

**A Survey Assessments of Health and Hygiene Sustainability in the
Cyclone Shelters Situated in Coastal Zone of Bangladesh (Cox's
Bazar Sadar and Maheshkhali)**

By

Sarah Hossain Aka
15346004

A thesis submitted to the Department of Pharmacy in partial fulfillment of the
requirements for the degree of
Bachelors of Pharmacy (Honours)

Department of Pharmacy
Brac University
January, 2020

© 2020, Brac University
All rights reserved.

Declaration

It is hereby declared that

1. The thesis submitted is my own original work while completing degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help.

Student's Full Name & Signature:

Sarah Hossain Aka
15346004

Approval

The thesis titled “A Survey Assessments of Health and Hygiene Sustainability in the Cyclone Shelters Situated in Coastal Zone of Bangladesh (Cox’s Bazar Sadar and Maheshkhali)” submitted by Sarah Hossain Aka (15346004) of Summer, 2015 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelors of Pharmacy (Honours) on 23rd January, 2020.

Examining Committee:

Supervisor:

Imon Rahman
Senior Lecturer, Department of Pharmacy
BRAC University

Program Coordinator:

Dr. Hasina Yasmin
Professor, Department of Pharmacy
BRAC University

Departmental Head:

Dr. Eva Rahman Kabir
Professor and Chairperson, Department of Pharmacy
BRAC University

Ethics Statement

This project does not involve any kind of animal trial.

Abstract

Bangladesh is a country where cyclone affects almost in every year mostly in the coastal zone. During the occurrence of cyclone, people severely suffer on health and hygiene facilities due to poor facilities especially due to the water and health facilities of cyclone shelters served by the governmental and non-governmental sectors. Health determinants include the economic and social atmosphere, the physical environment, and the characteristics and behaviors of the person. This project is based on the survey assessment on health and hygiene facilities in the cyclone shelter of the coastal belt especially Cox's Bazar Sadar and Maheshkhali Upazilla. To maintain a good hygiene, the practice for it is very difficult here due to the lack of sanitary latrine and proper sources of drinking water. As a result, the people taking protection in those shelters are getting affected easily by different diseases. 64.5% of the respondents said that there is no proper source of drinking water in that particular cyclone shelter. Also, diarrhea, dysentery, fever and several skin diseases occur here frequently and harm the people's day to day life during their stay in the cyclone shelters. All of these diseases hamper people's life and cause sufferings in the long run.

Keywords: Cyclone shelter; Water; Hygiene; Health; Diseases

Dedication

“Dedicated to my parents”

Acknowledgement

At first, all the praises to Almighty Allah, Who gave me the opportunity to come this far and made this project happen.

I would like to start by thanking my project supervisor Imon Rahman, Senior Lecturer, Department of Pharmacy, Brac University, without whom, the execution of this project would never be possible. I will be forever grateful to him for his guidance, encouragement, instructions and monitoring throughout my project work. Besides, I would also like to thank Professor Dr. Eva Rahman Kabir, Chairperson, Department of Pharmacy, Brac University, who has always been an inspiration for me.

Moreover, I would like to show my gratitude and respect to my parents, S.M. Abid Hossain and Mrs. Sk. Afroja Baby, who have supported me by every means throughout this project. Last but not least, I convey my love and blessings to all of those who helped me in any respect during the completion of this project.

Table of Contents

Declaration	ii
Approval.....	iii
Ethics Statement.....	iv
Abstract	v
Dedication.....	vi
Acknowledgement	vii
Table of Contents	viii
List of Tables	x
List of Figures.....	xi
List of Acronyms	xii
Chapter 1 Introduction	1
1.1 Cyclone and Bangladesh.....	1
1.2 Frequency of Cyclone in Bangladesh	4
1.3 Cyclone Prone Areas in Bangladesh.....	6
1.4 Health- According to WHO	7
1.5 Water Quality in the Cyclone Shelters.....	7
1.5.1 Condition of Water Quality	9
1.5.2 Standard Water Quality Guidelines	13
1.5.3 Guidelines for Drinking-Water Quality (GDWQ).....	13
1.6 Diseases Associated with the Cyclone Shelter.....	14

1.6.1 Water borne and Food borne Diseases.....	16
1.6.2 Vector borne Diseases.....	17
1.6.3 Diseases Associated with Crowding.....	18
1.6.4 Vaccine Preventable Diseases and Routine Immunization Coverage	20
1.6.5 Other Health Risks.....	21
1.7 Water Supply in the Cyclone shelter of Cox’s Bazar District.....	22
1.8 Public Health Issues during and after a Cyclone.....	23
1.9 Incidents of infectious disease followed by cyclone	24
Chapter 2 Methodology	26
2.1 Research Objective and Goals.....	26
2.2 Research Design	26
2.3 Research Questionnaire.....	26
Chapter 3 Result and Discussion	28
Chapter 4 Recommendations.....	43
Chapter 5 Conclusion.....	45
Chapter 6 Future Work	46
Chapter 7 References	47
Chapter 8 Annex	50

List of Tables

Table 1: Classification of cyclone according to its wind speed, modified from (Ahamed et al., 2012; Rahman, 2008)	3
Table 2: Major cyclones occurred in Bangladesh, modified from (Ahamed et al., 2012).....	5
Table 3 : Name of Upazilla (Project location).....	28
Table 4: Union (Project location)	29
Table 5: Distance of nearby cyclone shelter from your house	31
Table 6: Diseases faced during staying in the shelter	32
Table 7: Source of drinking water in the shelter.....	34
Table 8: Problem of the water in the shelter.....	35
Table 9: Organizations come to check the water quality or not	36
Table 10: Drinking water is supplied by any organization or not	37
Table 11: Rain water collection system in the shelter.....	38
Table 12: Sanitary latrine facility in the shelter.....	39
Table 13: The proper completion of the duty by the school management committee.....	40
Table 14: People's perception or satisfaction level with the facility of the cyclone shelter....	41
Table 15: Water logging and duration of water logging	42

