitals, 100-250 Bed Hospitals
Primary Health Care	Upazila Health Complexes, TB Clinics, Upazila Family Planning Office, MCWCs
Daycare facilities	Upazila Sub-centers, UH&FWCs, Community Clinics

The number of hospital beds in public and private health facilities is rising. In addition, teaching and training institutions for healthcare are increasing, and the seats in these teaching/training facilities have also increased in recent years.

However, the number of healthcare service providers is still very low. The WHO estimates that at least 2.5 medical staff (physicians, nurses and midwives) per 1,000 people are needed to provide adequate coverage with primary care interventions (WHO, 2006). According to the World Bank collection of development indicators, compiled from officially recognized sources, Bangladesh has 0.6672 physicians, 0.4891 nurses and midwives, and 0.8 community health workers per 1,000 people, indicating that the number is very low, even lower than the global

average of 1.6 physicians (World Bank, 2023a) and 4 nurses/midwives (World Bank, 2023b) per 1,000 people.

Bangladesh has a pluralistic healthcare system. The Ministry of Health and Family Welfare follows a comprehensive health service delivery structure, moving from the national level down to the district, upazila (sub-district), union, and eventually the ward levels. At multiple levels (primary, secondary, and tertiary), it offers outdoor (outpatient) treatment, indoor (inpatient) treatment, and emergency care. The Ministry of Health and Family Welfare's service delivery structure is depicted in the figure below.

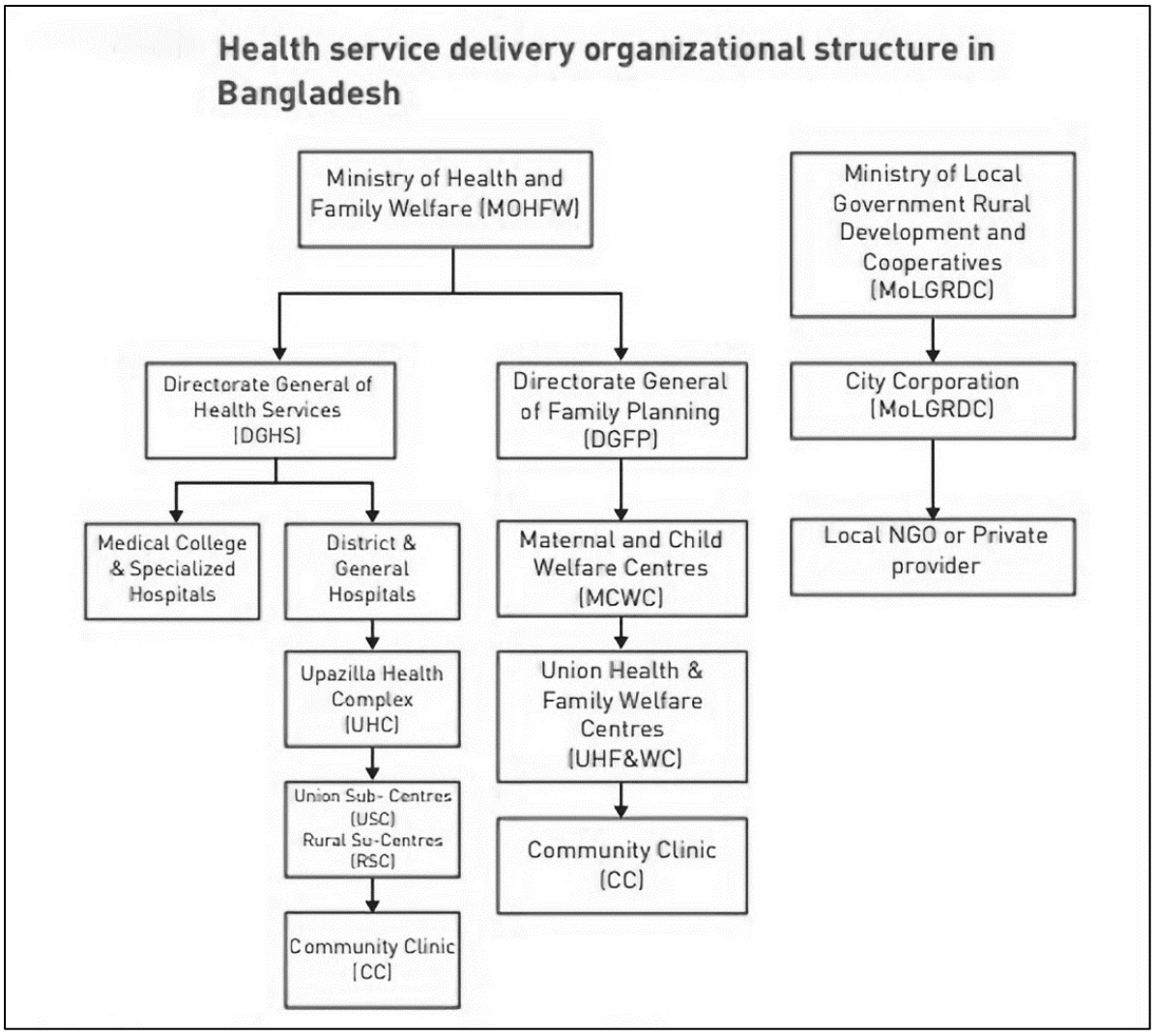


Figure 3-2: Health Service Delivery Organizational Structure in Bangladesh. Source: Asia Pacific Observatory on Health and Policies

3.3 CRITICAL HEALTH INFRASTRUCTURE

Critical health infrastructure refers to those essential physical and information technology facilities, networks, services, and assets which, if disrupted or destroyed, would seriously impact the health, safety, security, economic or social well-being of the community people and the effective functioning of government. Critical health infrastructures are not only those infrastructures related to serving patients via hospital services but also include information

systems regarding rehabilitation services for persons with disabilities and healthcare services, awareness among people, including persons with disabilities, knowledge of withstanding adverse conditions, providing emergency medications, contingency plans for health emergency period etc. In Bangladesh, healthcare infrastructures are considered significant places to seek health services (if available) when climatic disasters strike in any area. Health infrastructures are the most needed critical infrastructures (CI) for providing essential services during and after a disaster. Therefore, critical health infrastructures are primarily those infrastructures that are designed, constructed, and implemented to serve the people who are suffering from extreme health conditions, whether it be due to illness, environmental degradation, climatic disaster, anthropogenic hazards, or a pandemic.

A detailed description of the common and frequently visited critical health infrastructures of Bangladesh is illustrated in the following table-

Table 3.3: Critical Health Infrastructures of Bangladesh (Source: Generated from Literature Review)

Term	Description
Upazila Health Complex	Upazila health complexes are primary-level healthcare facilities located in the sub-districts in all geographical regions of Bangladesh. The Government provides healthcare services to its rural people through health facilities called upazila health complex (UHC) at the Upazila level and through union subcenters at the union level.
Union Health and Family Welfare Center/Union Health sub-center	Union health and family welfare centers in Bangladesh are designed to improve maternal and neonatal health by making family planning and maternal and childcare services available to people in rural areas. The Government of Bangladesh attempts to provide reproductive health services that emphasize maternal and child health (MCH) and family planning at different service delivery tiers through various service providers. For this purpose, it has established an extensive network of reproductive health services that reaches almost every village in the country.
Community Clinic	Community Clinic (CC) is the innovation of the Bangladesh Government to extend Primary Health Care to the doorsteps of rural people all over rural Bangladesh. The Community Clinic (CC) is a unique extension of Primary Health Care services to the doorsteps of rural people of Bangladesh. Community Clinic is the lowest-tier health facility at the primary level established throughout the country, including very hard-to-reach, remote & isolated areas.
Private Clinic	Private Clinics are privately managed organizations where sick and injured persons receive healthcare and treatment. A clinic, however, usually provides treatments to non-resident patients. Traditionally healthcare has been a vital government activity since the British period, and the trend continued after Bangladesh achieved its independence in 1971. During the early 1990s, Bangladesh firmly committed itself to a free market economy,

Term	Description
	so the healthcare sector slowly began to attract greater attention from the private sector. Most of the country's hospitals are in the government sector at different administrative tiers.
Government Hospital	A government hospital is a medical facility that is owned, funded, and operated by the government at either the national, state, or local level. These hospitals are established to provide healthcare services to the public, irrespective of their financial capabilities. In Bangladesh, government hospitals are an integral part of the healthcare system and play a crucial role in providing medical services to the population. The government of Bangladesh operates numerous hospitals and healthcare facilities across the country, catering to the healthcare needs of its citizens. The primary purpose of government hospitals is to deliver medical care, diagnosis, treatment, and preventive services to patients. They offer a wide range of healthcare services, including emergency care, outpatient clinics, inpatient care, surgeries, specialized treatments, and various diagnostic procedures. These hospitals may also be involved in medical research, training healthcare professionals, and promoting public health initiatives. One of the key characteristics of government hospitals is that they often offer subsidized or free medical services to individuals who cannot afford private healthcare. They generally have a mandate to prioritize the health needs of the underserved and economically disadvantaged populations. Government hospitals are funded through tax revenue, government budgets, and sometimes supplemented by patient fees or insurance reimbursements.
Diagnostic Center	A diagnostic center is a place that accounts for any health issues and provides treatment if needed. A diagnostic center performs various tests to determine the cause of the condition. There are different types of labs within this category, including radiology & MRI centers, imaging centers, pathology labs, etc.
Pharmacy	A pharmacy, also called a dispensary in Bangladesh, is a retail shop that provides pharmaceutical drugs, among other products. Pharmacy is a health profession explicitly concerned with the knowledge of medicines and wisdom in their uses.
Medical College Hospital	In Bangladesh, Medical College Hospitals are under the jurisdiction of the Ministry of Health and Family Welfare (MoHFW) and are affiliated with a university in the respective region and provide healthcare services along with medical education and training. These hospitals not only provide healthcare services to the public but also contribute to the training of medical students, interns, and resident doctors, fostering medical education and research in the country.

Term	Description
Medical Camp	Medical camp means a temporarily organized activity within a specified locality to provide free, subsidized, or sponsored medical or dental services, surgical, educational, and diagnostic services, eye camp, hearing camp or treatment.
Mental Healthcare Provider	In Bangladesh, mental health services are provided by psychiatrists, psychiatric nurses, and clinical psychologists, with little to no multidisciplinary teamwork between them. It is difficult for rural populations to access psychiatrists and other mental health professionals. Mental health services are often limited to a divisional tertiary level, where psychiatrists work at public medical college hospitals in cities. Very few healthcare workers in Bangladesh are trained in providing mental health services. Types of mental healthcare providers in Bangladesh include psychiatrists, nurses, psychologists, social workers, occupational therapists, and general mental health workers. Approximately half the psychiatrists in Bangladesh work in government mental health facilities or private sector clinics.
Maternal and Child Healthcare	Maternal and child health (MCH) care is the health service provided to mothers (women in their childbearing age) and children. Maternal health also includes introducing midwife-led maternal and newborn health care, and Increase facility delivery, ensuring 24/7 Emergency Neonatal and Obstetric Care is available, and Eliminating Obstetric Fistula in Bangladesh, Revitalize Family Planning.
Immunization	Bangladesh has made significant progress in elimination and control of Vaccine Preventable Diseases (VPDs). Bangladesh has also introduced several new vaccines since last decades. Hepatitis B vaccine was introduced in 2003, Haemophilus influenzae type b (Hib) in 2009, rubella in 2012, Pneumococcal Conjugate Vaccine (PCV) and Inactivated polio vaccine (IPV) in 2015, MR second dose in 2015 and fractional doses of the inactivated poliovirus vaccine (fIPV) in 2017. The government has plan to introduce rota and Human Papillomavirus (HPV) vaccine in near future. Surveillance for Japanese encephalitis (JE) and other VPDs is ongoing. The government has set target of elimination measles and rubella by 2020 maintain polio free status and control other VPDs (diphtheria, typhoid, cholera and others) as required.
Specialized Hospital	Specialized hospitals are physician-owned medical centers that target one area of medicine and care or a particular group of patients. Some of the most common specialty hospitals include orthopedic centers, surgical centers, and cardiac facilities. Government owned specialized hospitals includes National Institute of Traumatology & Orthopedic Rehabilitation (NITOR), National Institute of Mental Health (NIMH), National Institute of Ophthalmology (NIO), National Institute of Ear, Nose and Throat (ENT),

Term	Description
	National Institute of Kidney Diseases & Urology (NIKDU), National Institute of Cardiovascular Diseases (NICVD) etc.
Telemedicine	Telemedicine, sometimes called telehealth, is a direct line, whether it's a phone call, video chat or text message, to a physician or care provider via telecommunication. It is a rapidly growing technology in the health care field around the world as it ensures easier access to those who may not otherwise receive medical care. Telemedicine in Bangladesh is a recent advancement. While the initial care lacked critical technology infrastructure, the recent expansion of bandwidths and networks into rural areas has made telemedicine more accessible for Bangladeshis. Moreover, the Bangladeshi government has taken steps to facilitate health care needs by establishing new telemedicine programs. In 2001, the government established a cooperative known as the Bangladesh Telemedicine Association to promote telemedicine organizations. In 2003, the Sustainable Development Network Program emerged to promote cooperation between different providers.
E-Health System	An E-Health system, short for electronic health system, is a comprehensive healthcare solution that leverages digital technologies to manage and deliver healthcare services, health information, and data. These systems aim to improve the efficiency, quality, and accessibility of healthcare. E-Health has enormous potential to ensure healthcare quality, accessibility, and affordability in developing countries. The application of information and communication technology to healthcare, especially e-Health, is rapidly advancing in Bangladesh. Both the public and private sectors have contributed to the development of the e- Health infrastructure throughout the country.

3.4 PREVIOUS AND ONGOING INITIATIVES RELATED TO CLIMATE CHANGE IMPACTS ON HEALTH

There have been several projects and programs in the health sector in Bangladesh related to climate change and health over the past few decades. Numerous development activities under the initiatives of different ministries and departments of the Government of Bangladesh (i.e., MOHFW, DGHS, DGFP) and other agencies have been implemented. Most of these projects or programs have been funded by the World Bank, JICA, DFID, SIDA, USAID, CIDA, EC, AusAID, KFW, WHO, UNICEF, UNFPA, GIZ, UNAIDS, GFATM, GAVI, etc. through loans or grants.

The list of ongoing and previous projects in the health sector in Bangladesh is presented in the Annexture 3.

4 POLICY REVIEW AND ANALYSIS

Climate change poses significant challenges to Bangladesh, impacting various sectors, including health infrastructure, persons with disabilities and other vulnerable groups and communities. While Bangladesh has taken significant steps to address climate change-related challenges in health infrastructure, there are still gaps in the existing policies and legislation for vulnerable groups, which need to be addressed. Enhancing resilience in health infrastructure, ensuring the inclusion of vulnerable groups, and prioritizing the needs of the vulnerable groups is critical for effective climate change adaptation and mitigation in the country.

This section provides a detailed review of the existing national and international policies, plans, and strategies, and the gaps in these documents, and identifies the gaps in them regarding climate change impact on health, health infrastructure, and vulnerable groups. Analyzing the policy gap in addressing these issues reveals areas where further action is needed.

4.1 REVIEW OF NATIONAL POLICY, PLAN, AND STRATEGY

The **National Adaptation Plan (NAP), 2023-2050** addresses the key risks and vulnerabilities of climate change and the medium- and long-term climate change impacts further and implements climate change adaptation in the identified stress areas of Bangladesh. It addresses gender dimensions, youth and the elderly, persons with disabilities, ethnic communities, and socially disadvantaged communities in all possible aspects, and reveals core adaptation needs to climate change impacts. It also mentions risks and vulnerabilities to climate change among persons with disabilities. It also mentions developing climate-resilient infrastructures, improving public health, and enhancing urban resilience. It also mentions human health issues, like premature childbirth or death, and stroke due to increased salinity, which is a direct impact of climate change.

The NAP emphasizes the need to strengthen the health sector to ensure resilience and provide timely healthcare services to its population. Key initiatives include improving healthcare facilities, training healthcare professionals, and upgrading emergency response systems. The plan focuses on enhancing early warning systems for disease outbreaks and strengthening disease surveillance networks. It also emphasizes the importance of public awareness and community engagement in climate change adaptation and health-related issues. Infrastructure development includes the construction and renovation of healthcare facilities, the establishment of climate-resilient hospitals, and the provision of necessary medical equipment and supplies. Furthermore, the plan highlights integrating climate change considerations into health policies, research, and capacity-building efforts. By prioritizing health infrastructure in its adaptation strategies, Bangladesh aims to safeguard the well-being of its citizens and build a resilient healthcare system capable of effectively managing climate-related health risks.

The **Bangladesh Delta Plan (BDP) 2100** addresses the impact of climate change and the long-term delta-related challenges of sustainable management of water, ecology, food security, livelihood, environment, and land resources of Bangladesh. It addresses the impact of climate change on different hotspots of Bangladesh because they face different risks of natural hazards and climate change. BDP 2100 also mentions health hazards that are intensifying due to climate change. It also mentions that climate change and the resultant floods and cyclones will have a significant impact on infrastructure in Bangladesh. BDP 2100 also addresses protecting agriculture and vulnerable communities from floods, which is an adverse impact of climate change.

In **Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009**, the impact of climate change on human health is addressed in terms of the coastal belt and drought-prone areas in the northwest of the country where the shortage of safe drinking water imposes hardship on women and children and drinking saline water results in health hazards, especially for pregnant women. It also mentioned that climate change is likely to increase the incidence of waterborne and airborne diseases. In view of this, BCCSAP addresses implementing public health to reduce the spread of these diseases and to improve access to health services for those communities likely to be worst affected by climate change.

Mujib Climate Prosperity Plan (MCPP) 2030 addresses the impact of climate change on the economy and society of Bangladesh including water resources, agriculture and forestry, food security, human health, and infrastructure. It also addresses the accessibility of elderly people, low-income groups, and communities to health care who are having serious health implications because of working in extreme heat. It mentions that human health and environmental health are intricately linked as detrimental changes in the environment will eventually affect human health. It mentions that vulnerability mapping and analysis for women, especially when combined with different age groups, and indigenous women's knowledge and practices, will increase climate resilience and improve climate and environmental outcomes. MCPP 2030 also addresses access to public health care services for climate-sensitive diseases (e.g., malaria) which can be assured by financial protection (health insurance). The MCPP 2030 also foresees ways of strengthening vulnerable communities and increasing participation in pursuits that promote physical and mental health.

Bangladesh Country Investment Plan for Environment, Forestry and Climate Change (**EFCC CIP), 2016-2021** addresses the effect of climate change, climate-change-associated losses, adaptation to climate change, and climate change mitigation. It also mentions the effects of climate change in coastal districts. It addresses vulnerability to climate change, especially for women, and increases resilience at the community level. The plan addresses adaptation to climate change impacts on health in the adaptation priorities. It also addresses the needs of women and men of persons with disabilities.

The Climate Change Trust Act, 2010 mentions making necessary action plans for upgrading the life and livelihood of the group of people who are directly affected by the risks of climate change. The act emphasizes the adaptation, mitigation, technology development, and capacity building of the affected groups facing the adverse impact of climate change.

National Adaptation Program of Action (NAPA) 2005, updated in 2009, addresses the adverse impacts of climate stimuli including variability and extreme events by identification and implementation of immediate and urgent needs. It mainstreams adaptation to climate change into policies and programs in different sectors focusing on health. Climate change is expected to present increased risks to human health in Bangladesh.

Possible adaptive strategies for climate change impact on human health suggested are implementing surveillance systems for existing and new disease risks, ensuring health systems are geared up to meet future demands, developing of Strategy for alternative sources of safe drinking water and sanitation program in climate vulnerable areas and awareness and behavioral change and communication for climate change related health problems. The climate change impact is expected to increase risks to human health in Bangladesh, especially considering the poor state of the country's public health infrastructure. It is mentioned in the plan that the most adverse impacts of climate change will affect the poor people and even within the poor groups, the most vulnerable are the women, children, elderly and the sick.

Bangladesh Climate Change and Gender Action Plan (BccGAP, Draft Report, 2023) aim to ensure gender equality in policies, strategies and measures in six priority groups - natural resources, livelihood, infrastructure and settlements, women's leadership and participation, gender-responsive means of implementation, capacity-building, knowledge management, and communication. The impact of climate change on health and healthcare sectors has been prioritized in this plan and mentioned for adequate gender-segregated WASH facilities in the infrastructure and settlements sector. It provides actions to strengthen health services mainstreaming gender and climate change into government and non-government partners' health policies, strategies, plan and promote gender- and climate-responsive construction principles for infrastructure development. The activities include improving access to affordable community health centers to combat climate change impacts, establishing emergency information and healthcare service network etc. Since emergency shelters often fail to respond to the needs of vulnerable groups including women, children, and persons with disabilities (PWD). It also promotes strengthening and institutionalize gender mainstreaming in all sectoral policies and programs.

The **Standing Orders on Disasters (SOD), 2019** addresses planning on climate change and research activities, formulating strategies to deal with the climate change impacts, climate change risks and adaptation options. SOD 2019 also addresses different sectoral impacts from disasters and climate change and adaptation strategies to climate change impacts such as inventing new products (crops, fisheries, and new breeds of livestock) and technologies for cultivators and farmers. It addresses ensuring the supply of electricity and telecommunications in the healthcare centers of high-risk areas and installing solar panels as an alternative to ensure these services are also under their policy.

It addresses the infrastructure, agriculture, business, and services service-oriented agencies and people as 'elements at risk'. It also addresses assisting persons with disabilities for accessing essential services or infrastructure during disaster and post-disaster periods also

providing necessary assistance and advisory support to relevant stakeholders and people for building disaster-resilient infrastructures.

The **National Plan for Disaster Management (NPDM), 2021- 2025** places importance on disaster risk management linked with rapid urbanization and climate change. It considers climate change as a challenge that makes the rapidly growing cities highly at risk. Climate change impacts include increases in the incidence and intensity of extreme weather events and hazards such as soil salinization, rising sea levels and riverbank erosion. The document identified health and healthcare systems as a core investment area for incorporating disaster risk management aspects. It recognized the link between climate change and disaster and International Health Regulations by aligning national and international frameworks. It emphasizes integrating disaster risk management, particularly at the local level; and developing the capacity of health workers to understand disaster risk. This plan promotes safer and more resilient communities following 'whole of society' approach to disaster risk management and response initiatives. It specifically depicts mainstreaming gender and persons with disabilities through 'Twin track' mechanism to develop inclusive approach and empowerment by capacity development, awareness raising, law enforcement, search, and rescue facilities. Furthermore, this plan focuses on national-level action to strengthen the design and implementation of inclusive policies and social safety-net mechanisms, including access to basic health-care services such as maternal, newborn, and child health etc. It highlights rehabilitation programs that give psychosocial assistance and mental health services to anybody in need.