List of Figures

Figure 1: Cyclone prone areas of Bangladesh, adapted from (“FSC Contingency Planning -- Map of Cyclone Prone Areas Food Security Cluster,” 2014).....	6
Figure 2: Condition of water supply	23
Figure 3: Name of Upazilla (Project location)	28
Figure 4: Union (project location)	30
Figure 5: Distance of nearby cyclone shelter from your house	31
Figure 6: Diseases faced during staying in the shelter	33
Figure 7: Source of drinking water in the shelter	34
Figure 8: Problem of the water in the shelter	35
Figure 9: Organizations come to check the water quality or not	36
Figure 10: Drinking water is supplied by any organization or not	37
Figure 11: Rain water collection system in the shelter	38
Figure 12: Sanitary latrine facility in the shelter	39
Figure 13: The proper completion of the duty by the school management committee	40
Figure 14: people's perception or satisfaction level with the facility of the cyclone shelter ...	41
Figure 15: Water logging and duration of water logging	42

List of Acronyms

RAMP	Risk Analysis and Management for Projects
MPCS	Multi-Purpose Cyclone Shelter
NGO	Non-Governmental Organization
DMB	Disaster Management Board
CDMP	Comprehensive Disaster Management Program
GIS	Geographic Information System
GPS	Global Positioning System
CCDB	Christian Commission for Development in Bangladesh
PEDP	Punjab Energy Development Agency
JICA	The Japan International Cooperation Agency
EU	European Union
RWH	Rain Water Harvesting
CRED	Centre for Research on Epidemiology and Disasters

Chapter 1

Introduction

1.1 Cyclone and Bangladesh

Bangladesh being a country with a humid, warm, tropical climate stands as one of the most disaster prone countries of the world. Natural calamities like floods, river bank erosion, cyclones, storm surge, drought, earthquake, salinity intrusion and tsunami occur in this country frequently. Among these, the past few years had been devastated for the country by the massive damages and health issues faced here particularly because of the cyclones and floods caused. The most destructive natural occurrence is tropical cyclone. A tropical cyclone is defined as a non-frontal rainstorm that is identified by a low pressure centre, spiral rain bands and strong winds. Global warming can manipulate the utmost potentiality of tropical cyclones by changing the exterior power flux and higher level freezing exhaust has reported that there is an association between hurricane commotion and sea surface heat. About 10% of the tropical cyclones of the world forms in the Indian Ocean and its immediate surrounding zone lie within the Bay of Bengal and the direct hit is taken by Bangladesh.

Cyclone is a weather system, where a massive amount of wind spiraling with low atmospheric pressured center and rotates clockwise in the Southern Hemisphere and anti-clockwise in the Northern Hemisphere. Generally, cyclone is accompanied by violent storms and intense weather conditions. Cyclones initiate over the sea and move about 300 to 500 km a day, drawing heat energy from the sea waters (Arya, n.d.). According to Skymet Weather Team, the diameter of a cyclone differs from 150 to 1000 kilometers but their effects rule over thousands of square kilometers of the ocean surface (Skymet Weather Team, 2017). A matured cyclone consists of a central region of light winds known as its "Eye". The eye has an average diameter of about 20 to 30 km, but it can be 40 to 50 km for large cyclones (Arya,

n.d.). In Asia, especially in the western pacific, cyclones are known as “typhoon”. In the West, especially in the Atlantic and America, the symptoms of severe weather are called “hurricanes”, while in the Indian Ocean these are called “cyclones”. Name may be different, but they grow with the same sign, for example when sea temperatures increased to at least 27 degrees Celsius to a depth of 80 meters (Rahmadhy, 2012). Warm ocean that should be combined with a mass of air in the upper atmospheric layers of cool to be able to move the moisture from the sea became a source of energy for a tornado of wind (Rahmadhy, 2012).

There are various sorts of twisters incorporate tropical tornados, extra tropical violent winds and tornadoes. A tropical violent wind is a turning low-pressure climate framework that has controlled rainstorms yet no veneers. They structure over warm sea waters. Extra tropical violent winds are low-pressure frameworks that structure outside of the tropics in light of a ceaseless flimsiness of the westerly breezes. As this unsteadiness relies upon huge even temperature contrasts, concentrated areas of temperature change known as veneers portrayed extra tropical violent winds. A tornado is a quickly turning segment of air spreading descending from a rainstorm to the ground. The most rough tornadoes are fit for gigantic measure of annihilation with wind paces of up to 300 mph. Twister can likewise be ordered by the breeze speed (Ahamed, Rahman, & Faisal, 2012).

Twister have numerous eventual outcomes like-agrarian land is seriously influenced, particularly as far as water supply and soil disintegration, makes hurt human, plant and creature life, correspondence frameworks are gravely influenced, waterfront organizations like shipyards and oil wells are wrecked harshly (Reena, n.d.). As per the Emergency Event Database (EM-DAT) of the Center for Research on Epidemiology and Disasters (CRED), Bangladesh endured 145,871 human passings, 40.5 million influenced individuals, 1.7 million vagrants and a financial loss of US\$ 5.12 billion because of tropical tornados, since the 1990.

Table 1: Classification of cyclone according to its wind speed, modified from (Ahamed et al., 2012; Rahman, 2008)

Cyclone intensity	Range of maximum sustained wind speed (Km/hr)
Depression	44 to <52
Deep depression	52 to <63
Cyclonic storm	63 to <89
Severe cyclonic storm	89 to <119
Severe Cyclonic storm of Hurricane intensity	119 and above

Table 1 shows the classification of cyclone according to its wind speed.

Number of cyclones struck the world in different regions and made serious devastating impact on mankind. The 1970 Bhola Cyclone was the most hideous one. It struck the coastal area of East Pakistan and India's West Bengal on November 3rd, 1970 and took away at least 500,000 lives. The storm surge devastated many of the offshore islands, smearing out villages and abolishing crops throughout the region. Near about 3.6 million people were directly affected by the cyclone, and the total damage from the storm was approximately \$86.4 million according to 1970 USD (as per 2009 USD, it is \$490 million). In terms of agricultural damage, it was similarly severe with the loss of \$63 million worth of crops and 280,000 cattle (Hossain, 2018).

Cyclone is a natural phenomenon. No one can stop it, rather people in the coastal area can take some preventive measures like going to cyclone shelters, saving foods etc. to reduce the

losses in the procedure like saving human and animal life with the help of respective weather department (Hossain, 2018).

1.2 Frequency of Cyclone in Bangladesh

Bangladesh is one of the countries which are more prone and more vulnerable to natural calamities. According to Dasgupta, cyclone is a very common phenomenon in Bangladesh as it is a global hotspot for tropical cyclone, especially in the coastal areas due to the rise of sea level (Dasgupta et al., 2011). Bangladesh is a densely populated country with a population of 143 million and a population density of 1200 persons per square kilometers. These huge populations along with the other risk factors make Bangladesh the most vulnerable country in terms of cyclone (Karim & Mimura, 2008).

Cyclones occurred in the years 1970, 1991, 2007 and 2009 are noteworthy mentioned because of the huge destruction caused (Mahmood, Dhakal, & Keast, 2014). According to Food and Agriculture Organization of the United Nations, Bangladesh has been formed within the greatest deltaic plain the GBM Basin at the intersection of Ganges, Brahmaputra and Meghna rivers along with their tributaries. About 7% of the total area of the basin is located within the country which makes the low-lying coastal areas are vulnerable. This in result places a large number of population, infrastructure, agriculture, livestock and economic development at high stake of destruction by natural calamity like cyclone. The zone contains many distinctive development opportunities which are shortened by very high concentration of natural and human induced hazards with a 35 million people, representing 29% of the population living in the coastal zone in questionable situation. The population pressure in the coastal region made the human settlement areas mostly developed in an unorganized and isolated manner. The situation of there tends for community efforts such as cyclone shelters to cope with disasters.

The country's geographical location along with its low altitude and tropical monsoon climate make it one of the most disaster prone countries in the world. Bangladesh's coastal areas are mostly suffered when any cyclone arises in the Bay of Bengal. Since the last 100 years, almost 508 cyclones have formed from the Bay of Bengal and among them 17 percent have hit Bangladesh (Ahamed et al., 2012). Furthermore, every three years an acute tropical cyclone hits our country on an average. Almost every year, a large amount of damages occurred by several disasters including cyclone in Bangladesh. The damages include the life of people, cattle and also the financial damage. Recent studies have shown that people who are living in the coastal areas are mostly poor and they are affected by the natural disasters such as- cyclone most. During the last 100 years, 53 major cyclones hit our country which has a large impact on the life of those poor people (Haider & Ahmed, 2014). For instance, cyclone Sidr which occurred in November, 2007 affected the livelihood of 8.9 million people and the loss was around US\$1.67 billion (Dasgupta et al., 2011).

Table 2: Major cyclones occurred in Bangladesh, modified from (Ahamed et al., 2012)

Occurrence year	Number of death people
1970	500000
1971	11000
1983	1043
1985	11069
1988	5708
1991	145000
2007	3406
2009	150
2017	18

Table 2 presents the major cyclones which hit our country along with the number of death people caused by those cyclones.

1.3 Cyclone Prone Areas in Bangladesh

Bangladesh’s coastal districts are usually the most prone to the cyclone during the pre-monsoon and post-monsoon period. The duration of pre-monsoon is April to May and the duration of post-monsoon is October to November. In total 30 coastal districts, in which almost 36 million people are live in, are in a high risk of affecting by the cyclone and storm surges. Cox’s Bazar, Maheshkhali, Saint Martin’s island, Mongla, Bagerhat, Patuakhali, Khulna, Sathkhira, Bhola, Feni, Kutubdia, Ramu, Barguna, Barisal, Chandpur, Jhalokathi, Shariatpur, Pirojpur, Lakshmipur, Noakhali, Chittagong etc. are some of the areas which are affected during the cyclone most. (Mahmood et al., 2014; S. K. Paul, 2011). Figure 1 shows the cyclone prone areas of Bangladesh accordance to their risk issue.

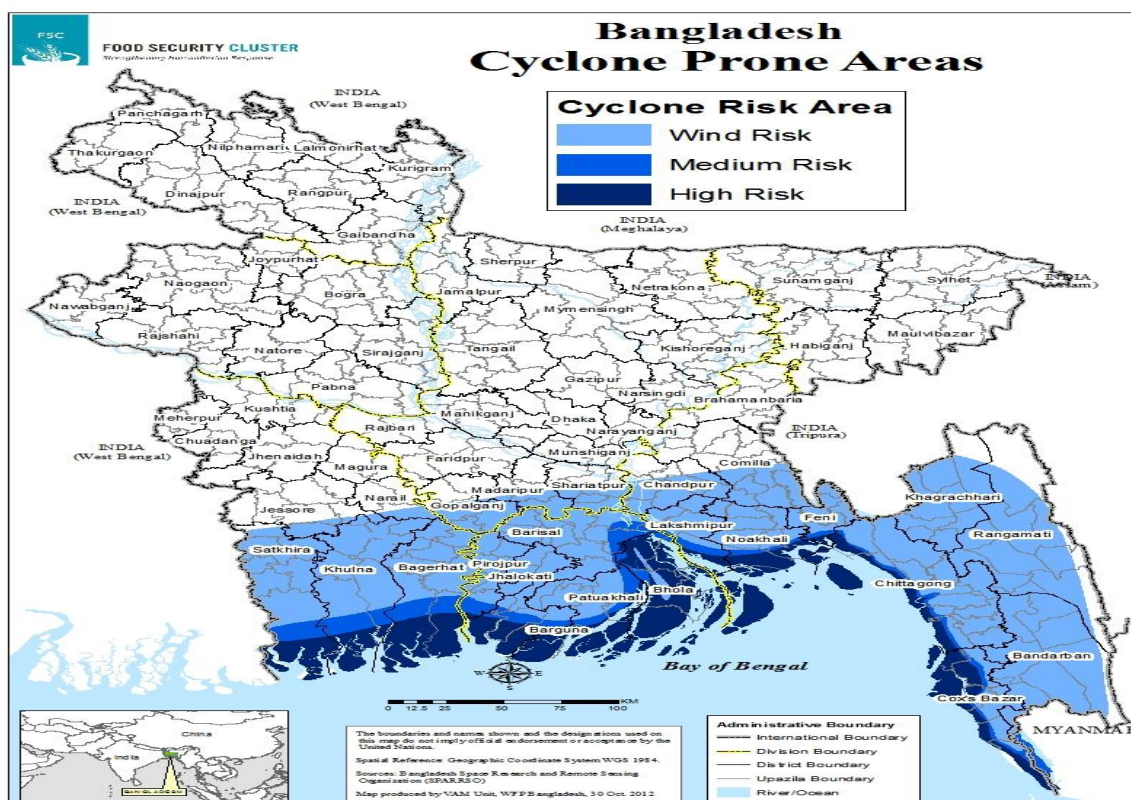


Figure 1: Cyclone prone areas of Bangladesh, adapted from (“FSC Contingency Planning -- Map of Cyclone Prone Areas | Food Security Cluster,” 2014)