The **Disaster Management Act, 2012** enacted for a coordinated and effective, object oriented, strengthened disaster management approach, and to formulate rules to build up infrastructure to fight back all the disasters. It is a legal framework of Bangladesh creating mandatory obligations and responsibilities on Ministries, committees, and appointments. How the private healthcare workers should provide service or infrastructure are obliged to run during disasters is documented in this act. In Addition, it emphasizes assisting the ultra-poor and under privileged community especially the older persons, women, children, and handicapped persons who are considered the most vulnerable and affected by disasters.

The **National Disaster Management Policy, 2015** defined the national perspective on disaster risk reduction and emergency management. It contained the strategic framework and national principles of disaster management in Bangladesh. It describes the broad national objectives, and strategies to reduce risks through immediate response mechanisms. This document mentioned climate change needs to be prioritized in risk mitigation strategies. It emphasizes vulnerable groups including women, children, the elderly and persons with disabilities and stated adaptation interventions for them.

The **8th Five Year Plan (8thFYP), 2020-2025** of Bangladesh addresses climate change natural disasters and other environmental hazards as a major focus for the Eighth Five Year Plan. It highlights the need to address the environment, climate change adaptation and mitigation, and disaster risk reduction. The plan also addresses the impact of climate change on health and well-being and emphasizes building capacity and strengthening health systems

to combat the health impact of climate change. It mentions enhancing adaptation capacity against climate change amongst the community including women. It emphasizes ensuring climate-resilient information services in the communities. The plan mentions improving the welfare of persons with disabilities where it emphasizes an enabling environment for supporting the persons with disabilities.

Perspective Plan, 2021-2041 provided strategy for Population Health and Nutrition (PHN) focusing on serving the needs of the rural community where private service at low-cost is very limited. The main elements of this strategy are expanding public health clinics and improve quality, strengthening district-level hospital care, strengthening national hospital, eliminating child nutrition gaps, strengthening private health care delivery system, introducing health insurance schemes, strengthening health sector governance, improving health information systems, increasing public health spending etc. Climate change-associated strategies for flood control, water storage, irrigation, land management, agriculture, forestry resource management, and ecological balance are major elements of the policy package for reducing poverty and improving environmental management in the plan. This plan linked climate change and natural disasters as a much higher incidence of poverty. Social protection schemes are suggested to be replaced to support the poor, vulnerable people including persons with disabilities, women, children and low-income group for achieving the element zero poverty country.

The **Bangladesh National Health Policy, 2011** focused exclusively on the physical health of all segments of the population. One of the goals of this policy is to make necessary basic medical utilities reach people of all strata and ensure easy and sustained availability of health services for the people emphasizing the poor communities. It aims to reduce the intensity of malnutrition among children and mothers and improve the malnutrition status of all segments of the population. Also, arranging special health services for the mentally retarded, the persons with disabilities and elderly population.

The **Right and Protection of Persons with Disabilities Act, 2013** mentioned getting health care is a fundamental right of persons with disabilities. The Act also depicts that the "Government will take necessary steps towards ensuring safety and security of persons with disabilities in the case of natural disasters, humanitarian emergencies and occurrences of violence."

The **Coastal Zone Policy, 2005** was prepared because the coastal zone is lagging in socio-economic developments, poor initiatives to cope with different disasters and the coastal zone has the potential to contribute to national development. This policy provides general guidance so that the coastal people can pursue their livelihoods under secured conditions in a sustainable manner without impairing the integrity of the natural environment. It stated coast and social economic development along the coast is at risk due to climate change.

The **Cyclone Shelter Construction, Maintenance, and Management Policy, 2011** focuses on establishing guidelines for cyclone shelter construction, designs and effective management and maintenance of the cyclone shelters. The policy addresses ensuring suitable road

communication for easy access to cyclone shelters during emergencies and accommodating and reserving a sperate room for person with disabilities and helpless people during the design and construction of the infrastructure.

The **National Strategy on Internal Displacement Management (NSIDM), 2021** addresses the impact of climate change. NSIDM 2021 incorporates the Government's poverty reduction strategy and strategies on education, health, nutrition, population, sanitation and water supply, financial inclusion, women and gender empowerment, social inclusion of ethnic and religious minorities, persons with disabilities, the extremely poor, and floating population, environmental protection, climate change management, disaster management, social security, and overall sustainable development.

It addresses ensuring loans for restoring livelihood and reconstruction of houses that target different vulnerable groups including women, persons with disabilities, ethnic and religious minorities, and the extremely poor. It also addresses the risk, vulnerability, and priorities of different groups of the community concerned including persons with disabilities and other vulnerable groups. Knowledge and actions generated by local communities to reduce risks are also addressed.

The Bangladesh National Building Code (BNBC), 2020 addresses various aspects of health infrastructure, climate change, and vulnerable groups, including persons with disabilities. The BNBC emphasizes the importance of creating inclusive environments that promote accessibility and accommodate the needs of all individuals, including those with disabilities. The BNBC provides guidelines for designing and building healthcare facilities, ensuring they meet the necessary standards for safety, functionality, and accessibility. BNBC also includes provisions for incorporating resilience measures into building design and construction. The code consists of guidelines for structural integrity, flood-resistant design, and energy-efficient systems, which are crucial for safeguarding the health infrastructure and ensuring the safety of vulnerable groups during extreme weather events. Overall, the BNBC plays a vital role in ensuring that health infrastructure is resilient, climate-ready, and inclusive, with particular attention to the needs of vulnerable groups, including persons with disabilities.

4.2 REVIEW OF INTERNATIONAL POLICY, PLAN, AND STRATEGY DOCUMENTS

The **IPCC's Sixth Assessment Report (AR6), 2023** highlights the crucial connection between health infrastructure and persons with disabilities in the context of climate change. The report emphasizes that climate change impacts, such as extreme weather events and changing disease patterns, disproportionately affect vulnerable populations, including persons with disabilities. The report underscores the urgent need to enhance health infrastructure to ensure the inclusion and accessibility of healthcare services for persons with disabilities. It stresses the importance of adopting an inclusive approach in infrastructure planning, design, and implementation, considering the unique needs and vulnerabilities of persons with disabilities. Furthermore, the report calls for integrating disability-inclusive policies and practices within health systems, including training healthcare professionals to provide

inclusive and accessible care. It highlights the significance of improving access to healthcare facilities, ensuring the availability of assistive technologies, and promoting universal health coverage to address the specific health requirements of persons with disabilities. By recognizing the intersectionality of climate change, health infrastructure, and persons with disabilities, the IPCC report underscores the importance of inclusive and adaptive measures to build resilient health systems that leave no one behind.

Paris Agreement, 2015 addresses the urgent threat of climate change based on the best available scientific knowledge. It emphasizes the intrinsic relationship among climate change actions, responses, and impacts. Moreover, the agreement addresses the vulnerabilities of food production systems to the adverse impacts of climate change. It also addresses human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities, and people in vulnerable situations, and the right to development, as well as gender equality, empowerment of women, and intergenerational equity.

It mentions reducing the risks and impacts of climate change, enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of global warming. It acknowledges that adaptation action should follow a country-driven, gender-responsive, participatory, and fully transparent approach, taking into consideration vulnerable groups, communities, and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate.

The **United Nations Sustainable Development Goals (SDGs), 2015** and health are closely intertwined. Goal 13 highlights urgent action to combat climate change and its impacts. Targets have been set to integrate climate change measures into national policies, strategies, and planning, strengthen resilience and adaptive capacity to climate-related hazards and natural disasters, capacity development, etc.

Goal 3 specifically focuses on ensuring healthy lives and promoting well-being for all ages. This goal has set targets to reduce maternal, premature, and child mortality, end epidemics and diseases, support the research and development of vaccines and medicines, etc. The goal has also emphasized universal access to sexual and reproductive health care, increased health financing, recruitment, development, training, and retention of health workforce services. The 17 goals of SDG pledge to leave no one behind and recognize disability as an issue that cuts across all SDGs. Goal 4 on inclusive and equitable quality education and promoting life-long learning opportunities for all focuses on eliminating gender disparities in education and ensuring equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities. In addition, the proposal calls for building and upgrading education facilities that are child, disability, and gender-sensitive and provide safe, non-violent, inclusive, and effective learning environments for all. Goal 8 promotes sustained, inclusive, and sustainable economic growth, full and productive employment, decent work for

all women and men, including persons with disabilities, and equal pay for work of equal value. Goal 10 strives to reduce inequality within and among countries by empowering and promoting the social, economic, and political inclusion of all persons with disabilities. Goal 11 calls for universal access to safe, inclusive, accessible, green, and public spaces, particularly for persons with disabilities.

The **Sendai Framework for Disaster Risk Reduction (SFDRR), 2015-2030** aims to significantly reduce disaster risk and loss of lives, livelihoods, and health considering economic, physical, social, cultural, and environmental assets. The SFDRR highlights the specific needs of people with disabilities. The SFDRR guiding principle states, "A gender, age, disability, and cultural perspective should be integrated into all policies and practices." Furthermore, priorities 3 and 4 in SFDRR cover issues related to accessibility and inclusion. Priority 3 emphasizes the "Principles of Universal Design" when discussing investments in critical facilities and physical infrastructure. Priority 4 addresses "Empowering women and persons with disabilities to publicly lead and promote gender-equitable, and universally accessible response, recovery, rehabilitation, and reconstruction approaches are key" to enhancing disaster preparedness and "build back better" (UN, 2015). Also, critical facilities, particularly schools, hospitals and physical infrastructures are advised to build using the principles of universal design considering persons with disabilities.

The **United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), 2006** is a core international human rights treaty. In article 25, it states providing affordable health care services to the person with disabilities including health-related rehabilitation. It also prohibited discrimination provisioning health insurance and the denial of healthcare and health services against the person with disabilities. Moreover, the document addresses climate change issues, such as mobility, food and water security, health, education, and employment opportunities.

In the **United Nations Disability Inclusion Strategy, 2019** the organizations of the United Nations system reaffirm that the full and complete realization of the human rights of all persons with disabilities is an inalienable, integral, and indivisible part of all human rights and fundamental freedoms.

4.3 SUMMARY OF THE POLICY GAP ANALYSIS

Bangladesh faces increased risks due to climate change-induced events like floods, cyclones, Drought, riverbank erosion, etc. Some national policies, plans and strategies clearly indicate climate change vulnerability of different sectors (mostly Agriculture, water, and WASH), like **National Adaptation Plan (NAP), Bangladesh Delta Plan, Bangladesh Climate Change Strategy and Action Plan (BCCSAP), 8th Five Year Plan, Perspective Plan and National Adaptation Programme of Action (NAPA).** However, these documents still lack adequate understanding of the emerging climate change risk on health and health infrastructure and relevant adaptation measures to reduce the impacts of climate change. These documents also mention the gender gap, which denotes that **woman, the poor, persons with disabilities and disadvantaged groups** are more susceptible to climate change impacts; few specific

adaptation measures for these groups have been addressed. However, specific adaptation strategies to minimize the climate change vulnerability (health, livelihood, education, etc.,) of these vulnerable groups are not sufficiently described by these national policy documents.

Some of the policy documents that deal with disaster management in Bangladesh, such as the **National Plan for Disaster Management, National Disaster Management Policy, Standing Orders on Disaster and Disaster Management Act**, satisfactorily address the impacts of different disasters and their effects on vulnerable groups. However, these policy documents do not clearly depict these disasters' effects on health and health infrastructures, considering the aspects of climate change. Moreover, these policies and legislation did not describe vulnerable group-specific (women, persons with disabilities, ethnic communities, elderly and others) climate change-induced disaster management strategies.

The **Bangladesh National Health Policy** ensured physical health-related treatment for all vulnerable groups, including persons with disabilities. Still, the impact of climate change impact on human health and health infrastructures and adaptation strategies for reducing the effects was not depicted. On the other hand, the **Coastal Zone Policy** mentioned climate change impacts; however, it did not specify the implications of climate change on human health, health infrastructure, or vulnerable people and how they can be prioritized while identifying or implementing the climate change adaptation measures. According to the **Rights and Protection of Persons with Disabilities Act,** getting health care is a fundamental right of persons with disabilities. But this act does not address the impact of climate change on their health or healthcare facilities or the adaptation strategies.

The **Cyclone Shelter Construction, Maintenance, and Management Policy** addresses neither human health in general nor health infrastructure. It also does not state any adaptive strategy concerning climate change. Though the policy addresses the design and location of suitable cyclone shelters for all groups, it does not acknowledge how the structural design of the cyclone shelters would be more disability-friendly and climate-resilient. On the other hand, **the Bangladesh National Building Code (BNBC)** provides guidelines for designing and constructing healthcare facilities. The document also provides guidelines about climate resilient and disability inclusive health infrastructure. However, there is lack of implementation of BNBC in the field level. Many healthcare infrastructures lack features and facilities which are mentioned in the building code. So proper monitoring is needed to ensure effective implementation of the building code at the field level.

The reviewed international policy documents, **Paris Agreement, Sendai Framework for Disaster Risk Reduction, Sustainable Development Goals (SDGs), United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) and United Nations Disability Inclusion Strategy** emphasized and focused on ensuring the rights of vulnerable groups like women, persons with disabilities and, ethnic groups, etc. in view of climate change and disaster aspects. These documents emphasize inclusive planning and implementation of climate adaptation and mitigation strategies to be initiated by different states of the world, considering these vulnerable groups' emerging and future climate change vulnerability.

However, these documents do not address climate change-induced specific health-related aspects.

Apart from the abovementioned gaps, the study team also identified gaps in integrating climate change aspects into these policies and legislations and their effective implementations derived from the KIIs, workshops and expert opinion.

- The national policy documents are not adequately aligned with the international policy documents, i.e., Sendai Framework for Disaster Risk Reduction and the United Nations Convention on the Rights of Persons with Disabilities, etc. which are essential to ensure the rights of the vulnerable groups and reduce the impacts of climate change on them.
- Due to lack of effective coordination of different implementing authorities of the reviewed policy and legislation and other relevant stakeholders often hampers the appropriate implementation of the policies and other plans.

5 STUDY AREA

5.1 ADMINISTRATIVE INFORMATION

Teknaf Municipality and Baharchar Union of Teknaf Upazila of Cox's Bazar district was selected for the assessment. Baharchara Union is located in the west of Teknaf Upazila. The distance of this union from the upazila headquarters is about 28 kilometers. It is bounded on the east by Teknaf Sadar Union and Hoikang Union, on the north by Jaliapalang Union of Ukhia Upazila, and on the west and south by the Bay of Bengal.

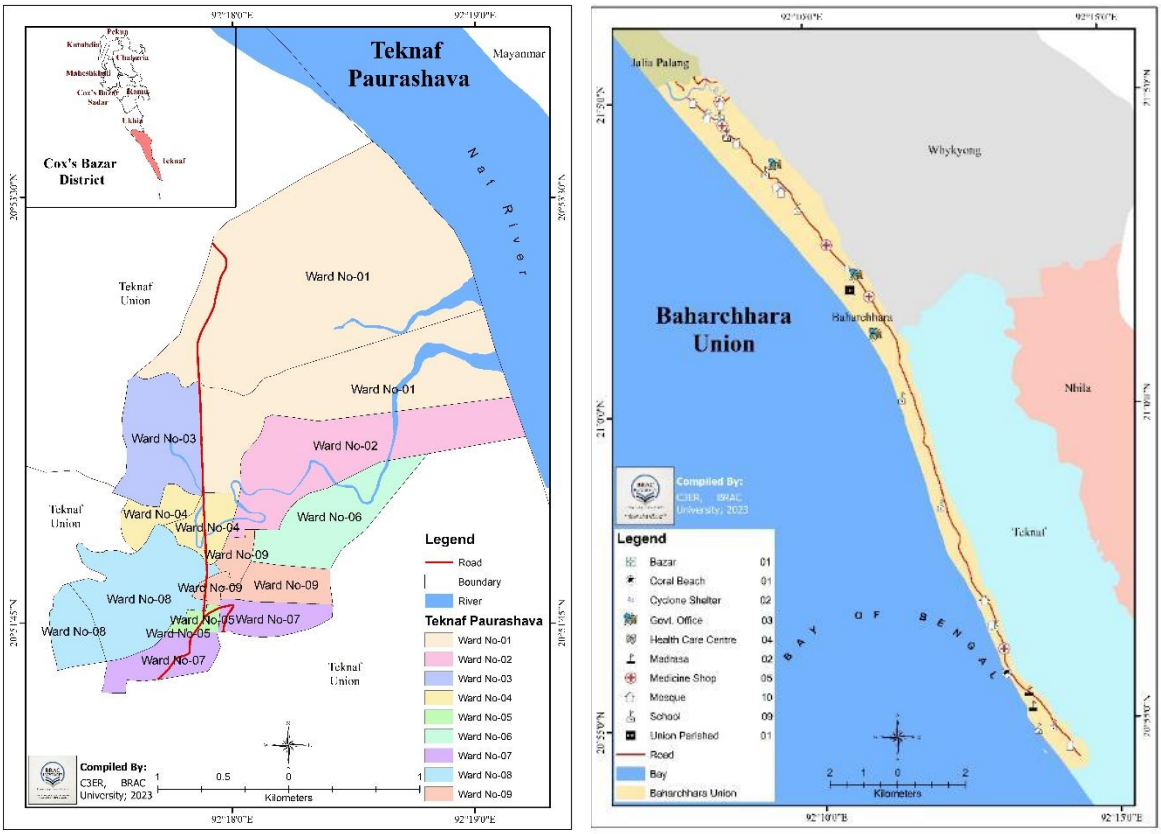


Figure 5-1: Study Area Map

5.2 POPULATION

According to the "Population & Housing Census, 2011", the total population of Teknaf Upazila is 264,389, and the total land area is 96,042 acres. Among them, the number of males and females is 133,106 and 131,283, respectively. The total population of Teknaf Municipality is 25,056; specifically, the number of males and females is 13,296 and 11,760, respectively. According to the "Population & Housing Census, 2011", the total population of Baharchara Union is 28,805, and the total land area is 3,783 acres. Among them, the number of males and females is 14,481 and 14,324, respectively.

5.3 LITERACY RATE

Based on the "Population & Housing Census 2011," the literacy rate of males and females of Teknaf Upazila is 29.7% and 23.6%, respectively. In Baharchara Union, the literacy rate of

males and females of is 24.1% and 21.2%, respectively. Comparing with the national literacy rate according to the Population & Housing Census 2011 (56.9% among males and 50.2% among females), the literacy rate is very low.

5.4 RELIGION

From the census, a significant proportion of people living in Teknaf Upazila and the Baharchara Union are Muslims. However, other religious groups, including Hindu, Buddhist, and Christian, are also present.

5.5 ETHNIC POPULATION

In Teknaf Upazila, Tanchaynga and Rakhain are prominent ethnic groups. In Baharchara Union, lives mainly the Tanchaynga ethnic group.

5.6 VULNERABLE AGE GROUP

BBS's Population & Housing Census 2011 shows that the most vulnerable age groups are below five and above 60 years old, representing 16.4% and 4.5% of the total population.

5.7 PERSON WITH DISABILITY

According to the BBS 2011, the percentage of persons with disabilities is 1.6% in Teknaf Upazila, while in Baharchara Union, the percentage of persons with disabilities is 1.9%.

5.8 HEALTHCARE FACILITIES

According to the Facility Registry of the Ministry of Health and Family Welfare (MoHFW), In Teknaf Upazila, there are 31 healthcare facilities of different types, including Teknaf Upazila Health Complex, community clinics, Union Health & Family Welfare Center (UH&FWC), private clinics and hospitals, etc. which provide healthcare support to the local communities living in this area. In Baharchara Union, One Health center and three Community Clinics are available to provide healthcare services.

6 RESULTS AND FINDINGS GENERATED FROM HOUSEHOLD SURVEY AND IMPACT CHAIN ANALYSIS (ICA)

6.1 HOUSEHOLD SURVEY RESULTS AND FINDINGS

This section represents the findings of the household survey. General information of the respondents, knowledge on climate change, scenario of climate change induced diseases, scenario of health infrastructure, impacts of climate change on different sectors, etc. were analyzed. Moreover, the data were validated by workshops and key informant interviews.

6.1.1 General Information

In this section, the demographic information of the respondents, household income, education level, knowledge on climate change, existing hazards, diseases, health infrastructures of the study area, etc. have been discussed.

6.1.1.1 Respondents Information

The study demonstrates the percentage of respondents based on gender, in which males represent the majority. The study also reveals the respondents' religion; most people who live in the study area follow Islam. This explains the reason of the difference in the percentage of male and female in the area since the society is very conservative, and women do not feel comfortable talking to men or participating in the survey due to religious issues. However, in the workshops and KII sessions, where the facilitators were female, females in the study area

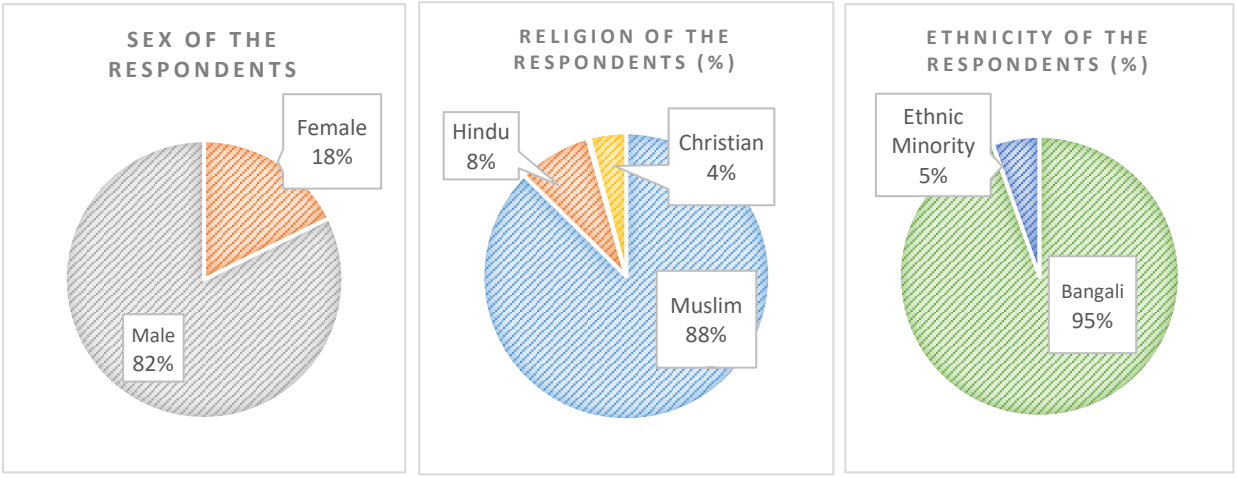


Figure 6-1: Demographic Scenario of the Respondents

participated spontaneously and provided valuable inputs. The study also found the percentage of Ethnicity of the respondents, from which a minor portion (5%) belongs to the Tanchangya community, and the rest of the people are Bengali. The level of education for majority (31%) is primary education, and immediately after that, a significant group of people, about 30%, is illiterate. Then the percentage of educated people below SSC, SSC, and HSC levels is 15%, 14%, and 6%, respectively. A minimal percentage (around 3%) of people attempt a graduation degree like BSC or BA. The literacy rate is meager in the study area. The information is true according to the KII participants as well. Most people lack interest in education, and some hold superstitious beliefs, according to the KII respondent.