1.4 Health- According to WHO

Several factors interact to affect people's and societies' health. It depends on the circumstances and climate of people who are healthy or not. In large proportion, variables such as our climate, ethnicity, income and education and relationships with family and friends all have significant health effects, while the most widely known causes, including access and use of health services, often have fewer implications. Health determinants include the economic and social atmosphere, the physical environment, and the characteristics and behaviors of the person (“WHO | The determinants of health,” 2010). World Health Organization (WHO), in 1948, defined Health as being “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity”. WHO also said in 1986 that “health is a resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities.” Moreover, sanitary practices are used to keep the body clean to prevent infection and disease and to prevent contact with viruses and bacteria. The aseptic technique includes bathing, cleaning and brushing teeth, washing the hands, cleaning food before eating, cleaning utensils and floors for preparing food before and after meals and many more. This can help avoid disease and contamination. When the body is cleaned, dead cells with germ are washed away and their chances of entering the body are decreased (“WHO | The determinants of health,” 2010).

1.5 Water Quality in the Cyclone Shelters

According to a study conducted by Akm Saiful Islam, some cyclone shelter was targeted to be observed for case study purpose. One cyclone center was located in village Kanai Nagar, Mongla. The local road in the vicinity of the shelter was not cemented and could pose a severe obstruction to admittance to the shelter during the rainy period. Widths of access streets close to the asylum were roughly 5m. Savoring water the twister focus was provided

from a capacity tank gathering water during the storm season, which is a variation of the since quite a while ago settled water collecting course of action. The nature of drinking water was not affirmed; however the general wellbeing of the individuals was acceptable. Inferable from insufficient downpour and capacity of water accessible in the neighborhood tank, individuals had put away drinking water that was gathered from a close by lake. Clearly this water was adequate to individuals for drinking. The sanctuary had its very own sanitation arrangement. There were two toilets in activity. The stockpile of water to the lavatory was given from the neighborhood tube well (Islam, Bala, Hussain, Hossain, & Rahman, 2011).

The twister focus was situated in town Maddha Kadamtola, Shoronkhola, Bagerhat. This asylum had its own hand tube-all around introduced to supply fresh drinking water. There were two sterile restrooms in the shelter in spite of the fact that their condition was not spotless. Flagging frameworks didn't fulfill needs during the catastrophe. Improvement of the sign framework is likewise required by nearby individuals (Akm Saiful Islam, 2007).

Tropical violent winds, joined by storm floods and winds, clears away a large portion of the meagerly manufactured houses in the country beach front territory; in this way individuals take asylum in solid tornado covers. These asylums contributed, all things considered, to diminish the losses of life in past crushing violent winds. The striking highlights of these violent wind covers are that they are multistoried structures built on a column cellar. The primary floor is kept open to permit rising water to stream unreservedly, and individuals take cover on the remainder of the floors. Presently a considerable lot of these asylums are additionally being utilized as schools, particularly the ones with various rooms (B. K. Paul & Rashid, 2017).

Typhoons are a typical kind of dry residue gatherer utilized in coal-taking care of and readiness plants. They are now and then utilized as a pre separator for detachment of coarser

residue from the air stream so as to decrease the heap on the auxiliary residue authorities (Bimal Kanti Paul, 2017).

According to a study (Perumal Santhanam, 2015), metals were dissected in water. Fe concentration was seen progressively high because of waterway inflow which may have conveyed metal contamination from the catchment territories during the inspecting time. In any case, after Thane tornado (December-2011), the influenced territory have recorded high metal fixation (aside from copper) contrasted with Minisal (Non-affected territory). After January, the substantial metal fixation was found to diminish in the twister influenced zone which did not demonstrate any noteworthy variety ($P > 0.05$). This might be on the grounds that of weakening of stream water. But zinc, every single other metal (Cu, Fe, Pb and Cd) were recorded high in three stations (Thane hited zones) than non-influenced region (Mimisal) (Chinnaraja, Santhanam, & Dinesh Kumar, 2015).

Deterioration of the natural issue remains is found to discharge substantial metals back to residue; and this procedure may be liable for the solid relationship of Zn and Cu with natural carbon. Additionally, the variety in the metal concentration is because of the effect of catastrophic events that caused huge scale seawater immersion and the subsiding tsunamis conveyed into the ocean, flotsam and jetsam, anthropogenic squanders, adjoining earthly parts counting plastic materials and local removals from the close to lands (Perumal Santhanam, 2015).

1.5.1 Condition of Water Quality

In Bangladesh, it is seen that 96% of the individuals are utilizing tube-well water for drinking purposes. However, because of the utilization of dangerous hotspots for individual reasons, the death rate is expanding step by step alongside causing social changes in looking after sanitation. The beach front territories of Bangladesh considered as saline zone where drinking

water supply is troublesome contrasted with different pieces of the nation because of the complex hydro topographical circumstance.

Because of constant assaults of violent winds and tidal floods, water and cleanliness offices are broken; tube wells are fundamentally harmed and transforms into unusable substance because of submergence; lakes and other water sources all are dirtied by the flood of saltiness of the water. These repayments of sanitation offices and frameworks are in this way prompting genuine calamity of savoring water the beach front territories of Bangladesh. Thus, event of waterborne sicknesses takes an appalling condition. These are skin infections, loose bowels, fever, looseness of the bowels, and so on. These ailments can be spread while swimming, washing, devouring water, or by eating nourishment those are presented to defiled water.

Alongside loose bowels and queasiness being the most normally uncovered indications of waterborne sickness, different side effects can incorporate respiratory issues, skin aggravation or ear diseases just as eye issues. In addition, tornado Aila has been recorded to hit the southwestern shore of Bangladesh on 25 May, 2009. The individuals of influenced zones needed to experience the greatest amount of sufferings from drinking water shortage and demolition of sanitation offices. Be that as it may, the unfortunate casualties are as yet enduring because of the absence of uncontaminated drinking water. Aila frustrated all the rest of the drinking water sources. During Aila, raised tidal floods contaminated all immaculate water sources with debased and unhygienic saline water. Many individuals are obliged to expend the defiled water for not having the option to contact get unadulterated and safe water and subsequently, they experience the ill effects of different ailments like sensitivity, skin ailment, cholera and looseness of the bowels as referenced before. This significantly hampers the soundness of mass individuals and furthermore adds to their distorted emotional wellness condition

bringing about incessant sicknesses and menstrual medical issues. In the influenced zones, safe water supply has now become an extraordinary test.