The main occupation of the surveyed people is salt farming – 28%. Students, agriculture wage laborers, farmers, and others each represent each around 10-15% of respondents. Livelihoods like business (7%), dry fish processing (5%), etc., were also mentioned.

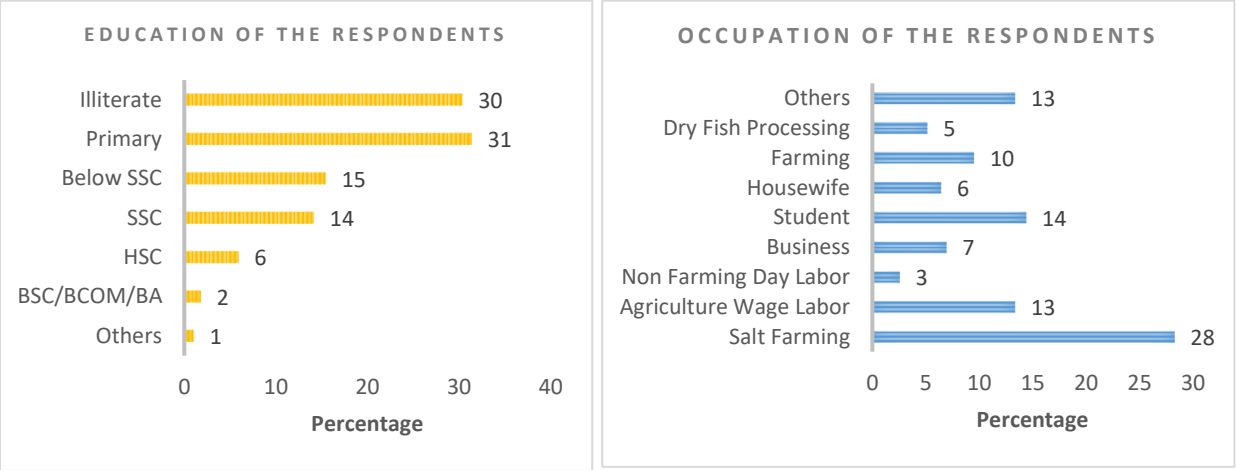


Figure 6-2: Education and Occupation Status of the Respondents

The study found that households' monthly income ranges between BDT 5,000 and BDT 15,000. Around 30-35% of the respondents mentioned their monthly household income is between BDT 15,000 and BDT 30,000. Significantly few respondents reported a monthly household income of more than 30,000. It can be seen from the result that around half of the respondents have a monthly household income of less than 15,000 BDT, indicating that the respondents are not financially solvent, which increases their vulnerability to climate change and disaster risks.

The findings from KII also indicate a similar scenario regarding poverty. According to multiple respondents, people of the study area are very poor[5].

[5]The Poverty Maps of Bangladesh 2016, published by Bangladesh Bureau of Statistics (BBS) also indicated that, the poverty group level of Teknaf Upazila is high.

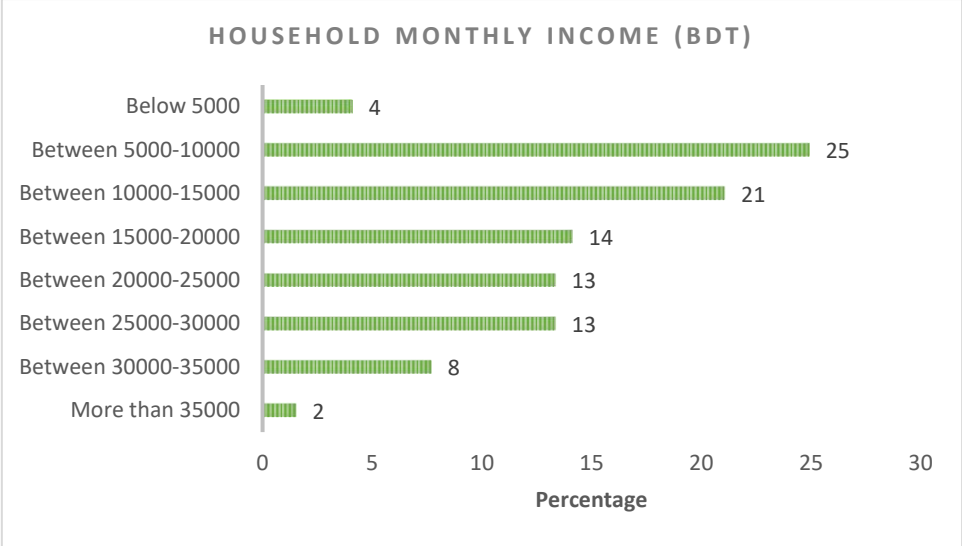


Figure 6-3: Household Monthly Income (BDT)

6.1.1.2 Knowledge and Understanding of Climate Change

This study inquired how often people hear about climate change. 53% of people think they sometimes hear about climate change, and 29% believe they often hear about it. Besides that, 17% of people always hear about climate change. In this study area, many people are very familiar with the term climate change. From the workshops and KII, it was found that there are many NGO activities in the area, who are working to raise climate awareness among the respondents. Moreover, there are different activities undertaken by local government institutions, and cyclone preparedness program (CPP) volunteers. The community in the area gets informed about climate change from these sources.

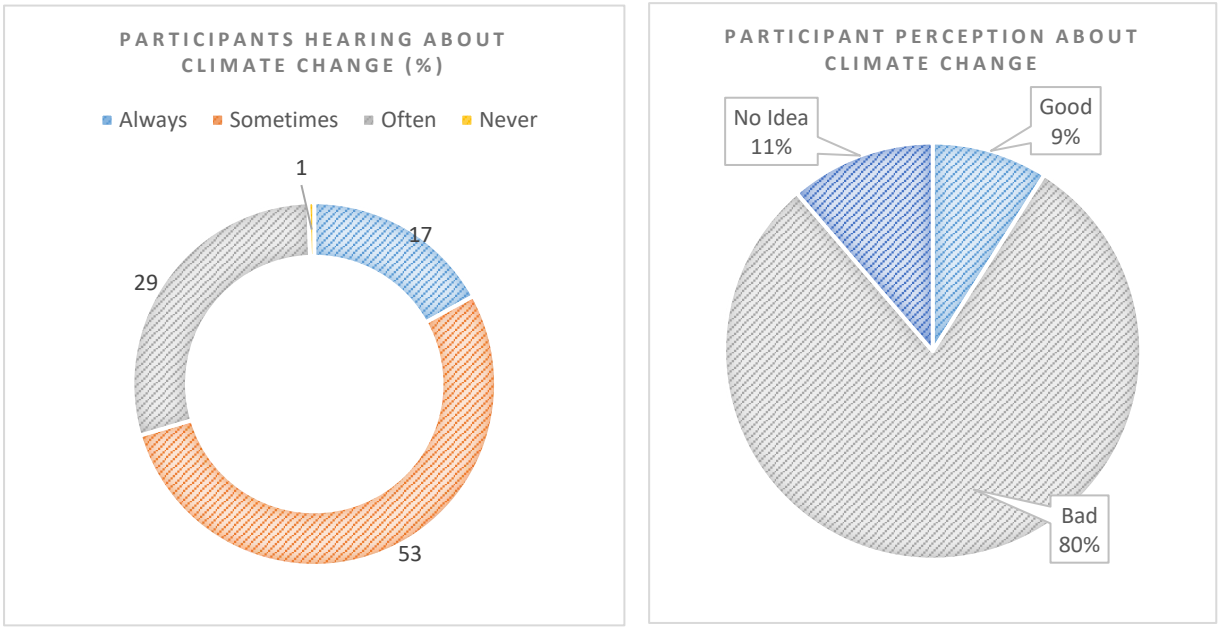


Figure 6-4: Participants' Knowledge regarding Climate Change

During the study, the participants were asked what their perceptions were about climate change. Most of the participants (80%) think that climate change is bad for them. Around 10% of the respondents believe it is good for them, and the rest have no idea about climate change.

6.1.1.3 Existing Hazard Scenario in the Study Area

The respondents were asked about the study area's typical climate change-induced hazards. The most common answers were cyclone/storm surge and landslide. More than 80% of the respondents mentioned them in their responses. A significant number of the respondents (30%) also said temperature rise.

Moreover, there are some anthropogenic hazards also seen in the Teknaf area, according to the KII. Kidnapping occurs in these localities, which creates panic in the populace. The Rohingya migrants[6] have increased deforestation, leading to more frequent landslides. Wild elephant attacks have become quite common as well. According to the workshops and KIIs, respondents mentioned several incidents of wild elephant attacks including an attack by a wild elephant caused the demise of a young girl last year.

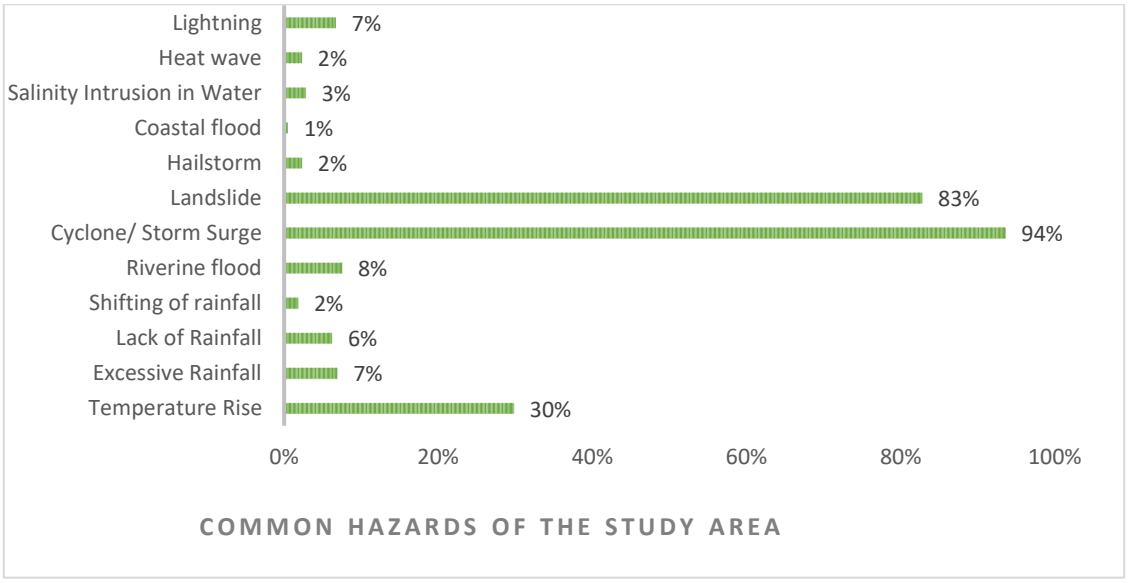


Figure 6-5: Common Hazards of the Study Area

6.1.1.4 Trends of Climate Change Induced Disasters

Most of the respondents (47%) think disaster frequency is increasing in the study locations due to changing behavior of climate. However, 31% believe that these climate-induced disasters are decreasing. The study team found similar results while conducting the ICA workshop and KIIs. Most of the participants of that workshop, and KIIs believe in increasing

[6] The Rohingya people are a stateless Indo-Aryan ethnic group who predominantly reside in Rakhine State, Myanmar. In August 2017, armed attacks, massive scale violence, and serious human rights violations forced thousands of Rohingya to flee their homes and over 740,000 Rohingya fled to Bangladesh Now, more than 960,000 Rohingya people are living in Bangladesh with a majority living in the Cox Bazar's region. These Rohingya people are cutting trees and are responsible for massive deforestation in the Teknaf area.

trends of disasters which are climate induced, specifically the elderly peoples and LGI staffs indicated these aspects who have been observing the changes over the years. Moreover, some of the participants believe that disaster is decreasing who have no or limited idea and knowledge about climate change issues. On the other hand, around one-fourth of the respondents (22%) ICA said the frequency of these disasters has remained the same.

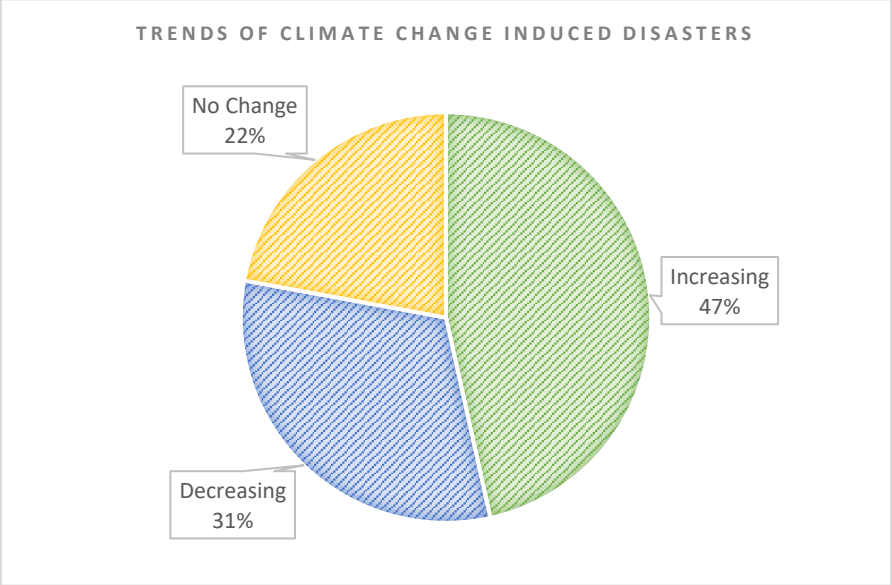


Figure *6-6*: Trends of Climate Change-Induced Disasters

6.1.1.5 Existing Climate Change Induced Diseases and Other Symptoms

The respondents were asked about the significant climatic diseases in the study area. In response, they mentioned several vector-borne, water-borne, and high-temperature-related diseases. The most common disease in the household survey was Dengue (97%). Dysentery (48%), Stroke (48%), Diarrhea (38%), Cholera (35%), Skin Disease (18%) were mentioned by the respondents as well. Moreover, the participants also revealed that, they have been facing some health-related symptoms (Fatigue 33%, Dizziness and Physical Restlessness 30%) as well which is also related to temperature rise.

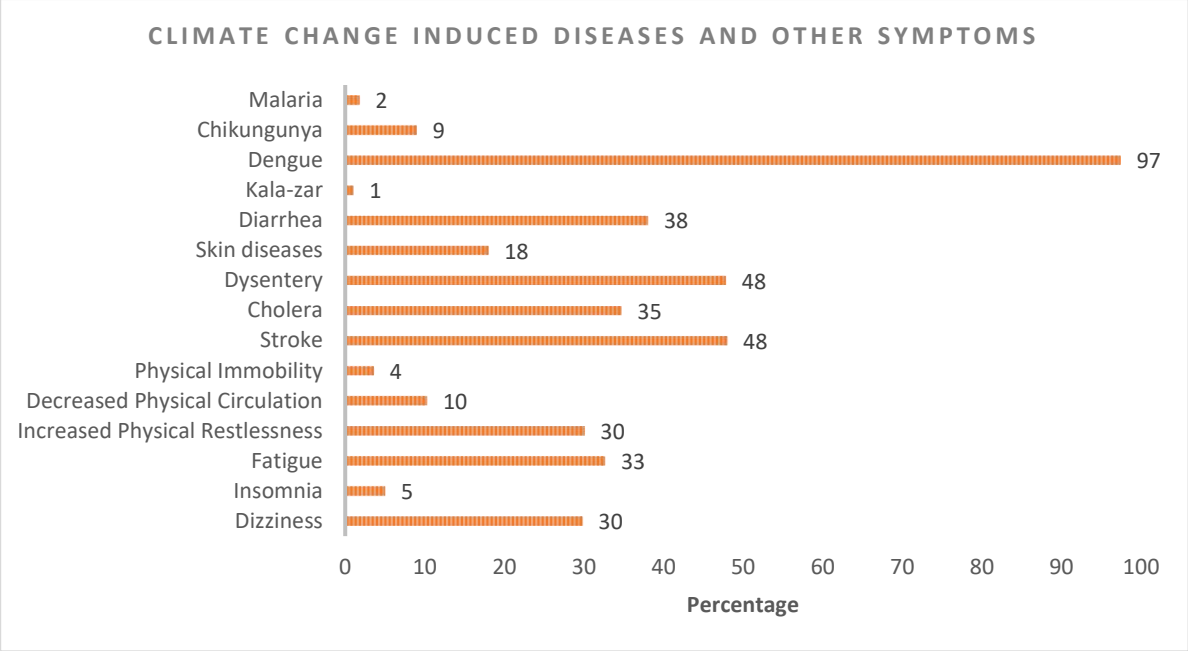


Figure 6-7: Scenario of Climate Change-Induced Diseases and other Symptoms in the Study Area

6.1.1.6 Trends of Major Climate Induced Disease and Other Symptoms

The respondents were asked about the trends of significant climate change-induced diseases in the study area. Most participants mentioned that the conditions of Cholera (76%), Stroke (85%), Dysentery (46%), Diarrhea (45%) and Dengue (39%) diseases are increasing. Moreover, the trends of Physical Restlessness and Fatigue are also increasing, said most respondents (59% and 52% respectively).

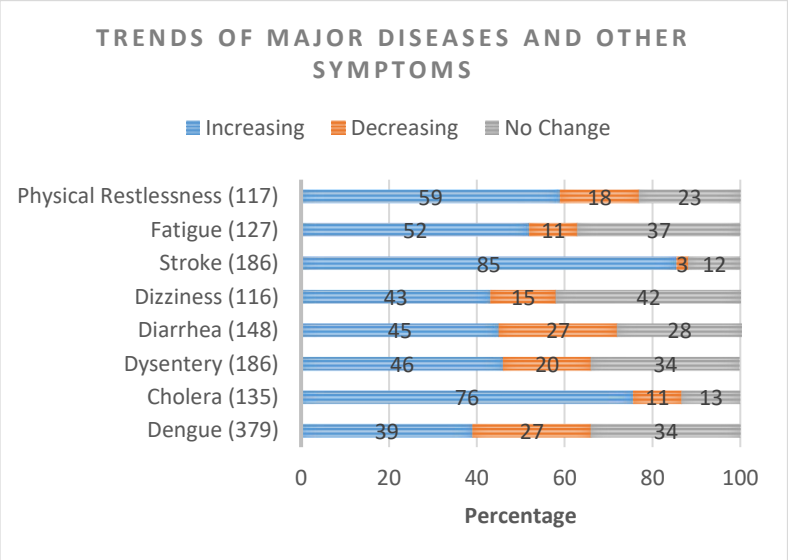


Figure 6-8: Trends of Major Climate Change Induced Diseases and Other Health related Symptoms

According to the KIIs, women and children are most susceptible to disease, with elevated temperatures leading to increased blood pressure and skin conditions. The frequency of disasters has grown over the past five years. The increase in salinity has been accountable for an upsurge in genitourinary illnesses and Urinary Tract Infections (UTIs). Dengue fever also increases after excessive rainfall, diarrhea rises due to high temperatures, and aged people suffer more from rheumatic pain.

6.1.1.7 Existing Scenario of Health Infrastructure

According to the DGHS registry, there are around 31 healthcare infrastructures in Teknaf upazila. Among them, 23 were identified in the study area of Teknaf Municipality and Baharchara Union. Among them, 20 were visited physically by the study team, and the rest was closed during the time of the field visit. 7 healthcare infrastructures were identified in the Baharchara Union, and the rest were identified outside Baharchara.