Disaster inclined waterfront zones are perpetually in danger for the individuals for polluted water, sanitation issues and wellbeing perspective. In 2009, tornado Aila broke a large portion of the water sources causing different infections in Dacopeupazila. The exploration has been directed to survey the present water quality with pertinent wellbeing risk in the network after very nearly one year of violent wind Aila. Sanitation condition, safe water supply revealing; cleanliness and wellbeing condition; and neighborhood prerequisites for the development of water supply and sanitation condition ought to involve worry as indicated by the investigation.

From an ongoing report, it is recorded that in Maheshkhali, overwhelming precipitation, extending from 119 to 159 millimeters, has caused water signing in Matarbari association of Maheshkhali Upazila in Cox's Bazar (Bangladesh Meteorological Department, 2018). 22 out of 31 towns, are seen as waterlogged and overflowed which influenced an expected 10,000 to 15,000 residents (Government D-Form, 2018).

The uncovering of two coal power plants, have been hindering each of the 10 conduit entryways and normal seepage frameworks in Matarbari association, which has additionally exacerbated the circumstance. Local people have expelled a piece of the bank for the water to start retreating. Nonetheless, nearby specialists of the force plant venture, and a couple of shrimp culture proprietors hindered the bank once more, making the water stay dormant.

Lavatories have been submerged, causing a surge of defecation into dormant water. 700 lavatories have been completely crushed, and 400 somewhat annihilated (Government D-Form, 2018). Moreover, tube-wells and water reservation frameworks are additionally immersed; 200 cylinder wells have been completely harmed, and 400 being in part harmed.

Subsequently, the Matarbari association is experiencing dirtied shower water and dangerous drinking water, in danger of waterborne malady flare-up.

Influenced individuals are accounted for to be experiencing waterborne sicknesses, for example, looseness of the bowels, skin ailment and stomach cramp. Three people group centers, one facility, and the main medical clinic in Matarbari have been mostly influenced by the waterlogging (Government D-Form, 2018).

As indicated by the general public, there have been five occurrences of death by suffocating, of which all were kids. Also, there have been two passing of new-conceived babies, because of the deficiency of treatment during conveyance, as the dormant water upset versatility which is undoubtedly a heartbreaking circumstance. Considering the asylum condition, 71.7% of the lodging on the island is kacha, which are especially defenseless to extraordinary precipitation and flooding (Population Census, 2011). They are profoundly defenseless to risk whenever over-burden with water for a considerable length of time. As per the Government D-Form, 300 kacha houses have been completely flawed, and 400 houses were found in part harmed. In addition, around 100 semi-paka and 200 paka houses have been totally crushed, alongside 200 semi-paka and 50 paka houses being to some degree broken. In any case, around 300 families are moved and gave vital security and haven in violent wind shields on the island.

Ocean level rising is the most imperative danger to the areas confronting atmosphere change. Collective wellbeing outcomes related with smothering violent winds incorporate tempest related passing, twisted, transferable sicknesses, psychosomatic impacts, uprooting and vagrancy, breakage to human services foundation, interruption of general wellbeing administrations, change of biological systems, social disengagement, loss of occupations and vocations and monetary emergency (Kabir, 2014).

1.5.2 Standard Water Quality Guidelines

World Health Organization (WHO) makes guidelines and the key function of it is to make patients benefitted. The WHO guidelines were introduced to protect our public health and are to be used as the base for the development of national standards.

On the other hand, Chemicals and by-products or wastes, from various industrial sources also reach the drinking-water as they are not properly thrown via a proper waste control plant. Many of the times these chemicals are produced within small industrial units which are situated near the human housing areas, and thus a number of chemicals can reach water as a consequence of disposal of general household chemicals. Many of the inorganic particles may also get mixed with the surface water because of the natural contamination (Sayato, 1989).

This approach is briefly mentioned below; its available factors are:

- Drinking Water Quality
- Waste Water Reuse
- Recreational Water

1.5.3 Guidelines for Drinking-Water Quality (GDWQ)

In the year 1958, WHO for the first time published the “WHO Guidelines for Drinking-Water Quality (GDWQ)”. It was the first environmental health document published as International Standards for Drinking-Water. Then, in the mid-1980s the first edition of the WHO guidelines for Drinking-Water Quality was published in 3 parts:

Volume 1: Recommendations

Volume 2: Health criteria and other supporting information

Besides, the chemical, physical and microbiological aspects of water quality, microbiological contaminations are also being importantly studied and guidelines are being formed. Critical reviews are done based on the chemical or physical or radiological contaminants on the water before using it. For many of the chemicals, the risk assessment results in the derivation of a dose below which adverse effects do not occur and is the basis for a Tolerable Daily Intake (TDI).

1.6 Diseases Associated with Cyclone Shelter

Any kind of natural calamity has numerous effects and various outcomes on the overall population of the certain place. Direct health effects due to various vectors and waterborne diseases are observed along with many indirect effects after the cyclone or within the cyclone shelters. The health issues were concerned with physical, social and psychological wellbeing of the overall combined people. A number of emerging diseases which can be of great threat for the near future like HIV/AIDS, Ebola, Lyme disease, Legionnaires` disease, toxic Escherichia coli, a new hantavirus, a new strain of cholera and a rash of rapidly evolving antibiotic resistant organisms are being persistent in the last few years of the cyclone shelter. Along with these resurgence and redistribution of many old diseases which are becoming rare around the globe is happening, for instance, malaria and dengue fever (Kabir, The impacts of cyclones Sidr and Aila on the health of the coastal people, 2014).

The environment of a place plays as the key of maintaining the health of the mass people and the environmental factors such as water, soil and air pollution, poor housing conditions, presence of animal reservoirs and insect vectors of disease accelerates the condition (Chowdhury et al., 2015). Disease outbreaks might occur here due to disrupted Water and Sanitation System in the affected areas. Moreover, extreme weather conditions such as storms

or tidal waves also pollute the coastal waters increasing the risk of gastroenteritis and other water-associated infectious diseases. The contamination of drinking water is another problem which raises health issues in the coastal shelter regions (Mallick, 2014).

Drinking water shortage and destruction of sanitation facilities made the people of these areas to suffer where they already are vulnerable to outbreaks of infectious, water borne and other types of diseases. Thus, diseases like diarrhea, dysentery, dengue, asthma and skin diseases are also increasing in the coastal region. The frequent changes in temperature and rainfall also affect the distribution of disease vectors, for instance, the malaria, dengue and diarrhea cases. The in total environment stands as problematic and challenging in the coastal area of Bangladesh, where children and women face many problems regarding their health status. Due to lack of proper health facilities, they are not capable to cope with the frequently changing environment which is worsening their health condition day by day (Razzak Moral, Hamidul Bari, Abdul Jabbar, Tariqul Islam, & Hasibul Hasan, 2019).

Safe water and sanitation provides enhancement of the standard of life through upgrading physical conditions of the mass people which is not being possible in the over populated cyclone shelters of the south coastal regions of Bangladesh.

Jaundice and encephalitis: Relief workers should understand that Bangladesh contains endemic infections with possible extended periods of brooding, for example, instinctive leishmaniasis. These can happen late when emergent situation times have gone by and when domestic and general relief workers are repatriated. Hazard factors for expanded transmission of transmittable sicknesses are probably going to investigate floodwaters by which wounds may come about because of being cleared by floodwaters through fallen structures and trash, and furthermore removal of dangers or by uprightness of close suffocating at which the survivors may have complexities, for example, goal pneumonia. In the event that there's any

postponement in showing for care and providing constrained access by talented work force to the influenced regions, the administration everything being equal and wounds may get confounded. In any case, dismalness and mortality from lockjaw can likewise be expanded if there's lacking immunization inclusion.

1.6.1 Water borne and Food borne Diseases

The threat for the Bangladeshi populous harmed by the cyclone is instant due to waterborne and foodborne diseases, probable- cholera, typhoid, Shigella, dysentery, etc. In dysenteriae serotype 1 isolations of Bangladesh, there is growing evidence of actual antimicrobial resistance, along with multidrug resistance.

Cholera: The disease is prevalent in Bangladesh and before the cyclone outbreak was identified; around 800-1000 reports were documented every day in the ICDDR hospital in Dhaka. Public water sources may become unsafe for consuming for several considerations: flood invasion; fecal defilement caused by bathroom flooding, lack of sanitation and river pollution by related water sources.

Hepatitis A+E: In Bangladesh, basic hepatitis levels are more, but the epidemic will worsen them.

Leptospirosis: It is familiar to occur in Bangladesh as a bacterial zoonosis. In specific during excessive rain and flooding, it spreads globally as an international threat. Disorders in individuals can occur in a subtle way when the microbes are introduced to the epidermis or mucous membranes, with contamination of soil or plants with the urine of infecting or contaminated water, swimming in flooding or accidental drinking. Immediate infection may occur by ingestion or consumption of water and foods defiled by the urine of infected animals. In general, infections occur in people who deal with water.

1.6.2 Diseases Spread by Vector

Malaria: There is a danger in Bangladesh throughout the rainstorm. Thirteen out of sixty-four legal local people are susceptible to areas of severe malaria. The areas which are just beside the zones of India and Myanmar constitute 98 percent of all Malaria cases to be specific. In the majority, the consequence of Plasmodium falciparum is 75% from these regions. In the 13 pandemic arched regions, focal scenes occur each year. In 2005, 37,679 P. falciparum and 10,442 P. vivax occurrences, including 501 dead, were reported by 13 districts (World Health Organization, 2007). The situation of gastrointestinal illnesses is significantly underdeclared since the standard records are not associated with data from organizations, NGOs, private medical facilities, and specialist associations. As a first-line treatment for verified, straightforward P. falciparum cases, Artemisinin based mixed treatment as artemether lumefantrine has been taken by the country in 2004. Unconfirmed, uncommon incidents are treated with a combination of chloroquine, irrespective of primaquine and accurate cases with quinine (whether confirmed or not). In the territory, P. vivax was also shown to have decreased affectability to chloroquine. Standard agents fuse Anopheles dirus, philippinensis, minimus, all of them are vulnerable to malathion as well as pyrethroids (World Health Organization, 2007).

Dengue Fever/Dengue Hemorrhagic Fever: Dengue incidents were confirmed in 2003 by 8 of 11 South-East Asian countries; in 2006 by 10 of 11 countries. The CFR remained in Bangladesh at least < 1 percent up to 2006 and in 2005 detailed 100 000 incidents. Under current circumstances, healthcare agencies and staff members will meet increased numbers of patients with wounds and injuries, it will become difficult to differentiate between Dengue's early adverse effects and to treat those who promote to DHF. All generation groups can be influenced by DHF. In particular, fresh water is gathered up in exposed water containers and precipitations in other fabricators, causing mosquito vectors to increase. The possibility

of transport may be increased by persons living in lack of safe homes and crowded environments (World Health Organization, 2007).

Japanese encephalitis: It occurs in Southeast Asia, spread by Culex mosquito, which rises in particular in paddy fields overflowed and that can affect all generations. Infection circles in Ardeidae winged animals. Pigs are hosts developing. Culicines are ordinarily zoophilic yet disease overflows into human populaces in relationship with touchy increments of mosquito populaces which happen during flooding.

Leishmaniasis: In Bangladesh, this is prevalent and occurs continuously in 175/100. This is produced by protozoa that is propagated from the snack of a sullied sand fly and can be seen after several weeks to months in cutaneous and intuitive structures. Alleviation laborers should observe the potential length of brooding as indications may show once they have back (World Health Organization, 2007).

Filariasis: This is a mosquito-borne parasite that causes the arms, genitourinary organs, breasts, etc., to swell. It is found mainly in 23 areas of Bangladesh, which is mostly flanked by India. Around 20 million individuals are now contaminated, a large portion of whom are weakened (World Health Organization, 2007).

1.6.3 Diseases Associated with Crowding

The population dissolution caused by cyclone damage can lead to packaging in relocation areas, thereby increasing the risk that certain passable diseases will be transmitted. Measles, ARI, diphtheria and pertussis are passed from person to person, and, under conditions of constrained movement of people in shared areas that regularly lack a safe home, the risk is increased. The risk of meningitis, aquatic and vector-borne diseases transmitted can also be increased by crowding.