The following table shows the details about these health infrastructures:

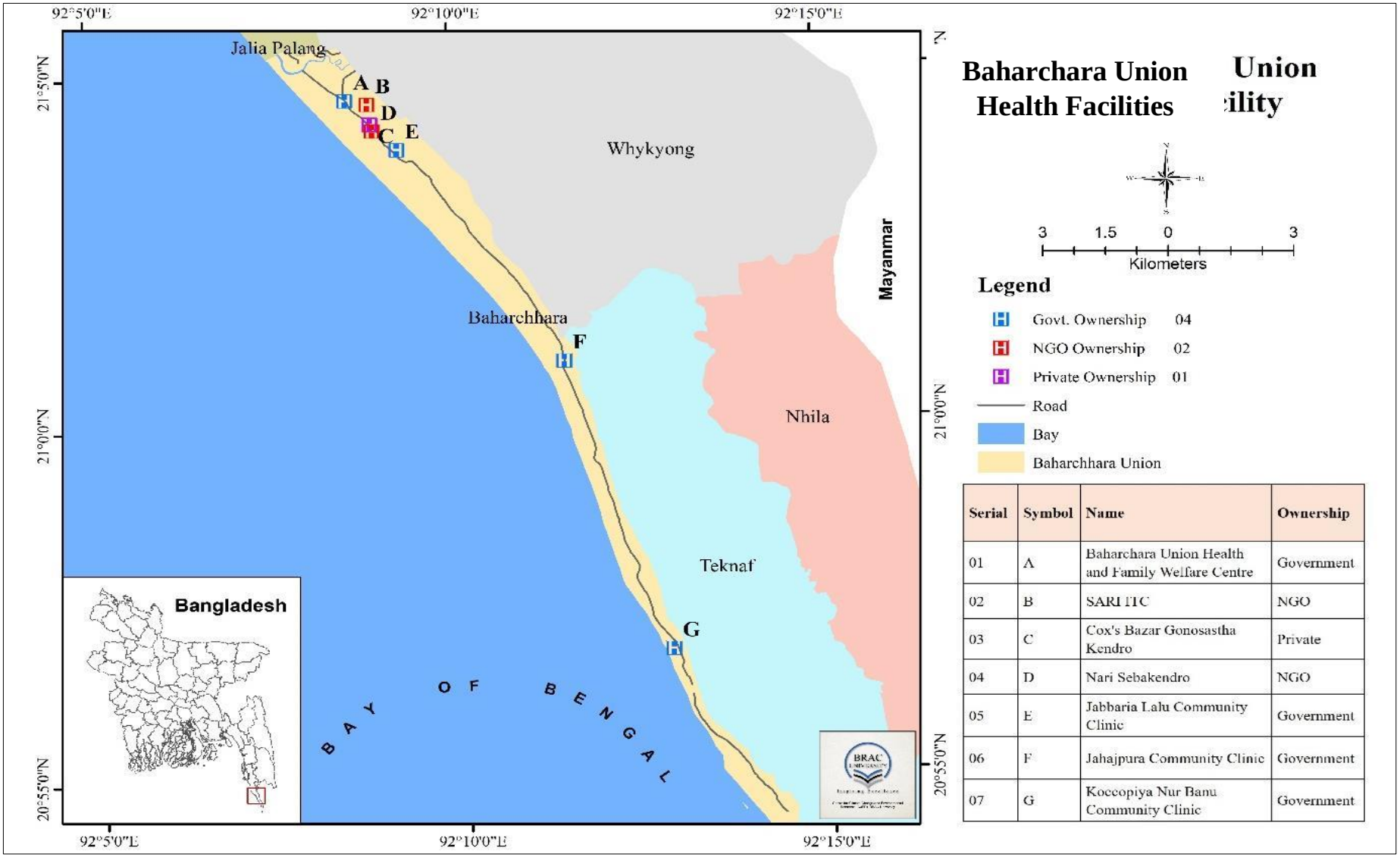
Table 6.1: Health Infrastructures in Teknaf Municipality (Source: Field Survey, 2023)

Name of the Health Infrastructure	Location	Health Infrastructure Type	Visited by the Field Team
Naf Shimanta Pathology Center	Teknaf Municipality	Diagnostic Centre	Visited
Naf View Medical Center	Teknaf Municipality	Diagnostic Centre	Visited
Dream Care Digital Diagnostics	Teknaf Municipality	Diagnostic Centre	Visited
Lab Medica	Teknaf Municipality	Diagnostic Centre	Visited
ICDDRB	Teknaf Municipality	Specialized Hospital	Visited
Merin City Hospital	Teknaf Municipality	Private Clinic	Visited
Upazila Health Complex	Teknaf Municipality	Upazila Health Complex	Visited
New Choshma Center	Teknaf Municipality	Eyecare Centre	Visited
Al Bahar Medical Center	Teknaf Municipality	Diagnostic Centre	Visited
Arefa Dental Care	Teknaf Municipality	Private Clinic	Visited
Teknaf Medical Center	Teknaf Municipality	Diagnostic Centre	Visited
Union Health And Family Welfare Center	Sabrang	Union Health and Family Welfare Centre	Visited
Koaingchori Para Community Clinic	Sabrang	Community Clinic	Visited
Baharchara Union Health and Family Welfare Centre	Baharchara	Union Health and Family Welfare Centre	Visited

Name of the Health Infrastructure	Location	Health Infrastructure Type	Visited by the Field Team
Cox's Bazar Gono Shasthya Kendro	Baharchara	Private Clinic	Visited
Nari Sheba Kendro	Baharchara	Mental Health Care	Visited
Jobbaria Lalu Community Clinic	Baharchara	Community Clinic	Visited
Kochchopia Nur Banu Community Clinic	Baharchara	Community Clinic	Visited
Jahajpura Community Clinic	Baharchara	Community Clinic	Visited
Sari ITC	Baharchara	Others	Visited
Mitha Panir Chora Community Clinic	Teknaf Municipality	Community Clinic	Not Visited
Najir Para Community Clinic	Teknaf Municipality	Community Clinic	Not Visited
Surjer Hashi Clinic	Teknaf Municipality	NGO Clinic	Not Visited

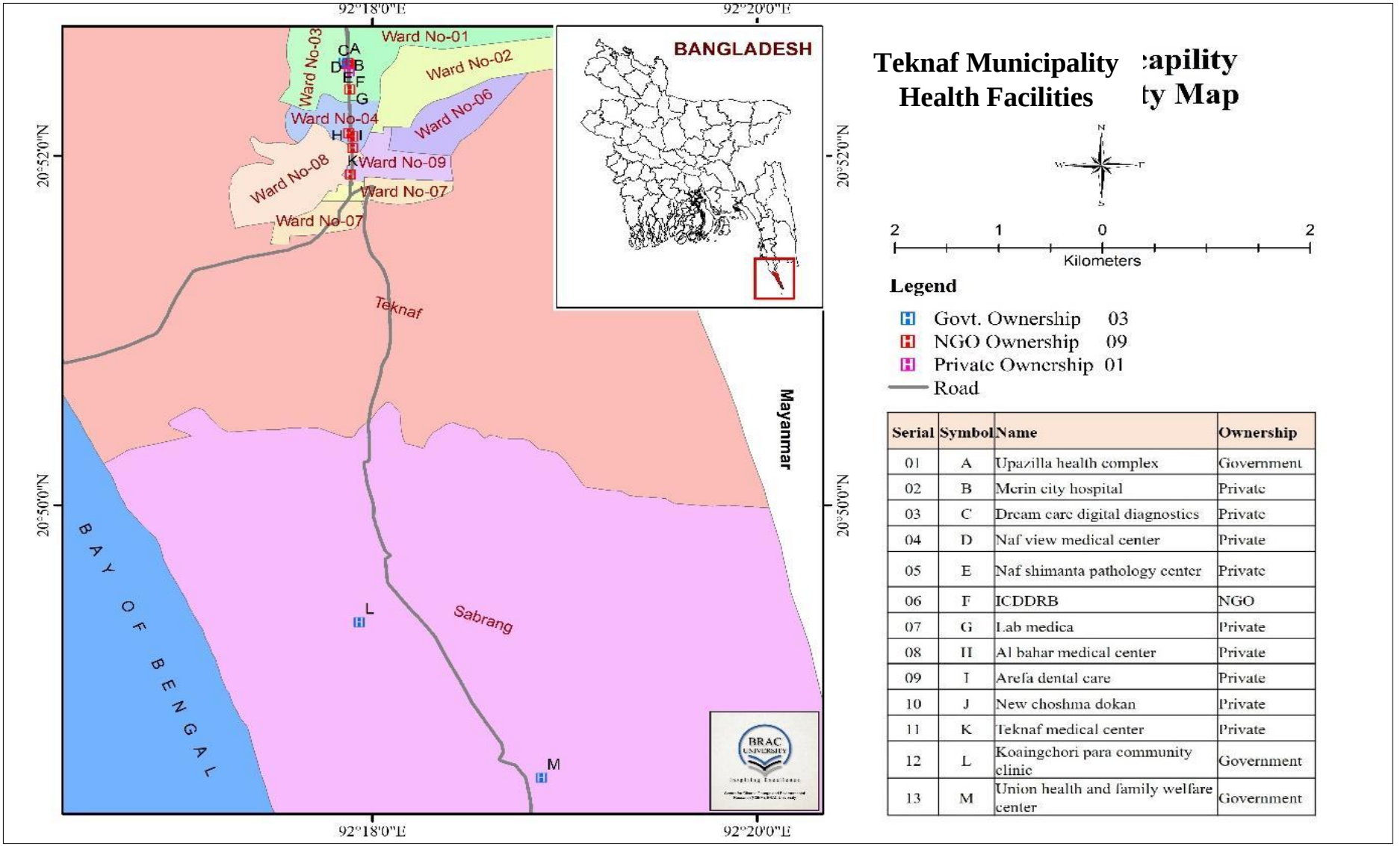
Respondents take healthcare services from both inside and outside Baharchara Union. The following figure shows the location of these health infrastructures in the study area.

According to the KIIs, health infrastructures are not capable of providing appropriate treatment to people from disadvantaged backgrounds, women, children, and those with impairments, who exhibit differing sensitivity to climatic risks. Inadequate ambulance service and a lack of a permanent hospital doctor are critical concerns in the Baharchara Union area. These facilities are more vulnerable to weather threats and lack appropriate medication availability.



Serial	Symbol	Name	Ownership
01	A	Baharchara Union Health and Family Welfare Centre	Government
02	B	SARI ITC	NGO
03	C	Cox's Bazar Gonosastha Kendro	Private
04	D	Nari Sebakendro	NGO
05	E	Jabbaria Lalu Community Clinic	Government
06	F	Jahajpura Community Clinic	Government
07	G	Koccopiya Nur Banu Community Clinic	Government

Figure 6-9: Location of the Health Infrastructures in Baharchara Union



Serial	Symbol	Name	Ownership
01	A	Upazilla health complex	Government
02	B	Merin city hospital	Private
03	C	Dream care digital diagnostics	Private
04	D	Naf view medical center	Private
05	E	Naf shimanta pathology center	Private
06	F	ICDDRB	NGO
07	G	Lab medica	Private
08	H	Al bahar medical center	Private
09	I	Arefa dental care	Private
10	J	New choshma dokan	Private
11	K	Teknaf medical center	Private
12	L	Koaingchori para community clinic	Government
13	M	Union health and family welfare center	Government

Figure 6-10: Location of the Health Infrastructures in Teknaf Municipality

6.1.1.8 Existing Scenario of Access to Health Facilities

The respondents were asked where they make use of healthcare services. Almost 98% of the respondents mentioned the Upazila Health Complex, making it the most visited health service provider. Very few respondents mentioned other health infrastructures, of which Union Sub-Health Centre has been mentioned most frequently (nearly 10% of respondents).

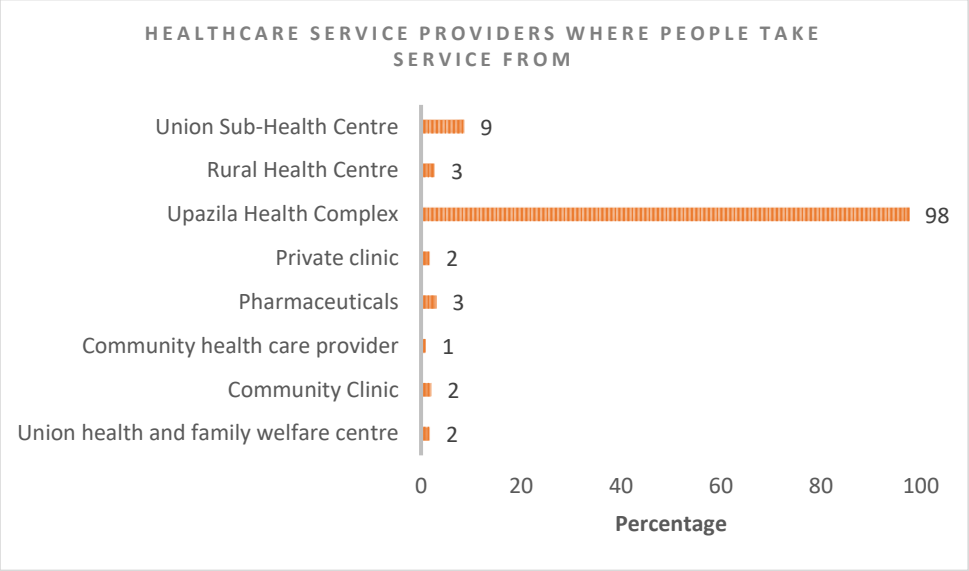


Figure 6-11: Healthcare Service Providers from where the Respondents take

According to the respondents, almost all the health infrastructures are open and have access for people, meaning that people can visit these healthcare centers when needed. The result is more than 80% in the case of Upazila Health Complex, Union Sub Health Centre, Union Health and Family Welfare Centre, Community Clinic, Community Health Provider, and Pharmaceuticals. However, most of these health infrastructures are not inclusive and accessible for person with disabilities and elderly people, etc., as most of them lack ramps and wheelchairs, etc., according to the field data and KII responses. The condition of upazila health complex and other health infrastructures are as follows-

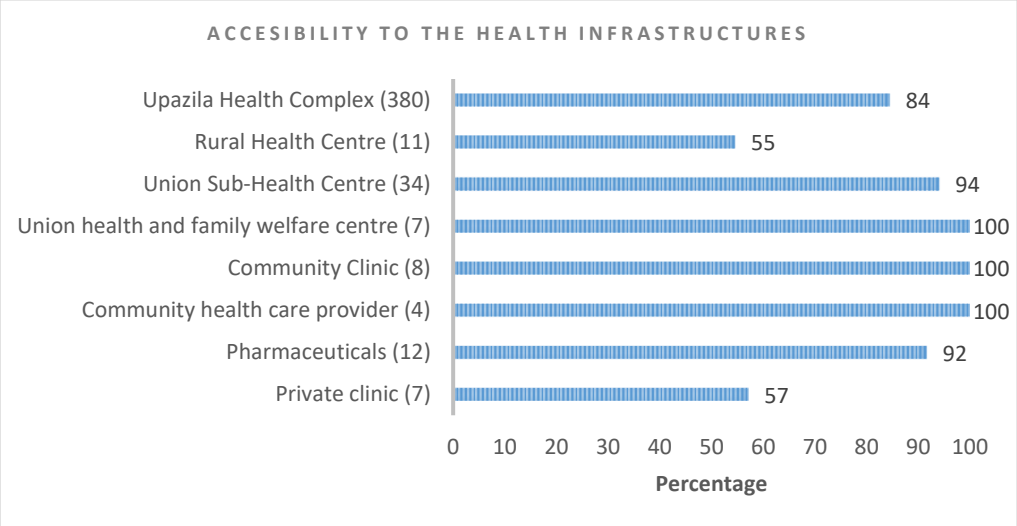


Figure 6-12: Accessibility Scenario in the Health Infrastructures

6.1.1.8.1 Upazila Health Complex

As almost every respondent mentions the Upazila Health Complex, detailed information about this health service provider is discussed separately.

Infrastructural Condition

Most of the respondents who take health services from Upazila Health Complex mentioned that Upazila Health Complex has safe drinking water. Many respondents said other features include adequate seating, cleanliness, full-time electricity, and toilet. This shows that the Upazila Health Complex has good infrastructural conditions.

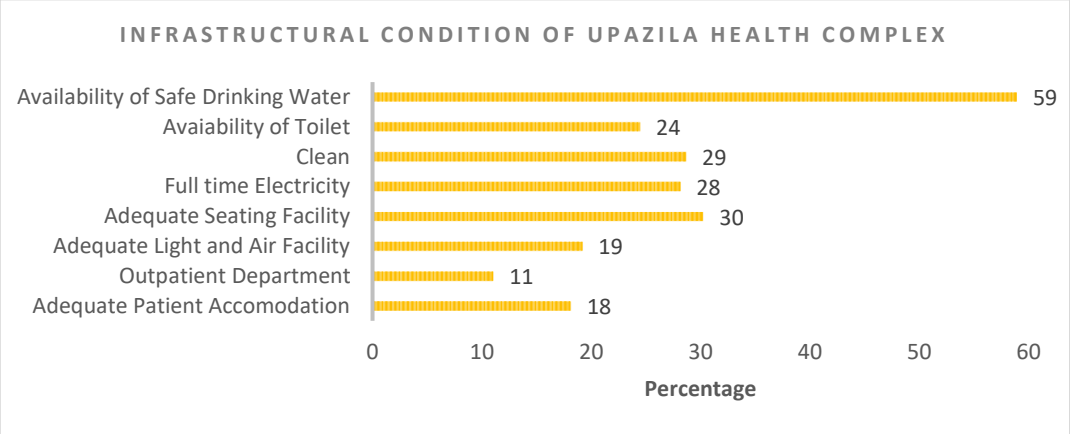


Figure 6-13: Infrastructural Condition of Upazila Health Complex

Gender and Disability Inclusive Facilities

In terms of gender and disability friendly facilities, the upazila health complex was reported (by around 40% of the respondents) to have wheelchairs, the primary treatment for vulnerable groups, and easily accessible entry and exit facilities. Ramp, expert doctor, medicine, etc., were mentioned as well.

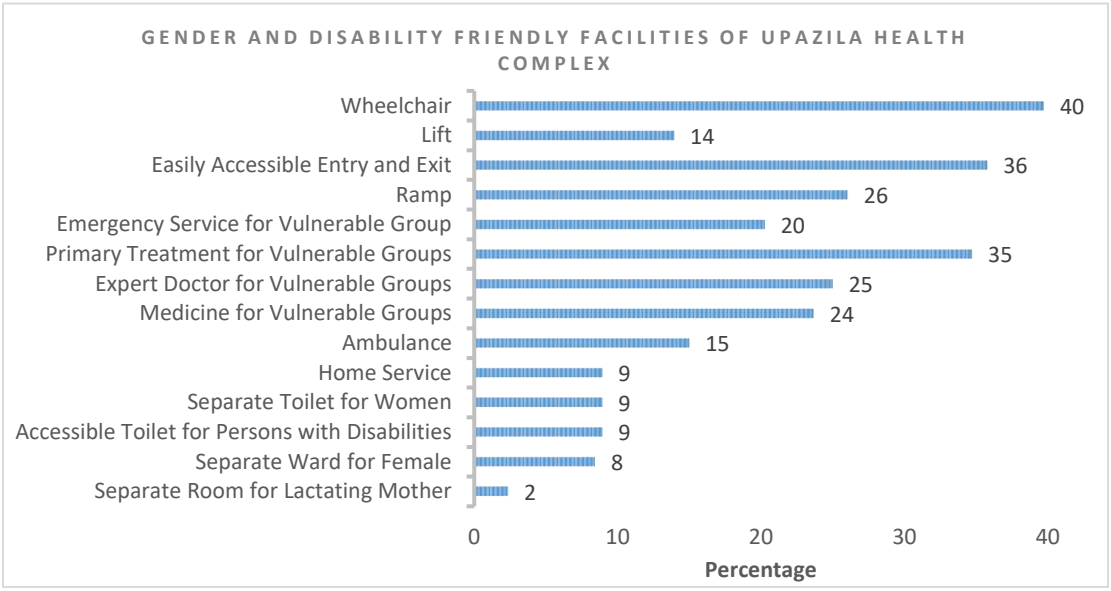


Figure 6-14: Gender and Disability Friendly Facilities of Upazila Health Complex

On the other hand, around 9% of the respondents revealed that facilities like separate toilet for women, different female wards, separate rooms for lactating mothers, accessible toilet for persons with diabilites etc. are not available, which indicates the lack of these inclusive facilities in the health complex.

Services Provided

Most respondents say the Upazila Health Complex provides emergency services and primary treatment. Expert doctors, ambulances, etc., were identified by respondents as well.

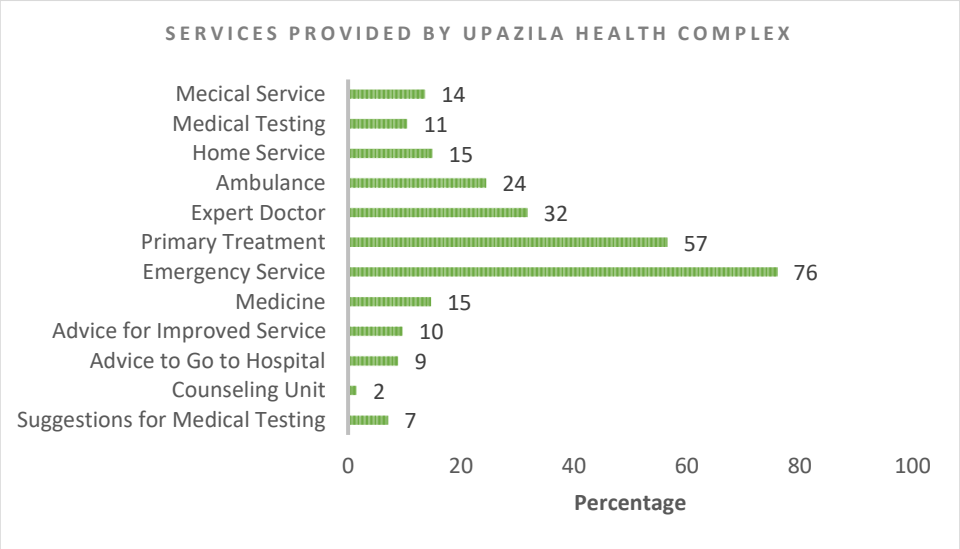


Figure 6-15: Services Provided by Upazila Health Complex

Reasons for Preference

The respondents who visit Upazila Health Complex to access the healthcare service, were asked the reason of their preference. In response, it was found that most of the respondents said the health complex was near to their home. However, in reality, it was found from the field scenario that people from Baharchara union need to travel 43 km to get services from upazila health complex[7]. The services offered from the health complex, such as free service (38%), low cost (33%), good

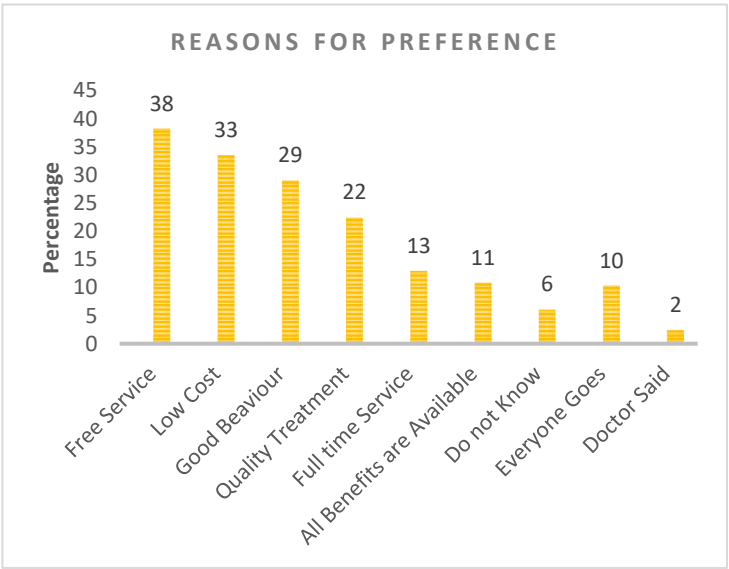


Figure 6-16: Respondents going reasons to Upazila Health Complex

[7] This indicated that the respondents probably failed to understand the question and the response seems misleading. This is why the option “near to the home” was eliminated.

behavior (29%), quality treatment (22%), etc. played vital role here and making them choose upazilla health complex over other health infrastructures, although the health complex is located far away from their homes. The other healthcare infrastructures, which are at near distance from their home, do not have these facilities, as a result respondents do not prefer going there.

Existing Problems of Upazila Health Complex

According to 70% of respondents, the major limitation of Upazila Health Complex is the lack of facilities meaning minimal medical test facilities, medicines, physicians, etc. Lack of medical equipment was mentioned by 42% of respondents. Unavailability of full-time service, unavailability of service providers, lack of accessibility and lack of medicine, etc., were some of the other major limitations of this healthcare infrastructure, according to the respondents.

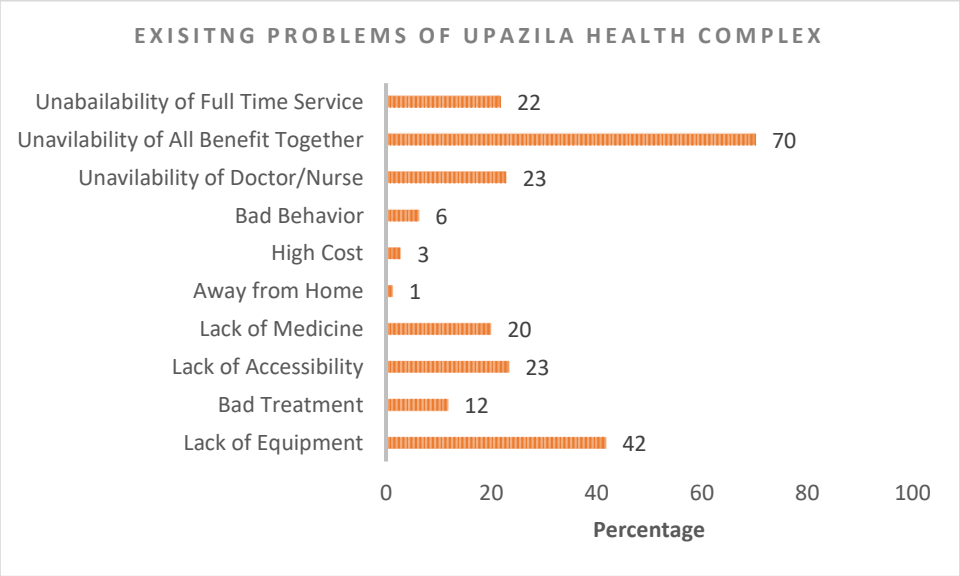


Figure 6-17: Existing Problems of Upazila Health Complex

6.1.1.8.2 Other Healthcare Infrastructures

Apart from the upazila health complex, the other healthcare infrastructures were mentioned by very few respondents (<10%). According to these few respondents, most infrastructures have safe drinking water, full-time electricity, cleanliness, etc. Moreover, these health infrastructures provide wheelchairs, ramps, easily accessible entry, exit, etc. inclusive facilities for persons with disabilities, according to those few participants. However, since the response was from a very little amount (less than 5 participants out of 389) of the respondents, this does not necessarily mean the health infrastructures have all these facilities. Furthermore, respondents mentioned that free services, good behavior, low cost, near home, etc., influence them to go to these places for healthcare facilities. These healthcare centers have emergency services, primary treatment facilities, expert doctors, etc. However, the respondents mentioned that these healthcare facilities often have some limitations, such as lack of medicine, unavailability of all the benefits together and unavailability of service providers, etc.

Table 6.2: Major information about other Health Infrastructures (Source: Field Survey, 2023)

Health Infrastructure	No of Response	Infrastructural Conditions	Inclusive Facilities	Reason for Preference	Facilities	Limitations
Rural Health Centre	11	Full-Time Electricity, Toilet, Safe Drinking Water	Primary Treatment, Easily Accessible Entry, and Exit, Emergency Service	Good Behavior, Low Cost, Free Service	Emergency Service, Expert Doctors, Primary Treatment	Lack Of Medicine, Lack of Access Roads, Lack of Equipment
Union Sub-Health Centre	34	Adequate Seating Facility, Full Time Electricity Facility, Hospital Outpatient Department.	Primary Treatment, Emergency Services for Vulnerable Groups, Medicines. Expert Doctors	Low Cost, Free Service, Good Behavior, Quality of Treatment Is Good	Expert Doctors, Primary Treatment, Ambulance, Emergency Service	Unavailability Of Doctor/Nurse, Lack of Medicines, Lack of Equipment, Lack of Accessibility
Union Health And Family Welfare Center	7	Safe Drinking Water Is Available, Available Toilets, Clean Enough	Wheelchair, Easily Accessible Entry and Exit, Primary Treatment	Near Home, Free Service, All the Benefits Are Available Together	Emergency Services, Primary Treatment, Medicine	Unavailability Of All Benefit Together, Unavailability of Doctor/ Nurse, Lack of Medicine.
Community Clinic	8	Safe Drinking Water Is Available, Full-Time Electricity Facility, and Clean Enough	Easily Accessible Entry and Exit, Wheelchair, Ramp	Near Home, Low Cost, Free Services	Emergency Services, Expert Doctors	Unavailability Of All Benefits Together, Unavailability of Fulltime Services, Lack of Medicine.
Community Health Care Provider	4	Safe Drinking Water Is Available, Available Toilets, Adequate Seating Facility	Ramp, Wheelchair, Primary Treatment	Low Cost, Free Services, Good Behavior	Primary Treatment, Expert Doctors, Home Services	Unavailability Of All Benefit Together, Unavailability of Fulltime Services, Lack of Equipment
Pharmaceuticals	12	Hospital Outpatient Department, Safe Drinking Water Is Available, Full-Time Electricity Service	Easily Accessible Entry and Exit, Primary Treatment, Medicines	Near Home, Low Cost, Good Behavior	Primary Treatment, Emergency Services, Expert Doctors	Unavailability Of All Benefits Together, Unavailability of Doctor/ Nurse, Unavailability of Fulltime Services,

Health Infrastructure	No of Response	Infrastructural Conditions	Inclusive Facilities	Reason for Preference	Facilities	Limitations
Community-Based Care	1	Safe Drinking Water Is Available	Wheelchair	Near Home	Primary Treatment, Emergency Services	Unavailability of All Benefits Together
Health Inastructure	**Noof Response**	**Infrastructural Conitions**	**Inclusive Facilities**	Reason for Prefence	**Facilities**	**Limitations**
Private Clinic	7	Safe Drinking Water Is Available, Available Toilet, Clean Enough	Wheelchairs, Lifts, Easily Accessible Entry, And Exit	Near Home, Low Cost, Good Behavior	Emergency Services, Primary Treatment, Expert Doctors	Unavailability of All Benefits Together, Lack of Medicine, Unavailability of Doctor/ Nurse,
Mother And Childcare	1	Safe Drinking Water Is Available, Adequate Seating Facility, Full-Time Electricity Service	Wheelchair, Primary Treatment, Medicines	Near Home, Free Services,	Emergency Services, Primary Treatment	Unavailability of All Benefits Together
Medical Camp	1	Safe Drinking Water Is Available, Adequate Seating Facility, Adequate Patient Accommodation	Primary Treatment, Expert Doctors	Near Home, Low Cost, Good Behavior	Emergency Services	Unavailability of All Benefits Together

6.1.2 Climate Change Impact in the Study Area

The aforementioned sections reveal that the disaster has become more frequent and intensified due to climate change. Therefore, the inhabitants of the study area have been facing several impacts due to this changed climatic behavior. The following are the consequences of disasters caused by climate change:

6.1.2.1 Impacts on Different Sectors

In the study area, the respondents from the household survey identified agriculture as the most impacted sector (74%), considering the impacts on crops, food production, and livelihood. In addition, infrastructure, water, fisheries, livestock, and forestry were mentioned, among other significant sectors. Moreover, according to a smaller percentage of respondents, the education and health sectors are also vulnerable to climate change induced disasters.

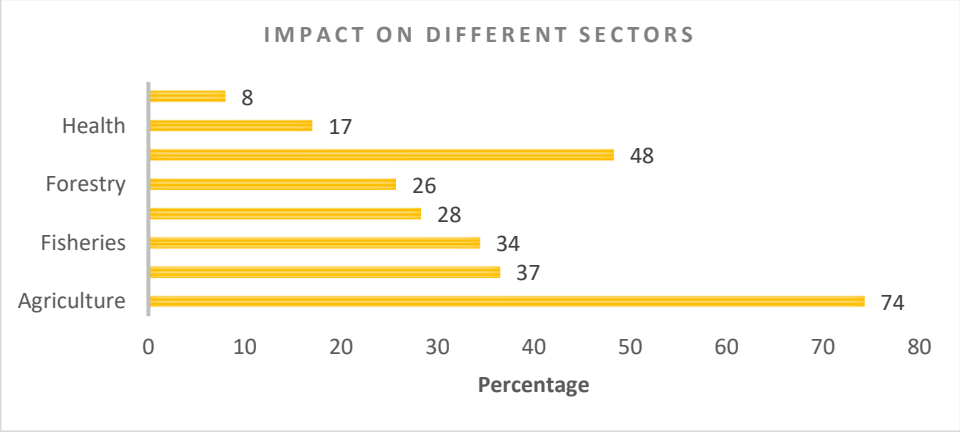


Figure 6-18: Sectoral Impacts of Climate Change

6.1.2.2 Impacts on Community

According to the respondents, the most harmful impact of climate change is lack of livelihood, as more than 80% of the respondents said they do not have any livelihood while disaster strikes. Some of the significant effects of climate change that the respondents faced include difficulty in movement (44.2%), food shortage (30.3%), sanitation problems (29.6%), drinking water problems (24.7%) a communication loss (18.8%), etc.

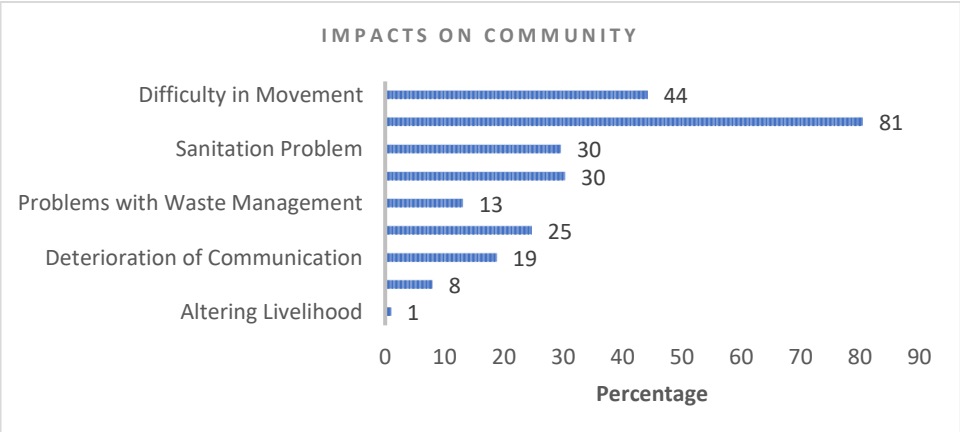


Figure 6-19: Climate Change Impacts on Community

Most of the KIIs highlight that woman, children, elderly people, and the persons with disabilities are the most vulnerable to climate change and related disaster impacts.

6.1.2.3 Impacts on Social Life

Migration is the most frequent impact of climate change-induced disasters on social life, as revealed by around 53% of respondents. Domestic conflict (48%), child marriage (41%), and social conflict (38%) were all mentioned by many of the respondents. Child labor was linked to climate change and its social impact by nearly 5% of the respondent.

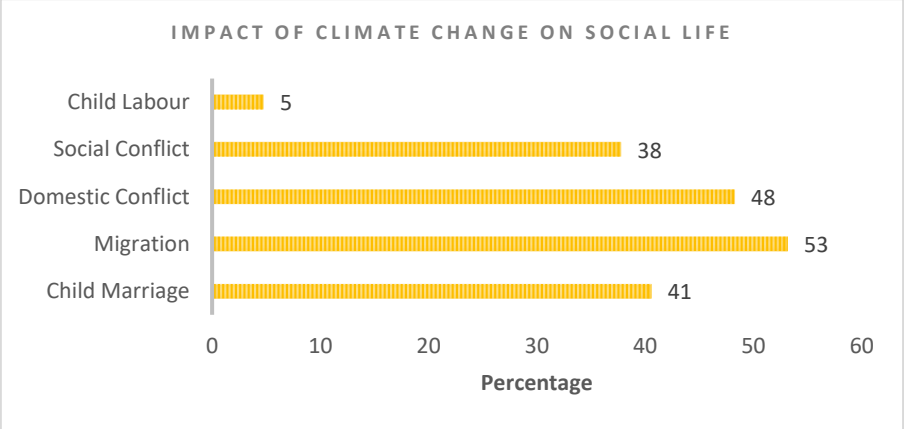


Figure 6-20: Climate Change impacts on Social Life

6.1.2.4 Impacts on Health

According to 88% of respondents, climate change is causing an increase in the number of diseases caused by vector-borne, waterborne, and high temperature. The trend of climate change induced disasters is increasing, and they believe that climate change is having an impact on mental health (76%). Moreover, the frequent climate change-induced disasters cause various injuries, losses of limbs, vision, hearing, and other ailments that affect 76% of the inhabitants of the study area. Around 25% of the respondents think that increasing salinity is also affecting their reproductive health, leading to infertility.

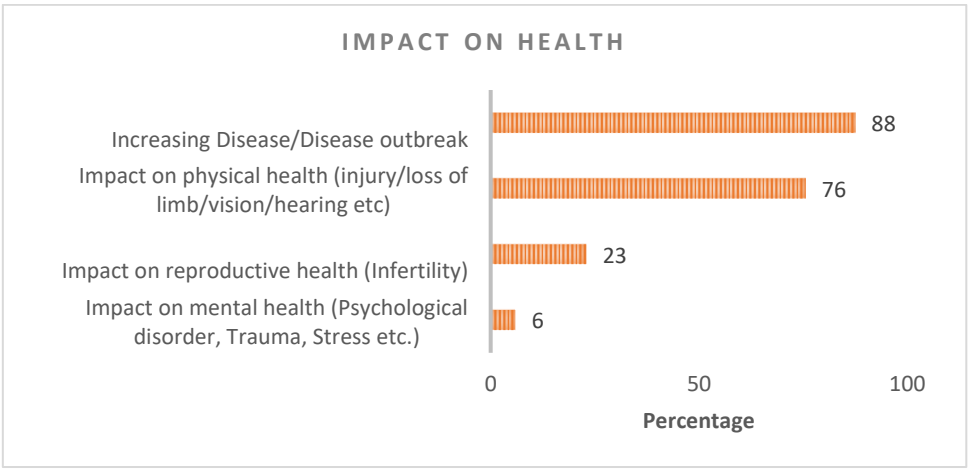


Figure 6-21: Climate Change Impacts on Health

6.1.2.5 Impacts on Critical Health Infrastructures

The study found that the most adverse impact of climate change induced disasters on health infrastructure was structural damage to infrastructure, with more than 80% of respondents identifying it. Asset damage to infrastructure (52%) and power loss (44%) have been identified by many respondents. Furthermore, it was found that climate change-related disasters also negatively impact access roads (32%), as well as water supplies (30%).

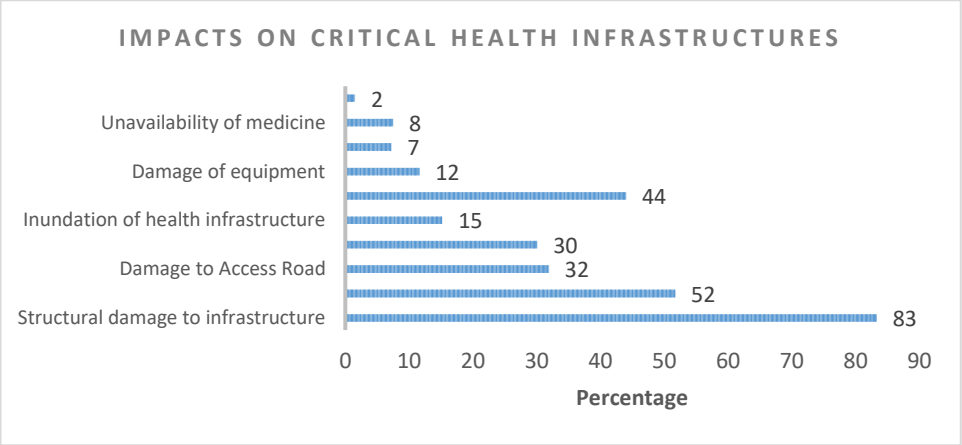


Figure 6-22 Scenario of Climate Change Impacts on Critical Health Infrastructures

KIIs revealed that the healthcare service providing process are often hampered during disasters. The hospitals and clinics often remain closed during disasters and the service providers cannot check the patients -as a result, the healthcare service gets seriously interrupted.

6.1.2.6 Impacts on Accessing Healthcare Service

In the study area, climate change has been causing an increasing trend of disasters, which has caused problems for the population of this location in accessing health care services when disasters occur. According to the respondents, lack of medical equipment (62.5%) and medicine (58.1%) was the prime obstacle to accessing healthcare services when disaster strikes. Moreover, the unavailability of service providers (doctor, nurse), damage to the access road, physical damage of infrastructures, etc., also creates problems accessing healthcare services during disasters.

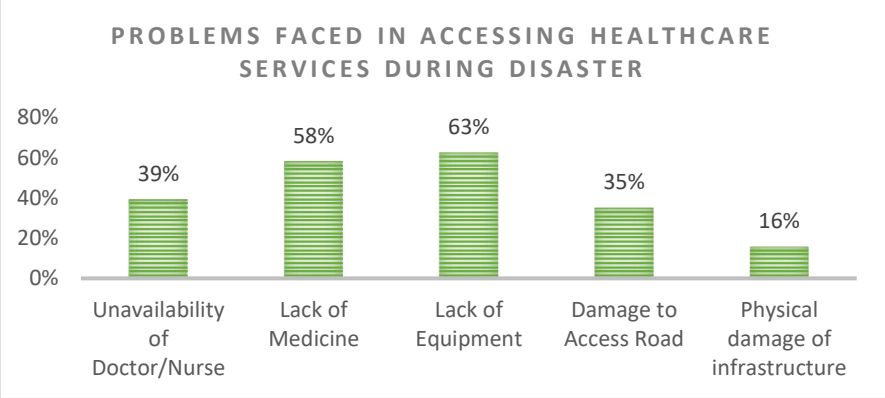


Figure 6-23: Problems Faced by the Respondents in Accessing the Healthcare Facilities

6.1.3 Other Aspects related to Cyclone Shelter Facilities and Receiving Early Warning

6.1.4 Accessing Cyclone Shelter Facilities

The respondents were asked about the facilities available in the shelters during the disaster. More than 80% of the respondents mentioned receiving medications and primary treatment in the shelters through the CPP volunteers. Significant number of respondents (50%-60%) reported the availability of stretchers and immediate treatment, but most of the cyclone shelters have no accessible entry and exit for persons with disabilities, elderly people, pregnant women etc. Availability of wheelchairs, assistive tools, assistive devices for persons with disabilities, etc., for the search and rescue were also mentioned by the respondents.

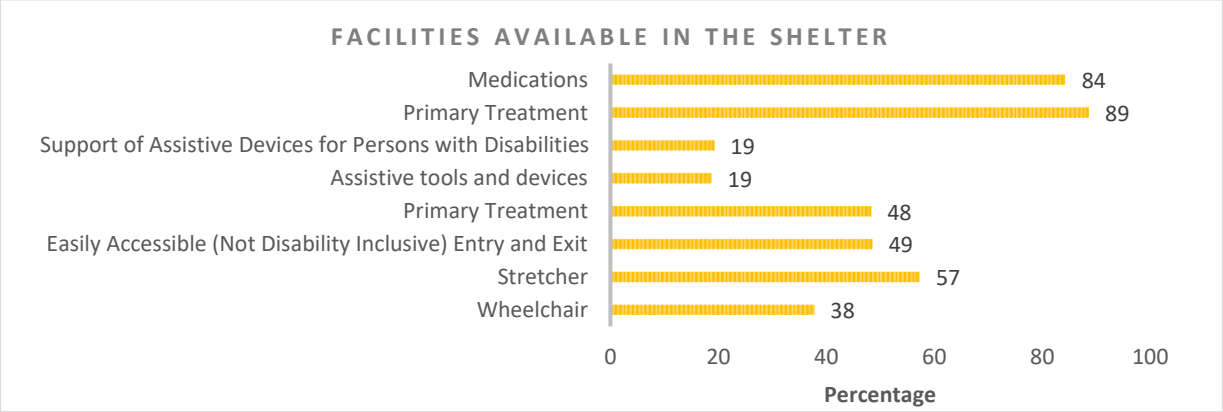


Figure 6-24: Scenario of the Facilities available in the Cyclone Shelters

Most respondents (311) reported that cyclone shelters have an active management committee. According to 12 respondents, there is no management committee, while 66 respondents are not aware of it. Of the 311 respondents who said there are committees in shelters, 256 respondents said that the committee is gender- and disability-inclusive. According to 11 respondents, the committee is not gender- and disability-inclusive, while 44 respondents expressed uncertainties.

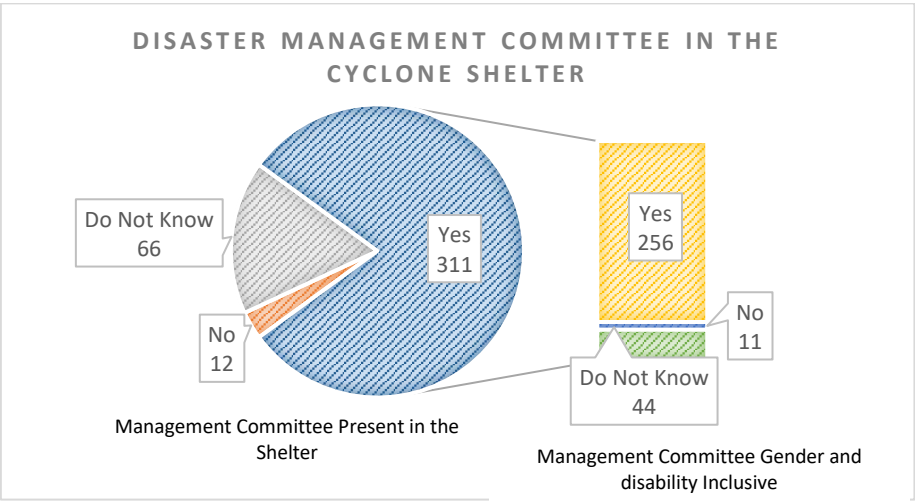


Figure 6-25: Scenario of Disaster Management Committee in the Cyclone Shelters

It was found by KIIs that third-gender individuals are not adequately accepted into cyclone shelters and hospitals during disasters such as cyclones. Furthermore, the food and medication supply for those sheltering in cyclone shelters during disasters were insufficient.