Tuberculosis (TB): The overall general medical issue here is important: Bangladesh is in the third in 22 Tuberculosis-strands, which account for 80% of the world's tuberculosis cases. In 2005, there were 322,000 cases of new tuberculosis, with 227 cases for every 100,000 inhabitants per annum. In 2005, 66,423 people were estimated to have been kicked off by TB; the mortality rate was 47 per 100,000 population each year. (World Health Organization, 2007).

The technique for managing TB termed DOTS (Directly Observed Therapy) was and has prevailed in Bangladesh. The method is now universally regulated. DOTS administrations are provided by the National TB Program (NTP) system and are accessible in the significant majority of wellness offices in the Well-being Service.

Nevertheless, the rate has increased steadily from 17% in 1995, and remains below the 70% world-wide mark. The rate of treatment accomplishment increased from 71% in 1995 to 90% in 2004 (the global target for the treatment success is 85%). Multi-drug-safe TB prevalence has not been fully assessed. There is no complete knowledge of the prevalence of HIV contamination in TB patients (World Health Organization, 2007).

In the intense period of this crisis, one of the primary issues is the interference of hostile to TB treatment arrangement. It is, therefore, difficult to ensure that these patients are guaranteed continued access to therapy during the time of severe crisis. Seeing that the NTP agreement is working, it is necessary for the NTP administrations to build a strong combined effort. Once the disaster and fundamental human resources have been recovered, various parts of the TB protection can be issued.

Plague: This was not recorded in Bangladesh and regions of Myanmar and India where the disease is widespread.

1.6.4 Routine Immunization and Treatable Vaccinations

As of now, the event of measles in Bangladesh was apparently small, as it was successful around the world to combat a lost time inoculation struggle for 9 months to 10-year-old children in 2006, and a strong regular vaccination program. Any measles case was not reported in 2007 by Bangladesh. Inclusion in immunize could be lacking, especially among those who were conceived after the crusade, to prevent transfer among populations of tornado influenced territories. By correlation numerous rubella flare-ups have been recognized (World Health Organization, 2007).

Tetanus has a high case- casualty pace of 70–100% and is internationally under-detailed. The hatching time frame is generally 321 days. Bangladesh is one of the high hazard nations. In these conditions wounds and wounds ought to be seen with a high file of doubt. *Clostridium tetani* spores, present in the dirt, contaminate unimportant, unnoticed injuries, slashes and consumes (World Health Organization, 2007).

Proper administration of harmed survivors ought to be actualized at the earliest opportunity to limit future incapacity and to turn away avoidable passing after debacles. It was seen in Aceh, that a shorter brooding period is related with extreme infection and a more terrible visualization. Health-care workers operating in disaster settings should be alerted by the occurrence of cases of dysphagia and trismus, often the first symptoms of the disease. Maternal and neonatal tetanus, and its manifestations, is of specific worry, as just 13% of mothers are gone to by social insurance staff at conveyance. Polio isn't at present endemic in Bangladesh. Be that as it may, an infection importation from northern India in 2006 prompted a flare-up (18 cases) which is currently viewed as controlled after a few immunizations adjust. If populations are damaged across national borders because of the cyclone and flood, there is a risk that new wild polio infections will be imported after long periods of time, which may not be detected if the reconnaissance structure is compromised.

1.6.5 Other Health Risks

Chronic disease: The involvement with regular stock prescription may occur to patients with incessant illness.

Infection with the skin: Contaminations happen because of swarming as well as in view of an absence of water and hence diminished cleanliness. These are known as 'water-washed' maladies and incorporate incidental diarrheas, skin/wound contaminations and invasions (for example- scabies)

Sexually transmitted infections (STIs) including human immunodeficiency infection (HIV): At the point when a crisis creates, individuals might be exposed to circumstances that considerably increment their introduction. Hazard factors incorporate monstrous dislodging of individuals from their homes; ladies and youngsters left to fight for themselves; pervasiveness of abusive behavior at home; social administrations overpowered or crushed; and an absence of intends to forestall HIV contamination, for example, clean needles, safe blood transfusions and accessibility of condoms. The general predominance in the populace is evaluated to be 0.1%, with 11 000 individuals (of whom 1400 are ladies) living with the infection. Bangladesh has a concentrated HIV scourge, primarily influencing business sex laborers, their customers and infusing drugs clients. The crisis reaction ought to guarantee a base bundle of HIV counteraction, treatment and care administrations, including the reinforcing of standard insurances, with the arrangement of gloves, sterile needles and syringes and safe waste removal the board in wellbeing administrations. Extra administrations ought to incorporate arrangement of condoms, training and counteraction messages, and post-presentation prophylaxis for word related introduction and for overcomers of assault. Needle and syringes trade projects ought to be kept up. Endeavors ought to be made to guarantee that HIV/Helps patients getting Workmanship don't have their

treatment hindered and to give Craftsmanship to avoidance of pregnancy related HIV transmission (World Health Organization, 2007).

Environmental risks: These may exist from harmed mechanical offices (synthetic, radiological) and drinking-water polluted with arsenic has been recently archived. HCWs should remember that patients' side effects might be steady with such causes.

Avian flu (A/H5N1): It has reappeared in Bangladesh with reports from poultry ranches during 2007. No human cases have been accounted for.

1.7 Water Supply in the Cyclone shelter of Cox's Bazar District

The majority of the multi-purpose cyclone shelter relies on tube wells for water supply, the percentage of this type of MPCSSs is 72% and very little reliance on the installation of rainwater harvesting systems which is around 2%. The majority of 22% had no secure source of water in the shelter. Water is available in certain areas (tube well), but the level of water during the dry season is considerably lower and it is difficult to obtain water from those sources. The school students have to suffer during the school time because of the lack of water. High iron content has been found in some water supplies in specific areas. High iron concentration was observed more particularly in Maheshkhali (Street, Adamson, Yo, & Hoy, 2019). The metal taste was present in the water of these areas. When people drink the water, the taste becomes strong with the increases in the concentration of the iron. Initially, the water collected from the sample areas looked fine but after several hours it becomes brown and colorless, which also suggests that iron was present. The local hotels in that area had yellowish marks on their water glasses and jugs indicating the existence of iron in water. There was no red label in the tube wells indicating the existence of arsenic (Street et al., 2019).