6.1.4.1 Receiving Early Warning Messages or Information

The respondents were asked whether they received an early warning messages or information before any major disaster occurred. Among the 389 respondents, 354 said they received the early warning. Among the 354 people who said they received the early warning, almost everyone understood it, and four said they did not comprehend despite receiving the warning.

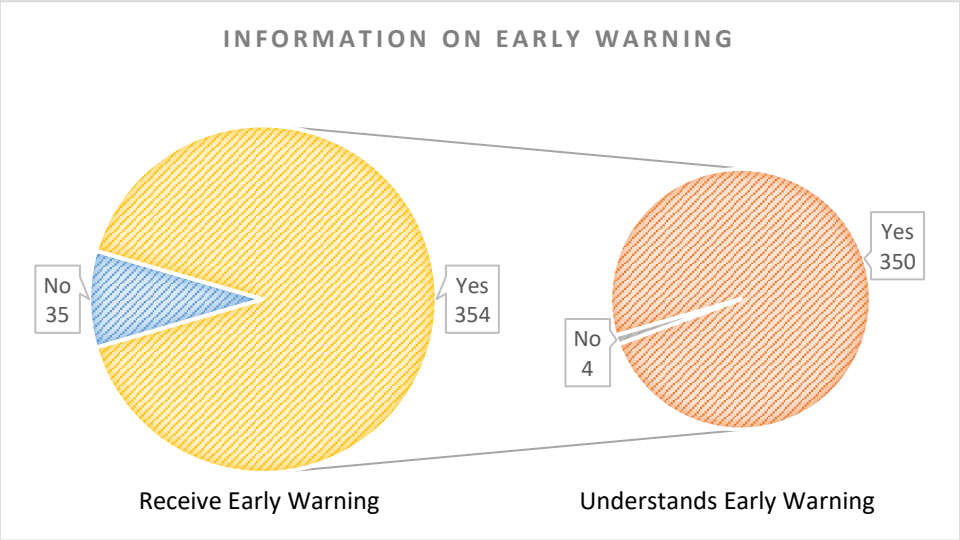


Figure 6-26: Scenario of Early Warning

The respondents were also asked from where they received the warnings. The most common response was community-based communication (64%) and mass media (59%), meaning they mainly received warnings from family members, religious institutions, CBO leaders, etc. However, local level media, and mechanical media were also common responses, meaning that TV channels, miking, SMS, community radio show, leaflets, etc., also played crucial roles in disseminating early warnings. Around 33% of respondents mentioned social media sources, like Facebook and YouTube.

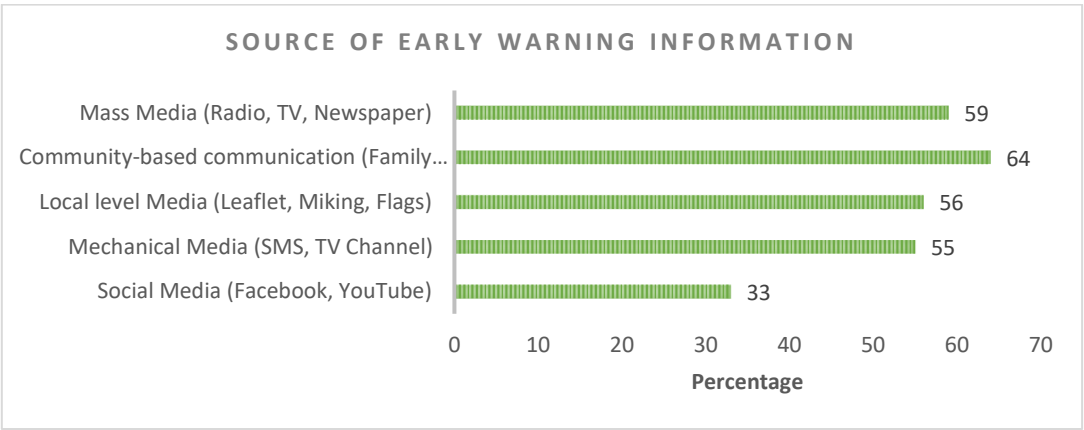


Figure 6-27: Different Sources of Early Warning

The respondents who received early warnings were asked what their activities were after receiving the warning. About 85% of respondents said they take shelter in safe places nearby, and around 60% said they take necessary steps to protect the household area. This indicates that people in this area take the warning seriously and act accordingly. However, 40% of the respondents said they do not take the warning seriously and lead their daily life as usual. After receiving the warning from different sources, 35% of respondents said they conveyed the message to the nearest neighbours.

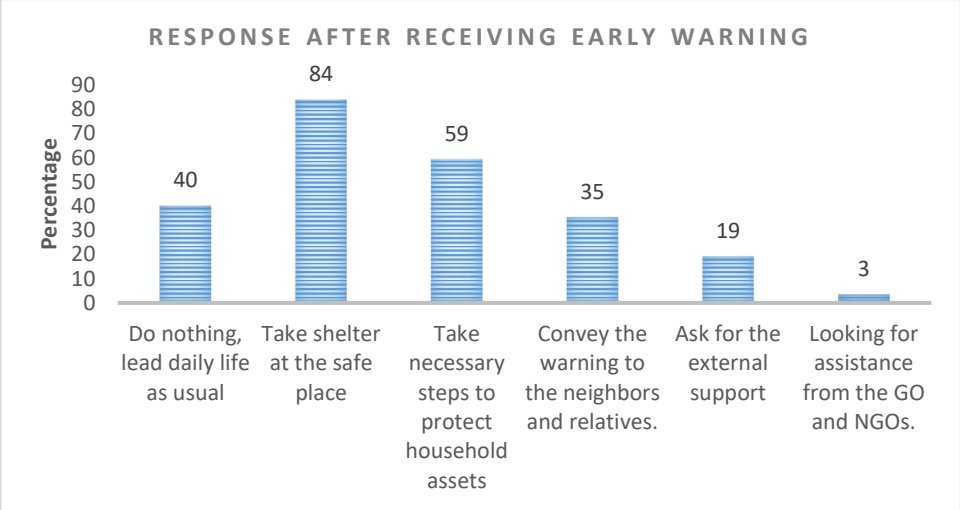


Figure 6-28: Activities After Receiving Early Warning

The behavior of the respondents after receiving early warning according to their sex, education level, presence of person with disabilities in the household, and household income was also identified. It is found that majority of both male and female respondents take shelter at safe place during disasters and take necessary steps to protect the household. The activity of conveying warning to neighbours and relatives is more common in males, whereas females tend to ask for external support more than male. Around 40% of the respondents of both sexes do nothing after receiving the early warning.

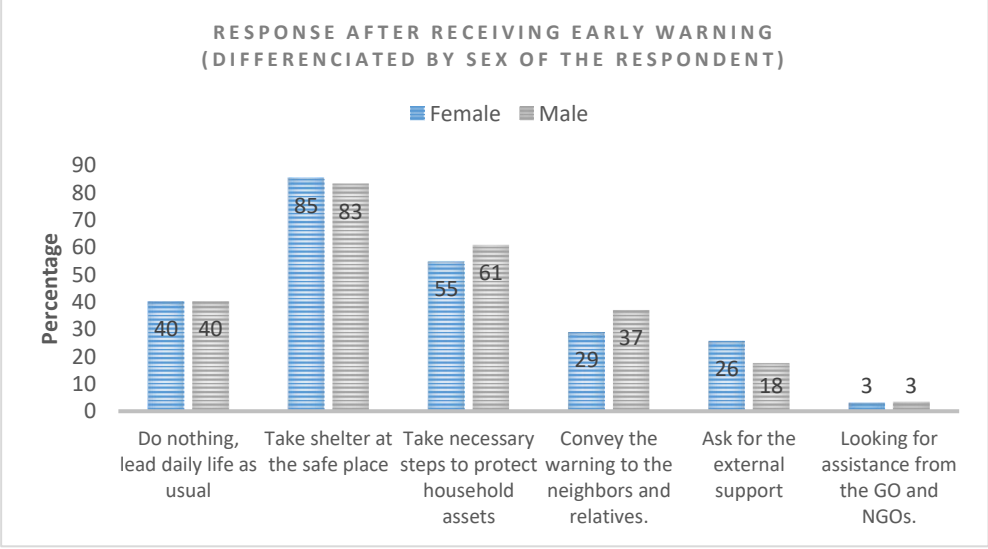


Figure 6-29: Activities After Receiving Early Warning (Differenciated by Sex)

The respondents with household income less than 15,000 BDT are more vulnerable to the climatic disasters and around 90% of them report taking shelter during disasters, whereas 76% of the respondents with household income more than 15,000 BDT do the same. It was found that the tendency to do nothing after receiving early warning is observed less often among the respondents with household income more than 15000 BDT. Majority of Low-income respondents (74%) try to take necessary steps to protect household assets, as opposed to middle-income respondents (44%).

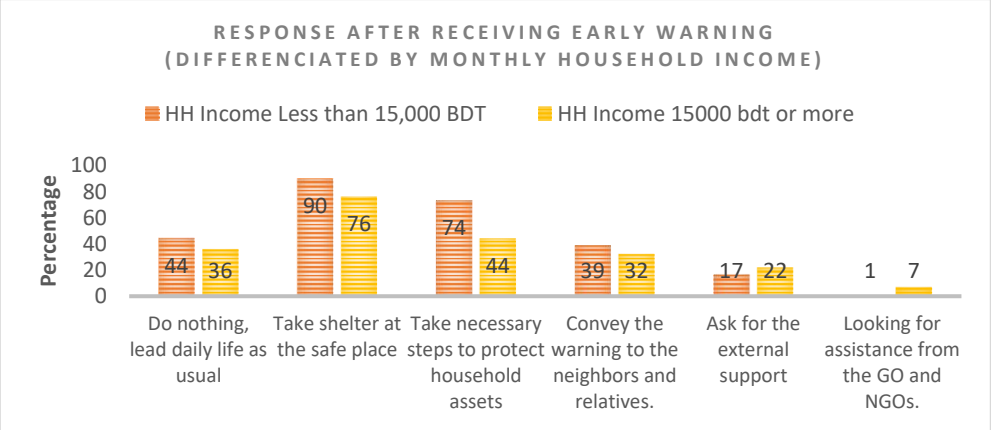


Figure 6-30: Activities After Receiving Early Warning (Differentiated by Household Income)

The effect of education was also reflected in the study. The tendency of doing nothing is observed more (48%) in the respondents without anR formal education, than the respondents receiving at least primary education (37%). However, the percentage of respondents taking shelters during the disasters are quite similar, indicating that the respondents who did not receive any formal education might receive the information regarding disasters from other sources such as training, seminar, etc. Uneducated respondents ask for external support and convey warning to neighbors and relatives more than the educated respondents, which indicates their adaptive capacity of developing stronger community and social networks to support and help each other out in time of emergencies. The response of taking necessary steps to protect household assets is observed more among the educated respondents.

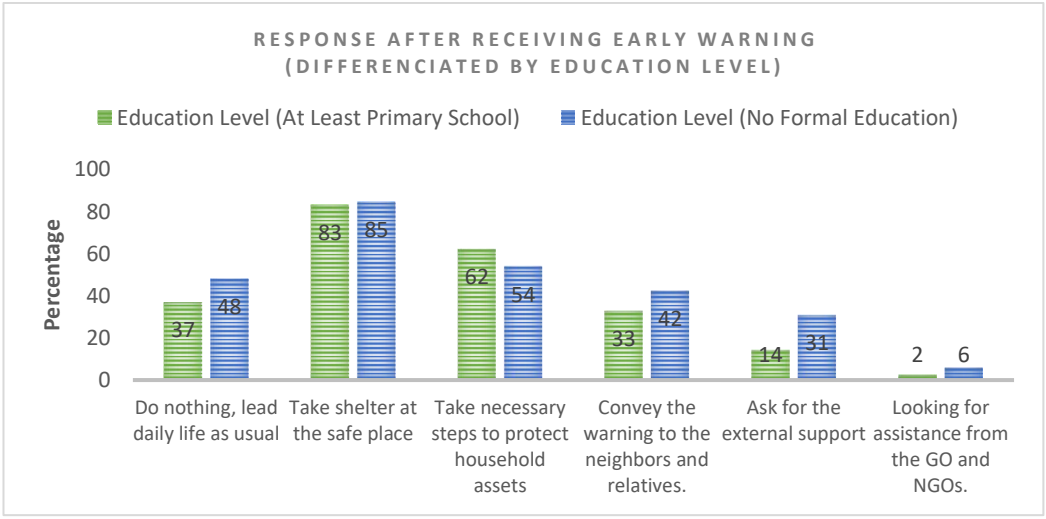


Figure 6-31: Activities After Receiving Early Warning (Differentiated by Education Level)

The respondents who have persons with disabilities in their households showed more tendency to do nothing after receiving an early warning (55%) than the respondents without persons with disabilities in their households. According to the responses, 84% of the respondents without disabilities said they take shelter at a safe place, whereas the answer is only 75% of the respondents with disabilities in their households. This might happen because the cyclone shelters are not accessible for person with disabilities, and it is difficult for persons with disabilities to move and take shelter. As a result, the family members prefer to stay with them for their safety and needs. A similar result was found in the case of the response where 60% of the respondents without disabilities said they take necessary steps to protect household assets whereas the % of respondents with disabilities reported the same in 55%. Again, persons with disabilities might find it difficult to take any steps. A higher percentage of respondents (19%) with disabilities in their household ask for external support than persons without disabilities (15%).

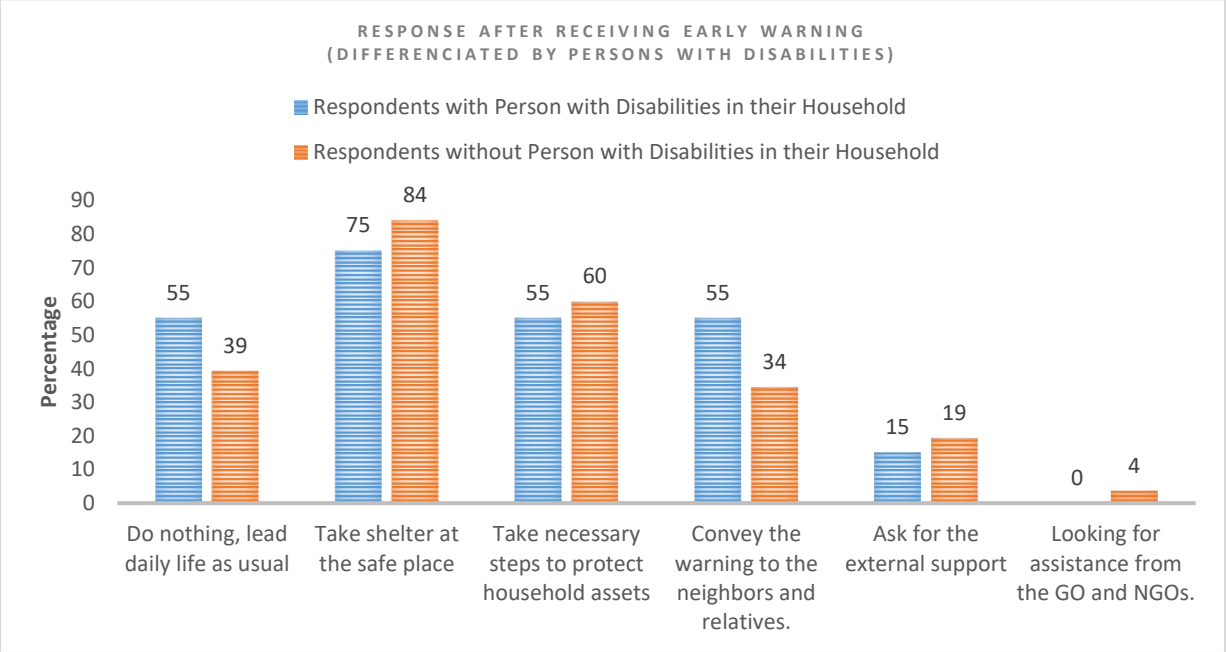


Figure 6-32: Activities After Receiving Early Warning (Differentiated by Persons with Disabilities)

6.1.5 Practiced Climate Change Adaptation Measures to Reduce the Impact of Climate Change on Health

The respondents were asked about the measures they have taken so far to reduce the impact of climate change on health. Around 90% of the respondents said they have worked on increasing public education and awareness about climate change impacts and adaptation measures, by getting involved in awareness raising campaigns, training events and workshops. Moreover, working on early warning for disease outbreaks (47%), making the houses climate-proof (31%), increasing community-based neighbourhood support (29%), etc., were also mentioned by respondents.

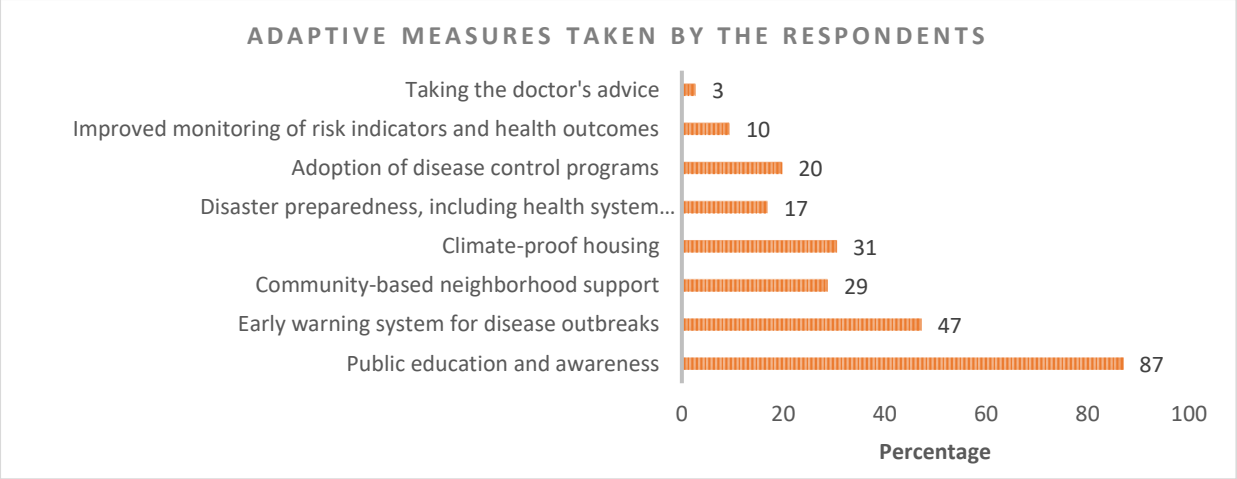


Figure 6-33: Adaptation Measures taken by Respondents

The study shows that people barely receive any support from different sources to adapt to the increased impact of disasters; mainly, they depend on themselves. After a disaster, only 23% of respondents mentioned receiving financial aid from the government. Transportation, medicine, management, financial support, and other services are primarily self-funded without any assistance from government, community, or NGO.

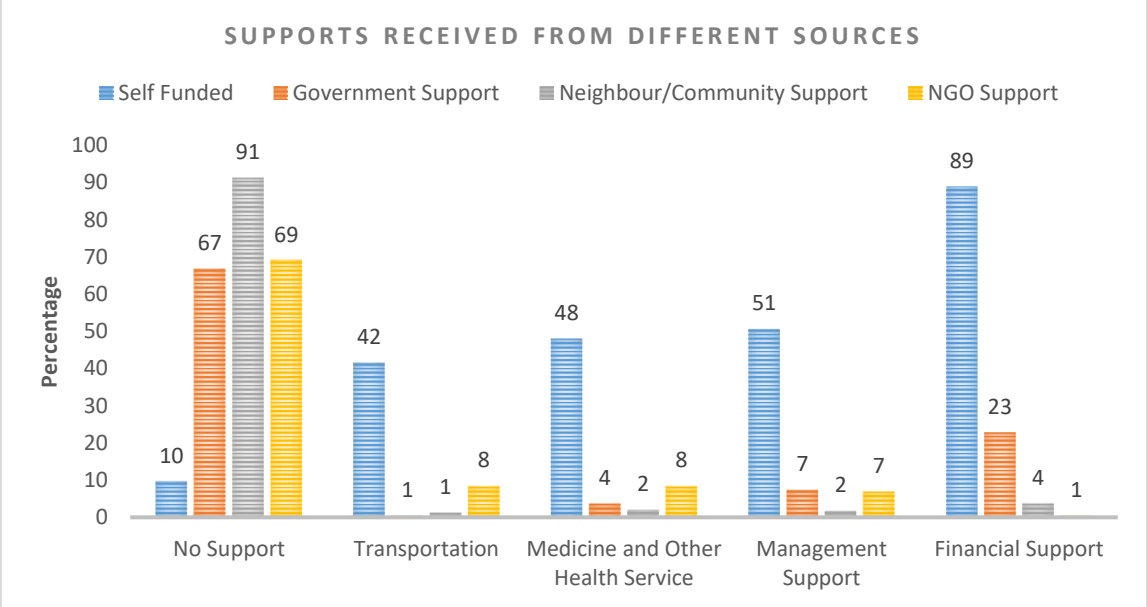


Figure 6-34: Scenario of Support received from Different Sources

6.1.6 Summary of the Household Survey Findings

The assessment unveiled significant insights into the health landscape, climate hazards, the impacts of these disasters on health and health infrastructure, and the knowledge and capacity of the respondents in the study area. The participants in the household survey were predominantly male, Muslim, and of Bangali ethnicity, with most having received no formal education beyond the primary level, engaged in diverse economic activities, and facing financial vulnerability, rendering them susceptible to climate change and disaster risks.

A majority of the respondents exhibited awareness of climate change and perceived it as negative. The workshop and Key Informant Interviews (KII) revealed that the community gained insights into climate change through various NGOs, Local Government Institutions (LGI), and Cyclone Preparedness Program (CPP) volunteer activities. Agriculture was prominently identified as the most affected sector, with loss of livelihood as the most detrimental impact of climate change. Migration was highlighted as the most common social consequence of climate change.

The participants recognized various health impacts, including disease outbreaks and physical health effects. The study also pinpointed the adverse influence of climate change induced disasters on health infrastructure, manifesting in structural and asset damage, as well as power loss, among other challenges. According to the respondents, the lack of medical equipment and medicines posed significant barriers to accessing healthcare services during disasters, exacerbating the vulnerability of healthcare facilities during climate change-induced disasters.

Cyclones, landslides, and temperature rise were identified as the primary climate change-induced hazards in the study area, with the frequency of disasters being perceived as on the rise. The respondents reported several prevalent vector-borne, water-borne, and high-temperature-related diseases, such as dengue, dysentery, stroke, and diarrhea, among others, with conditions like diarrhea, dysentery, dengue, and stroke observed to be on an upward trajectory.

The study team identified 23 health infrastructures in the study area, of which 20 were physically visited. These infrastructures encountered challenges in providing appropriate treatment to disadvantaged individuals, women, children, and those with impairments, who demonstrated varying sensitivities to climate risks. Critical concerns included inadequate ambulance services and the absence of a permanent hospital doctor in the Baharchara Union area, leaving these facilities more susceptible to weather threats and lacking in essential medication availability.

Despite lower educational attainment in the area, the majority of the 354 respondents who received early warnings managed to comprehend the signals and take necessary action, often seeking shelter at safe locations. This understanding could be attributed to the awareness-raising campaigns conducted by NGOs, the government, and CPP volunteers, among others. Family members, religious institutions, and Community-Based Organization (CBO) leaders were identified as common sources of early warning.

Cyclone shelters were found to offer limited provisions, including available facilities, medications, primary treatment, stretchers, and immediate care, with inadequate food and medication supplies for individuals seeking shelter during disasters.

Regarding adaptive measures, most respondents emphasized the importance of increasing public education and awareness about climate change impacts and associated adaptation measures through engagement in awareness-raising campaigns, training events, and

workshops. Dependency on self-funding was the prevalent coping strategy, with minimal support received from external sources.

6.2 IMPACT CHAIN ANALYSIS (ICA) RESULT AND FINDINGS

6.2.1 Impact Chain Analysis for Male Group

A total of 17 participants joined the session, who participated in the process with great enthusiasm and leadership. In the beginning, significant climatic hazards were identified, such as cyclones, coastal floods, excessive rain, salinity, temperature rise and tidal surge, etc. According to them, the impact of salinity results in infertility, cholera, diarrhea, allergies, and skin problems. This was also found in several studies as well (Rahaman & Rana, 2015) (Chakraborty, et al., 2019) (Wang, et al., 2020) (Rahaman, Rahman, & Nazimuzzaman, 2019). The frequency of cyclones that cause death, injury, and diarrhea is perceived to be rising. Malaria, diarrhea, jaundice, respiratory illnesses, cholera, etc., are all perceived as severe and caused by floods. Along with physical issues, there are numerous mental health issues, including frustration. One significant finding from this session is that climate-related disasters contribute to depression, anxiety, and stress. Different anthropogenic activities such as drug addiction, underage marriage, polygamy, kidnapping, trafficking of human beings, and road accidents are worsening the situation by increasing the sensitivity and vulnerability of the community.

From this session, it was understood that healthcare infrastructures (such as community clinics, pharmacies, goshastho kendro, union health centers, family planning centers) and different vulnerable groups (women, children, persons with disabilities, and transgender people) are highly exposed to disasters. Corruption of service providers, unavailability of persons with disabilities, friendly accessible entries, unhygienic practices during surgery, and the inadequacy of medical equipment are the main reasons which increase the sensitivity of the exposed infrastructures and vulnerable groups to climatic hazard impacts.

As the existing adaptive capacity, it was found that the locals do not have sufficient knowledge and depend on kabiraj or indigenous treatments, sometimes causing negative side effects. Financially solvent locals travel to the nearest city, Cox's Bazar, for better treatment.

The community recommended providing more expert doctors, continuous electricity supply, emergency medical facilities such as ambulances, hospital emergency units, regular delivery facilities, emergency cesarean section facilities for risky pregnancies, and persons with disability-friendly access to improve healthcare conditions in that area. Equity in the provision of treatment to all vulnerable groups should be ensured.

A brief impact chain analysis identifying all the impacts, exposure, sensitivity, adaptive capacity, and potential adaptive measures are presented in the following figure.

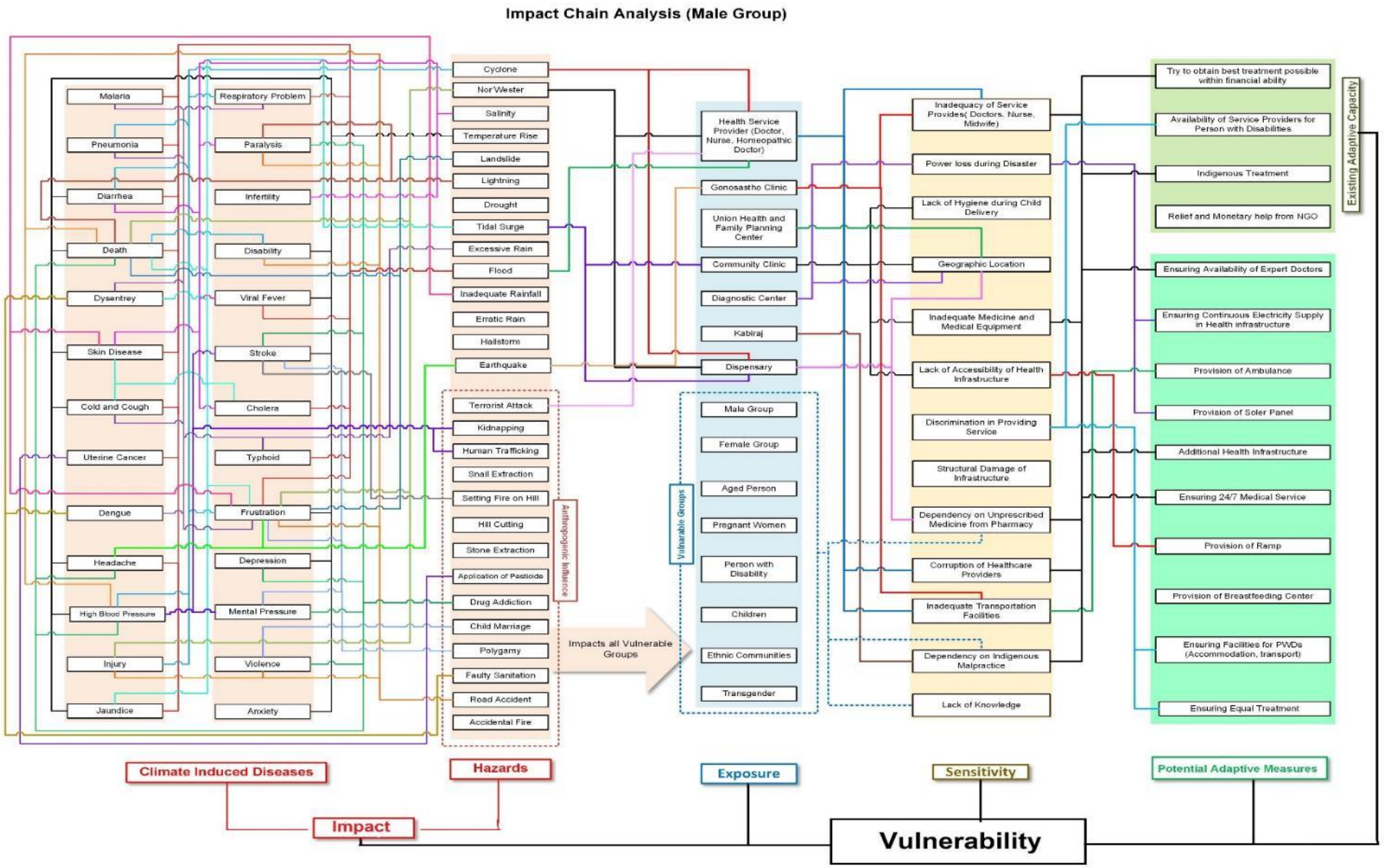


Figure 6-35: Schematic Diagram of Impact Chain Analysis (Male Group)

6.2.2 Impact Chain Analysis for Female Group

In the session conducted with the female group of Baharchara Union, Teknaf, there were 18 participants. At first, the most common hazards were identified. According to the participants, cyclones, landslides, coastal floods and high temperatures are the main climate hazards in that region. Salinity caused by cyclone and its associated surge has been named one of the most disastrous events. Skin conditions and issues with reproductive health are affecting more women and adolescent girls than before. It was found that, due to salinity, children also suffer from severe skin conditions. A rise in temperature results in serious physical health issues like dysentery, diarrhea, headaches, high blood pressure, heat stroke, and mental health issues, like stress, anger, sadness, and restlessness. The intensity of climatic hazard consequences is seen as increasing due to anthropogenic factors, such as forest degradation. Moreover, non-climatic hazards such as kidnapping, and wild elephant attacks are also increasing the vulnerability of the community. To free someone who has been kidnapped, the family members have to pay a specific amount of money to the kidnapper. This money could be used during disasters, however, when they use it for this purpose, they usually face problems adapting to the impact of disasters. On the other hand, when this kind of situation arise, the family members face severe mental pressure and anxiety which also increase their vulnerability to be impacted by climate change induced disaster.

The critical healthcare infrastructures in the area exposed to different climatic hazards were also identified. Healthcare facilities, hospitals, the Upazila Health Complex, the Gonoshastho Clinic, family planning centers, and diagnostic centers are perceived as being at risk from these climatic hazards. Various vulnerable groups, including women, children, the elderly, and pregnant women, are seen as particularly vulnerable to disasters. According to the female participants, the key factors that increase infrastructure and human sensitivity to climatic disasters include inadequate service providers, such as doctors and nurses, the absence of emergency services, the neglect of doctors, power loss during disasters, and water scarcity.

For better medical treatment, locals from the area travel to the closest city, Cox's Bazar. Most low-income people depend on indigenous medical techniques. People suffer from erroneous application of these indigenous treatments due to illiteracy. Sometimes the government, NGOs, or INGOs provide financial assistance to persons in need.

Construction of accessible healthcare facilities, provision of medical equipment in existing healthcare facilities and qualified doctors may increase women’s capacity to adapt to climatic disasters. People reported that there were no emergency services or ambulances available. Only pregnant women are eligible for emergency ambulance services, which must be open to the entire neighborhood.

The following figure shows the impact chain prepared from this information.

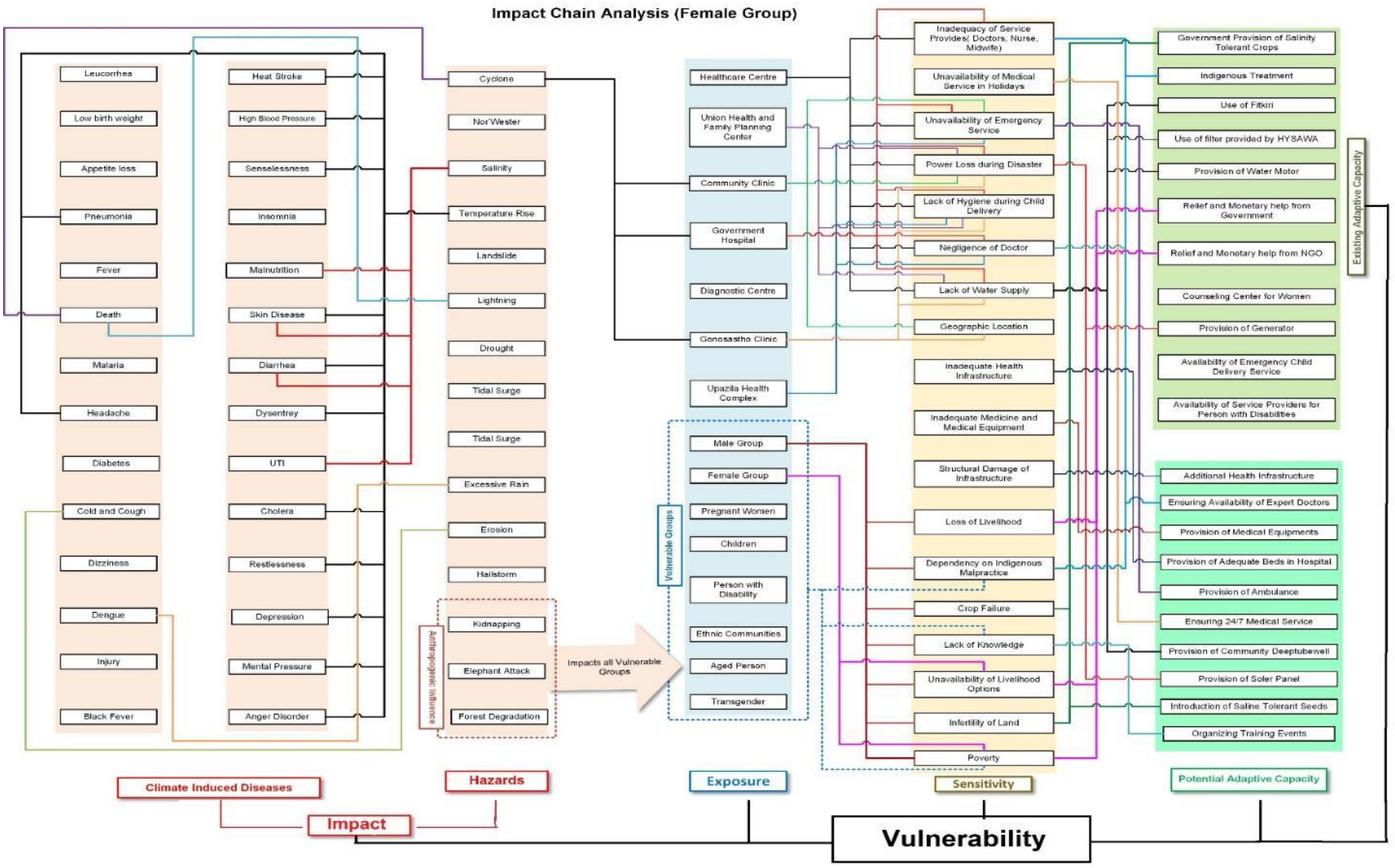


Figure 6-36: Schematic Diagram of Impact Chain Analysis (Female Group)

6.2.3 Impact Chain Analysis for Persons with Disability Group

During this session, 18 individuals with disabilities were in attendance. The participants recognized significant climatic hazards such as temperature rise, tidal surges, cyclones, and salinity, among others. They also identified associated diseases, including pneumonia, high blood pressure, headaches, paralysis, heat strokes, and spasms.

According to the participants, there are community clinics, government hospitals, NGOs, and maternity clinics in the area, which are not directly exposed to various disasters. However, they are at risk of being affected by landslides. Regarding sensitivity factors, the participants noted insufficient availability of doctors and medicine, as well as the closure of medical services during holidays. They also mentioned that the healthcare infrastructure's environment is not disability-friendly and accessible. Additionally, they emphasized that persons with disabilities do not receive equitable treatment.

In terms of existing adaptive capacity, the participants highlighted their reliance on the Cyclone Preparedness Program (CPP) during disasters, along with occasional support from various NGOs, including CDD, Red Crescent, and FIVDB. They emphasized their ability to comprehend early warnings and utilize the hotline service during emergencies.

Regarding potential adaptive measures, the respondents suggested the construction of additional healthcare facilities and the assurance of the availability of medical professionals and equipment. They also recommended the provision of ambulances and the installation of ramps. Additionally, they proposed the implementation of training programs focusing on livelihoods, health, and smartphone usage. They also highlighted the potential benefits of providing special tools such as white canes, hearing aids, wheelchairs, as well as raincoats, helmets, and torchlights.

A detailed impact chain is presented in the following figure-

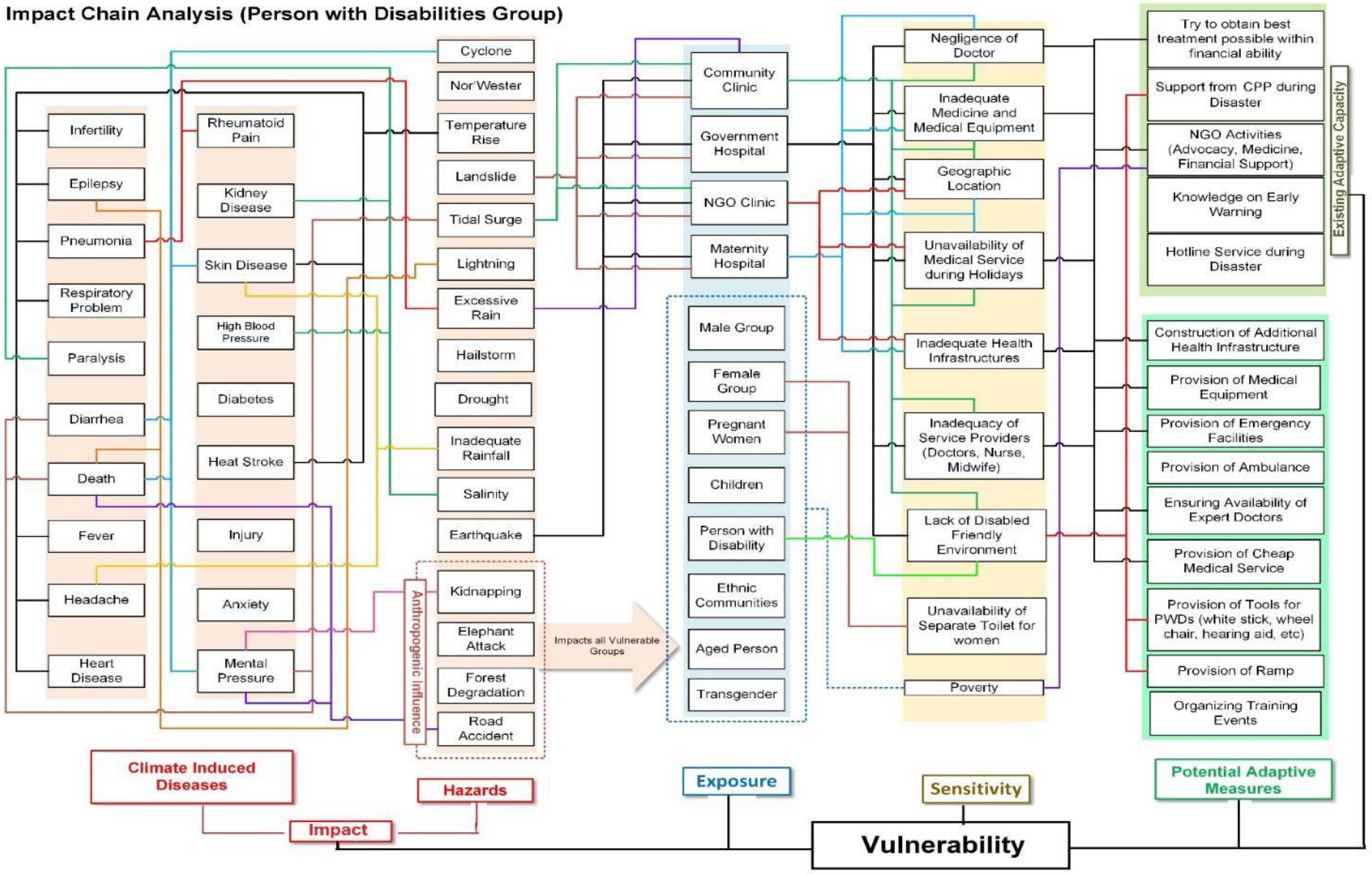


Figure 6-37: Schematic Diagram of Impact Chain Analysis (Person with Disabilities Group)

6.2.4 Findings from Integrated Impact Chain Analysis

The consolidated impact chain integrates all the previously presented impact chains. Based on the combined ICA, it was determined that the most impactful hazard in the study area is the rise in temperature, significantly affecting the well-being of the community and health infrastructures. Additionally, cyclones, storm surges, nor 'westers, salinity, floods, tidal surges, and excessive rainfall are other hazards detrimentally impacting health and health infrastructures.

These climatic hazards have been linked to the proliferation of various diseases in the study area. Skin diseases, cholera, strokes, and high blood pressure are among the most commonly identified ailments, as indicated by the combined impact chain analysis. Furthermore, mental health concerns, such as frustration and increased psychological pressure, have been observed to be on the rise.

In addition to their effect on health, these hazards also exert pressure on the health infrastructures in the study area. As per the combined ICA, the most vulnerable health infrastructures include community clinics, government hospitals, and NGO clinics. Furthermore, various vulnerable groups, such as women, pregnant women, the elderly, and individuals with disabilities, are exposed to various climatic hazards.

The key vulnerabilities of these health infrastructures were identified as insufficient service providers, inadequate health infrastructure, shortages of medicine and medical equipment, water scarcity, and power outages during disasters. Additionally, livelihood losses, crop damages, lack of knowledge, and poverty exacerbate the vulnerability of these groups.

Common adaptive measures identified include the government's introduction of salinity-tolerant crops, financial support from both governmental and non-governmental sources, and the utilization of indigenous treatments. People strive to access the best possible treatment within their financial means. The potential adaptive measures identified encompass the provision of expert medical professionals, the expansion of health infrastructure, continuous power supply, the establishment of community deep tube wells, ensuring the availability of medicine and medical equipment in health facilities, and the construction of ramps and access roads, among others.

The following figure illustrates the comprehensive impact chain analysis, incorporating all the aforementioned information.

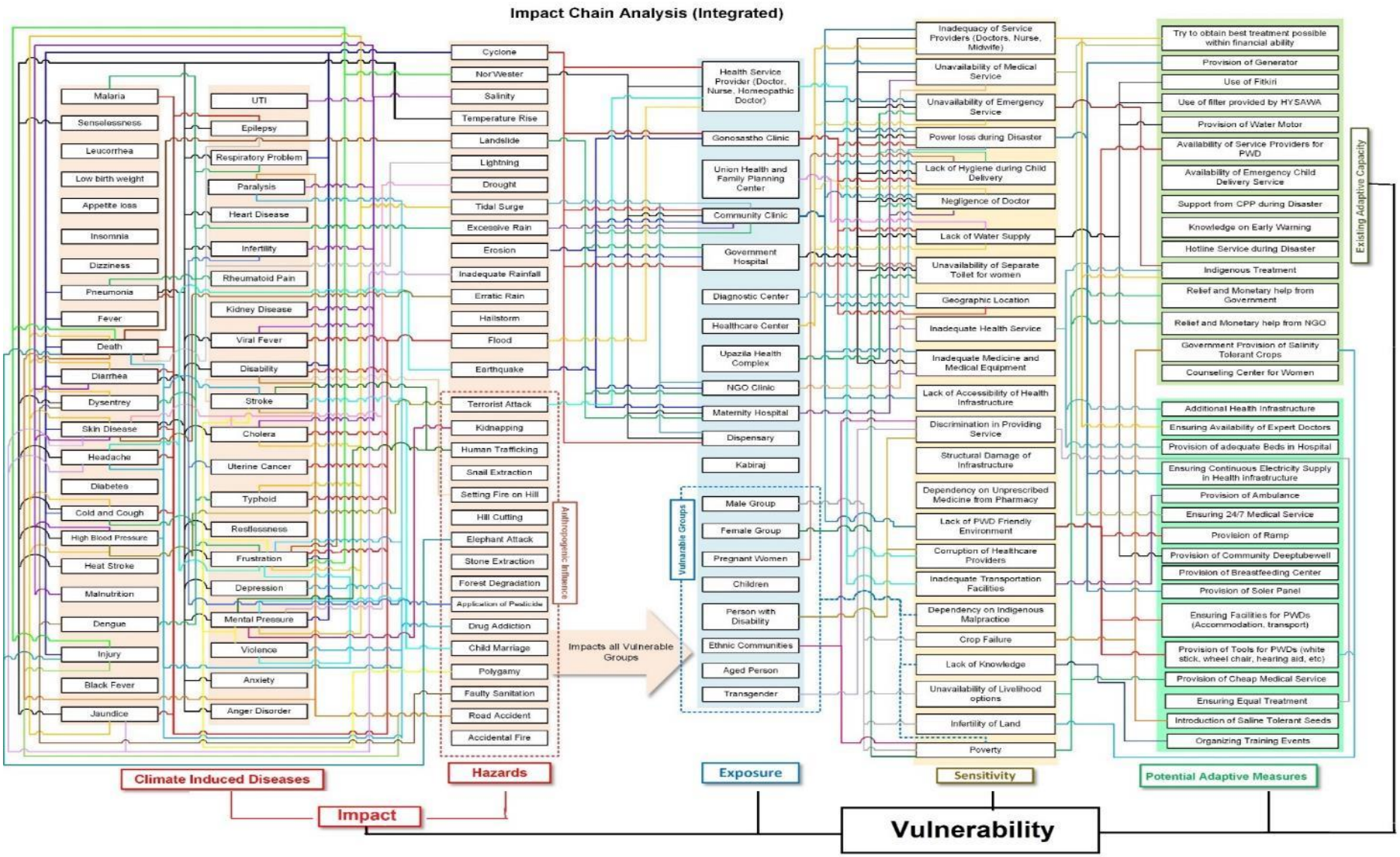


Figure 6-38: Schematic Diagram of Impact Chain Analysis (Combined)

7 MAJOR RECOMMENDATIONS

7.1 REVISION AND EFFECTIVE IMPLEMENTATION OF EXISTING POLICY AND LEGISLATIVE FRAMEWORK

- National Adaptation Plan (NAP), 8th Five Year Plan, Bangladesh Delta Plan, Mujib Climate Prosperity Plan, etc., clearly indicated the climate change vulnerability of disadvantaged groups, like persons with disabilities, women, elderly, etc. Based on the documents, specific initiatives or time-bound action plans need to be initiated by the relevant government or non-government authorities to address their issues, specifically health aspects in every climate change projects.
- Necessary revision of National Coastal Zone Policy, Bangladesh Climate Change Strategy and Action Plan (BCCSAP), National Health Policy, etc. are needed to minimize the climate change impacts on vulnerable groups and to ensure the issues related to physical, informational, and infrastructural accessibility.
- The policies and legislation related to disaster management, like National Plan for Disaster Management, National Disaster Management Policy, Standing Orders on Disaster and Disaster Management Act, need to emphasize the formulation and implementation of vulnerable group-specific (women, persons with disabilities, ethnic communities, elderly and others) climate change-induced disaster management strategies.
- National Health Adaptation Plan need to be developed to specifically address the climate change impacts on health and health infrastructures, along with adaptation strategies considering the climate-vulnerable groups.
- Legal frameworks and policies need to be established or strengthened to protect the rights of persons with disabilities, ethnic communities, and transgender groups, ensuring non-discrimination, equal opportunities, and access to services.
- Policies need to be updated/modified considering the health sector (e.g., healthcare facilities, health infrastructures, health service providers, health service centers, etc.) while considering the other sectors in terms of the sectoral impacts of climate change.
- National Policy frameworks are often not aligned with the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), among other relevant international agreements; this alignment needs to be ensured.
- Fostering coordination and collaboration among relevant stakeholders, including government agencies, civil society organizations, and international partners, need to be ensured for effective implementation of national and international policy and legislation framework.

7.2 ENSURING HEALTH SERVICE/FACILITIES AT HEALTH INFRASTRUCTURES

- To serve the community people before, during, and after disasters, more functional and inclusive and accessible health infrastructures ensuring doctors, nurses, midwife, necessary medicines, necessary vaccines, medical equipment, wheelchair, stretcher, crutches, hygiene and accessible washroom facilities, ramp facilities and ambulance, etc., are required.
- The continuous (24/7) presence of doctors and nurses in the health infrastructures need to be ensured and given utmost importance.
- Emergency services need to be introduced in the health infrastructures of the study area.
- Specialized doctors, like dermatologists and gynecologists, need to be deployed in the study locations to reduce the problems related to skin diseases and reproductive health problems, which are thought to be occurring due to salinity intrusion and temperature rise.
- Rehabilitation professionals to increase the functional independence of persons with disabilities need to be deployed in the available health infrastructures for disability mainstreaming.
- Several counselling units need to be opened in the health government and non-government health infrastructure to minimize mental health-related problems faced by local community due to frequent climatic hazards.
- Accessible telemedicine (SMS, sign language) systems can be introduced to make health services accessible to a larger population.
- The health budget provided by the government need to be increased to ensure accessibility in critical health infrastructures.
- Health infrastructure needs to have special transport equipment for persons with disabilities and elderly people, specifically before, during and after disaster period.
- The health infrastructures of the study locations, specifically NGOs and other private health infrastructures, need to be frequently monitored by regulatory authorities to ensure proper diagnosis and improve health service quality.
- Proper research and monitoring are needed to understand the relationship between climate change and the increasing climate change-induced diseases identified by the community, which will help prevent and reduce such diseases' impacts.

7.3 CONSTRUCTING OR RENOVATING ACCESSIBLE HEALTH INFRASTRUCTURE

- More diagnostic and accessible healthcare centers need to be constructed in the study locations.
- Infrastructure for health care needs to be climate-resilient, accessible, and capable of adjusting to the severe effects of climate change-induced hazards, like severe cyclones and storm surges.
- An alternate electricity supply mechanism needs to be installed in health infrastructures to ensure no disruption in the provision of health services. Moreover, generators and solar panels in the clinics and other health infrastructures are needed to ensure continuous electricity in times of disaster and emergency.
- Rainwater harvesting needs to be introduced in the health infrastructures to ensure water availability during disaster period.
- Health infrastructures in structurally critical and fragile conditions need to be renovated or rebuilt, to ensure accessibility.
- The access roads need to be repaired or reconstructed to improve the accessibility to the health infrastructures.
- Universal Design Guidelines (UDG) need to be followed for constructing or renovating health infrastructures.

7.4 REDUCING CLIMATE CHANGE VULNERABILITY OF COMMUNITY

- A storage facility needs to be built in the study location to sustain the seed distribution schedule maintained by the relevant authority so that people can sow the salinity-tolerant crop seeds and seedlings at a suitable time.
- Excavation of ponds and construction of water reservoirs need to be done by the government and private sectors in the study area to minimize salinity intrusion problems and to ensure the efficient use of surface water for vulnerable communities.
- Inclusive safe water options (tube wells, river osmosis, rainwater harvesting, etc.) for household and community levels need to be built into the study locations.
- Economic incentives during disasters provided by the government and NGOs need to be distributed considering equity and inclusion so that vulnerable groups (female group, elderly people, persons with disabilities, transgender and ethnic communities, etc.) can access the financial incentives.
- Killas need to be constructed in the study area to minimize livestock losses during the disaster period.
- Cyclone shelters need to have separate rooms, and sanitation facilities for women and persons with disabilities need to be improved. Moreover, functional first aid kits should be stored in the cyclone shelters.
- Facilities like streetlights, solar systems, rainwater harvesting, etc. need to be installed in the cyclone shelters.

- Comprehensive afforestation programs need to be taken to plant trees in the study area for environment conservation and to minimize the impacts of disasters.
- Multisectoral coordination is needed in primary, secondary, and tertiary level of disaster preparedness and management.
- Inclusive early warning messages need to be disseminated by the responsible authority.
- The Government and other relevant stakeholders need to formulate some appropriate strategies in order to ensure a full percentage of evacuation through effective dissemination of early warning and increase awareness of the community people so that they can respond to the early warning during disaster period to avoid casualty.

7.5 PROVIDING CAPACITY BUILDING TRAINING AND AWARENESS RAISING SESSIONS

- The health service providers (Doctor, Nurse, Midwife, Community Health Workers, and Traditional birth attendants, etc.) need to be trained in dealing with climate change induced health problems or emergency.
- First responders need to be trained in inclusive search, rescue, and evacuation of the vulnerable community in the case of disasters.
- Governmental Departments, NGOs, and communities can work together to develop and implement comprehensive disaster preparedness plans that address mental health issues. This might include providing training to emergency response teams and volunteers to recognize and respond to signs of stress, trauma, and psychological impact due to climatic hazards.
- Capacity-building training programs on appropriate alternate livelihood options to reduce climate change impact need to be organized for vulnerable communities.
- Training on first aid, primary health service, and other simple health-related topics, like Cyclone Preparedness Program (CPP), need to be provided to the ward disaster management committee and other volunteer groups.
- Capacity building for field-level implementation staff (e.g., DPHE emergency response team) is required.
- The government and non-government health service providers need to arrange capacity-building and awareness-raising sessions on climate change risk, climate change adaptation and disaster management measures for vulnerable communities, such as women, elderly people, ethnic communities, youth, children, persons with disabilities and gender-diverse groups.
- The religious leaders (imams, priests, and others) need to be included in different capacity-building and awareness-raising sessions/campaigns to encourage people to actively participate in these events and utilize the learnings to minimize their climate change vulnerability.
- Sensitization and awareness programs need to be conducted to promote understanding and acceptance of diversity, including disability, ethnicity, and gender identity, among the public and service providers.

7.6 ENSURING INCLUSIVE HEALTH AND OTHER SERVICES FOR THE VULNERABLE COMMUNITY

- Sufficient equipment, such as prosthetic organs (artificial limbs), wheelchairs, hearing aids, crutches, and white sticks, is required for persons with disabilities to respond to and remain secure during and after disasters.
- Job prospects need to be generated for persons with disabilities, ethnic communities, transgender groups, etc.
- Equal treatment facilities need to be provided for persons with disabilities, ethnic communities, and transgender group.
- Participation of vulnerable people, including persons with disabilities, ethnic people, transgender people, in the management committees of community clinics and union-level health service points need to be ensured.
- Women, persons with disabilities and transgender people can be included in the CPP program as volunteers.
- Accessibility needs to be ensured in all health facilities (both physical and non-physical).
- Community-based rehabilitation programs need to be implemented to support the rehabilitation and inclusion of persons with disabilities, ethnic communities, and transgender groups, enabling their active participation in their locality.
- Inclusive education systems need to be established, ensuring that persons with disabilities, ethnic communities, and transgender groups have access to quality education and equal learning and skill development opportunities.
- Information accessibility and alternate methods (Including braille, text-to-speech, websites, and talking book) need to be ensured for all types of health and climate change-related programs.
- Accessible information and communication technologies (ICT) need to be deployed and made available to enhance the digital inclusion of persons with disabilities, ethnic communities, and transgender groups in their local language.
- Collaboration and partnerships between government agencies, civil society organizations, organizations of persons with disabilities (OPDs) and relevant stakeholders need to be encouraged to address the specific needs and challenges faced by persons with disabilities, ethnic communities, and transgender groups in disaster management and climate change adaptation.

8 CONCLUSION AND WAY FORWARD

This study yielded significant insights into the impact of climate change on health and healthcare infrastructure. Employing the ICA method alongside other approaches, the study identified the implications of climate change, current adaptive measures, and potential community adaptation strategies. It also pinpointed the primary risks and vulnerabilities to human health and healthcare infrastructure arising from climate change.

The findings and recommendations of this study are poised to guide governmental bodies, non-governmental organizations, relevant authorities, and policymakers in implementing necessary measures to mitigate these risks. Furthermore, this study highlights the advantages and disadvantages of adopting the ICA method, a relatively contemporary approach to identify and analyze the effects of climate change across different sectors. This, in turn, paves the way for potential ICA implementation in various sectors, enabling similar research and facilitating the adoption of essential measures to minimize sector-specific risks.

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ANNEXTURE 1: COMMON TERMS AND DEFINITIONS

The terms and definitions for the assignment are the following:

Term	Definition
Critical Infrastructure (CI)	Critical infrastructure (CI) refers to those essential physical and information technology facilities, networks, services, and assets, which, if disrupted or destroyed, would severely impact the health, safety, security, economic or social well-being, or the effective functioning of authorities. Critical infrastructures are considered facilities and services vital to the basic operations of a society (CISA, 2019).
Risk	The potential for adverse consequences for human or ecological systems, recognizing the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, livelihoods, health and wellbeing, economic, social and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species (IPCC, 2020).
Hazard	Hazard refers to a dangerous phenomenon, substance, human activity, or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. Hazards may or may not lead to disasters, depending on their severity, exposure, and vulnerability of population, environment, biodiversity and infrastructure, etc. Climatic hazard refers to a specific event or condition that has the potential to cause harm, damage, or disruption due to its association with weather or climate conditions. These hazards are often the result of natural processes and can vary in severity and frequency (UNDRR, 2009).
Disaster	A disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. Disaster is an event that occurs suddenly/unexpectedly in most cases and disrupts the normal course of life in the affected area. Disasters can be natural (e.g., earthquakes, hurricanes) or human-made (e.g., industrial accidents, terrorist attacks). Disasters can result in loss of life, property damage, economic disruption, and adverse environmental impacts (UNDRR, 2009).
Potential Impact	Potential impact refers to all impacts that may occur given a projected change in climate, without considering adaptation. The effects on natural and human systems of extreme weather, climate events, and climate change. Impacts generally refer to effects on lives, livelihoods, health status, ecosystems, economic, social, and cultural assets, services (including environmental), and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a

Term	Definition
	specific period and the vulnerability of an exposed society or system. Exposure and sensitivity, in combination, determine the potential impact of climate change (IPCC, Glossary of Terms, 2018).
Exposure	Exposure refers to the people, property, systems, or other elements present in hazard zones that are thereby subject to potential losses (UNDRR, 2009).
Sensitivity	Sensitivity is in turn described as the Degree to which a system is affected by or responsive to climate stimuli (IPCC, 2001).
Adaptive Capacity	Adaptive capacity includes the combination of all the strengths, attributes, and resources available within a community, society or organization that can be used to achieve agreed goals. The ability of systems, institutions, humans, and other organisms to adjust to potential climate change-induced hazards and damages, take advantage of opportunities or respond to consequences is called the adaptive capacity (UNDRR, 2009).
Vulnerability	Vulnerability is the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. Vulnerability is a function of the character, magnitude, and rate of climate change and the variation to which a system is exposed, its sensitivity, and its adaptive capacity (UNDRR, 2009).
Resilience	Climate resilience refers to the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. The IPCC Sixth Assessment Report defines resilience as the capacity of social, economic and ecosystems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure as well as biodiversity in case of ecosystems while also maintaining the capacity for adaptation, learning and transformation (UNDRR, 2009).
Disaster Risk Reduction (DRR)	Disaster risk reduction is the concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. The goal of disaster risk reduction is to enhance resilience and build the capacity to effectively prepare for, respond to, and recover from disasters (UNDRR, 2009).
Impact Chain Analysis	Impact Chain Analysis is an analytical tool that helps to understand better, systemize and prioritize the factors that drive vulnerability in the system under review. In addition, it helps to understand the relationship between risk components (hazard, exposure, capacity, sensitivity, and vulnerability) and their attributed underlying factors. Expert knowledge and a sound understanding of the system at the heart of

Term	Definition
	the vulnerability assessment are indispensable in developing impact chains (Kerstin, et al., 2014).
Assistive technology	Assistive technology is an umbrella term covering the systems and services related to the delivery of assistive products and services. Assistive technology enables people to live healthy, productive, independent, and dignified lives, and to participate in education, the labor market and civic life. Assistive technology reduces the need for formal health and support services, long-term care, and the work of caregivers. Without assistive technology, people are often excluded, isolated, and locked into poverty, thereby increasing the impact of disease and disability on a person, their family, and society (WHO, Assistive Technology, 2023).
Reasonable accommodation	Reasonable accommodation is any modification or adjustment to a job or the work environment that will enable an applicant or employee with a disability to participate in the application process or to perform essential job functions (adata, 2023).

ANNEXTURE 2: SAFEGUARDING GUIDELINES

- All the information must be collected with the consent of the respondent. The respondents must be informed about the project details, purpose, and objectives and ensure that this information will only be used for research purposes.
- The respondents' personal information (name, phone number, etc.) will not be shared with anyone other than the project and study team members for research purposes.
- The location for conducting the ICA workshops must be accessible to the respondents.
- All the photographs and recordings during the ICA workshops, key informant interviews, and household surveys will be used in the report only if the respondents give consent.
- The location for ICA workshops will be a space with adequate air and light. Essential utilities such as drinking water supply, washroom facilities, electricity, etc. will be ensured.
- Participants of the ICA workshops will be provided with monetary compensation, transportation, and food.
- Respondents of KIIs will be provided with transportation facilities.
- No offensive or harmful questions will be asked to the respondents which can offend or hurt them.
- The researchers will be responsible for not making any harmful or offensive comments about the respondents during data collection.
- The data from the household survey will be used anonymously in the report. No name or other personal information will be in the report.
- Female respondents will visit the study area and conduct workshops and KIIs to collect data from female respondents so that the respondents feel comfortable sharing the information.
- The study team will hire a local interpreter to facilitate communication by translating questions and responses accurately to minimize the language barrier. This will help ensure the collected data accurately reflects the respondents' thoughts and opinions.
- Proper COVID-19 protocols (maintaining a safe distance, providing masks, sanitizer, etc.) will be maintained during the data collection process.

ANNEXTURE 3: LIST OF PREVIOUS AND ONGOING INITIATIVES

The summary of previous and ongoing initiatives are here as follows[8]-

Project Name	Project Development Objective	Implementing Agency	Project Period
Resilience, Entrepreneurship, and Livelihood Improvement Project	Improve the poor's and extremely poor's livelihoods, enhance their resilience, and support rural entrepreneurship in project areas.	Social Development Foundation	2021-2026
Additional Financing for and Restructuring of the COVID-19 Emergency Response and Pandemic Preparedness Project	To support the Government of Bangladesh to prevent, detect and respond to the threat posed by COVID-19 and strengthen national systems for public health preparedness	Ministry of Health and Family Welfare	2021
Bangladesh: COVID-19 Emergency Response and Pandemic Preparedness Project	To support the Government of Bangladesh to prevent, detect and respond to the threat posed by COVID-19 and strengthen national systems for public health preparedness	Ministry of Health and Family Welfare	2020-2023
Health and Gender Support Project for Cox's Bazar District	Improve access to and utilization of HNP and GBV response services among the host and the displaced Rohingya population in Cox's Bazar district.	Ministry of Health and Family Welfare, Government of Bangladesh	2020-2023

[8] C3ER conducted the Baseline Survey of the project titled Strengthening Community Resilience to Climate Sensitive Diseases in Bangladesh's City Corporation, funded jointly by BRAC and Climate Bridge Fund (CBF) and implemented by BRAC Health, Nutrition Population Program (HNPP). This table was prepared by C3ER to use in the final report of that project.

Project Name	Project Development Objective	Implementing Agency	Project Period
Additional Financing for Health Sector Support Project	The Project Development Objective (PDO) is to strengthen the health, nutrition, and population (HNP) sector's core management systems and deliver essential HNP services focusing on selected geographical areas.	Ministry of Health and Family Welfare	2018
Health Sector Support Project	The Project Development Objective (PDO) is to strengthen the health, nutrition, and population (HNP) sector's core management systems and deliver essential HNP services focusing on selected geographical areas.	Ministry of Health and Family Welfare	2017-2023
HSDP Additional Finance	To enable the Government of Bangladesh to strengthen health systems and improve health services, particularly for low-income people.	Ministry of Health and Family Welfare	2016
Health Population and Nutrition Sector Development Program (HPNSDP)	To accelerate the progress of the health, population, and nutrition (HPN) sector and address the challenges, the Ministry of Health and Family Welfare (MOHFW), Government of Bangladesh (GOB) has been implementing the Health Population and Nutrition Sector Development Program (HPNSDP) for a period of five years from July 2017 to June 2021. After HPSP (1998-2003) and HNPSP (2003-2011), and HNPSP (2011-2017), the HPNSDP is the fourth sector-wide program for the overall improvement of health, population, and nutrition sub-sectors. The program's priority is to stimulate demand and improve access to and utilization of HPN services to reduce morbidity and mortality, population	Ministry of Health and Family Welfare	1998-2021

Project Name	Project Development Objective	Implementing Agency	Project Period
	growth rate, and nutritional status, especially of women and children.		
Bangladesh - Health Sector Development Program	To enable the Government of Bangladesh to strengthen health systems and improve health services, particularly for low-income people.	Ministry of Health and Family Welfare	
Integrated Nutrition Project	The National Nutrition Project for Bangladesh will be the first of many investments supporting the government's 15-year vision to extend community nutrition services to the country. The national program aims to improve nutritional status to prevent malnutrition from becoming a public health problem. The project consists of two components. The first, the Service Component, comprises two sub-components: Area-based community nutrition services improve behavioral practices in critical areas such as breastfeeding, timely introduction of solid foods, and increased food intake during pregnancy. It also raises awareness and treatment of malnutrition in the primary care health system and provides food security and income-generating activities to the poorest households in the community.	GoB, BRAC	1995-2006

ANNEXTURE 4: PHOTO GALLERY
















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CDI