Figure 2: Condition of water supply

1.8 Public Health Issues during and after a Cyclone

The effects of tropical cyclones on public health include death, trauma and contagious diseases. After the major tropical cyclones, general-health professionals perform fast medical assessments, usually recording massive destruction, homelessness, and relocation, significant infrastructure damage, power loss, deprivation of access to medicine and nutrition. Moreover, the impact on the human health of tropical cyclones is fatalities from hurricanes, damage to health, the spread of diseases, social disturbances, job losses and livelihoods, and economic crisis, as well as psycho-social impacts, displacement, and deprivation, damages in the public health infrastructure, ecosystem change. An epidemiological study focuses on researching storm related death. Health issues due to the storm, such as trauma, respiratory and intestinal diseases, dermal diseases, animal stings, and insect bites are also studied by researchers. Health issues due to the storm, such as trauma, respiratory and intestinal diseases, dermal diseases, animal stings, and insect bites are also studied by the researchers. Effective epidemiological monitoring is undertaken to prevent the spread of disease and to track injury rates. Surveillance of mortality rates, including reports in hospitals, typically has an initial

peak in storm-related injuries. Frequent outbreaks of infectious diseases can also be seen. Raises in communicable diseases including those with extended maturation (hepatitis, tuberculosis) and those distinguished by subsequent development due to slow vector growth need to be identified both rapidly and continuously. The epidemiological study may include the diagnosis of infections, solid waste disposal, water supply disinfecting, carrying out mosquito monitoring, detecting environmental risks, and immunizing patients under the relevant public health initiatives. Hygiene preparation for homeless refugees, reactivation of public health surveillance programs, the reconstruction of the health system and removal of unsanitary conditions are important to prevent an increased number of contagious diseases. The existence of high densities of poor housing areas in low-lying regions enhances the threats in countries like Bangladesh and the Philippines, which are still at danger from tropical cyclones for the immediate cause of death (Shultz, Russell, & Espinel, 2005).

Water is usually salty in nature in the coastal areas. The plans for water conservation must, therefore, be maintained so that pure drinking water is available in the cyclone shelters. Separate toilets for the pregnant, there must be separate rooms for women. Besides, during a disaster period, the issues of light, safe water, proper food, toilets and sanitation at cyclone shelter need to keep in consideration for vulnerable communities (MoDMR, 2012).

1.9 Incidents of infectious disease followed by cyclone

Circumstances which increase the chance of contagious diseases after the cyclone include deterioration to sanitation and healthcare services, disruption to water and sewage networks, differences in density of population (especially in overcrowd shelters), migration and relocation of people, expanded ecological exposure as a result of dwelling destruction and biological changes. Infectious disease incidents after tropical cyclones in developed nations are uncommon but in developing countries are much more frequent. After cyclone

monitoring of infectious diseases, changes in self-limited digestive and respiratory disorders have rarely been reported in developed countries, but more generally no rise in contagious disease. On the other hand, while some surveys in developing countries indicate a little rise in the incidence of infectious diseases arising from tropical cyclones, epidemiology outbreaks were recorded in other cases. Examples include balantidiasis outbreaks on the Pacific island of Truk after the 1971 typhoon. Also, typhoid fever after the 1980 cyclone in Mauritius and severe respiratory infections in Puerto Rico after the 1989 hurricane. There have been both rises in severe respiratory and self-limiting illnesses, after Storm Georges in 1998, in the Dominican Republic. In addition to leptospirosis infections in Nicaragua with gastrointestinal diseases in Honduras, a significant increase in cholera was recorded in Guatemala, Nicaragua, and Belize following Hurricane Mitch in 1998. Factors particular to developing countries that have a higher probability of epidemic growth include increased disease rates, weak immunization rates, inadequate access to safe drinking water, poor health care, excessive shelter crowding, and malnutrition. For developing nations, extended disruption of the daily services of public health is more likely and leads to a rise in the illnesses. In Bangladesh, the 1970 cyclone may have resulted in a higher rate of transmission of the infection resulting from disruption to the health infrastructure and the disturbance of outpatient treatment of patients with active tuberculosis (Shultz et al., 2005).

Chapter 2

Methodology

2.1 Research Objective and Goals

The main objective of this research is to identify the diseases that people face while staying in cyclone shelter and availability of safe drinking water in disaster period. Moreover, what kind of facilities people are getting while living in those cyclone shelters during the disaster period, and after coming back to their normal life from the cyclone shelter if they are affected by any kind of disease that may affect them while living in the shelters.

2.2 Research Design

At first, a comprehensive literature review was done to understand the context of the cyclone shelter properly. A focus group discussion was done to validate and pretesting the questionnaire. After that, we took the given recommendation to finalize the questionnaire. Random sampling was done to finalize the total population and sample. A total of 450 surveys were done and among them, 409 was found completely validated. The survey was done surrounding the area of cyclone shelters in Cox's Bazar and Maheshkhali as these two places get affected most during a cyclone.

2.3 Research Questionnaire

RQ 1: What is the distance of nearby cyclone shelter from your house?

RQ 2: What kinds of diseases do you face during the stay or after leaving the cyclone shelter?

RQ 3: Is there any drinkable source of water in the shelter?

RQ 4: What kinds of problems are there in the water of shelter?

RQ 5: Did any organization come to check the water quality?

RQ 6: Did any organization supply drinking water in the cyclone shelter?

RQ 7: Is there any rain water collection system in the shelter?

RQ 8: Is there any sanitary latrine in the shelter?

RQ 9: Is the school management committee doing their duty properly?

RQ 10: Are you satisfied with the facilities of the cyclone shelter?

RQ 11: Does there any water logging occur around the cyclone shelter? If yes, for how many days?

Chapter 3

Result and Discussion

The study was done in the district of Cox's Bazar and the cyclone shelter of upazilla Cox's Bazar Sadar and Maheshkhali. The sample was distributed more or less equally. About 51% of population was taken from Cox's Bazar and 48.9% population from Maheshkhali.

Table 3 : Name of Upazilla (Project location)

	Frequency	Percent	Cumulative Percent
Cox's Bazar	209	51.1	51.1
Maheshkhali	200	48.9	100.0
Total	409	100.0	

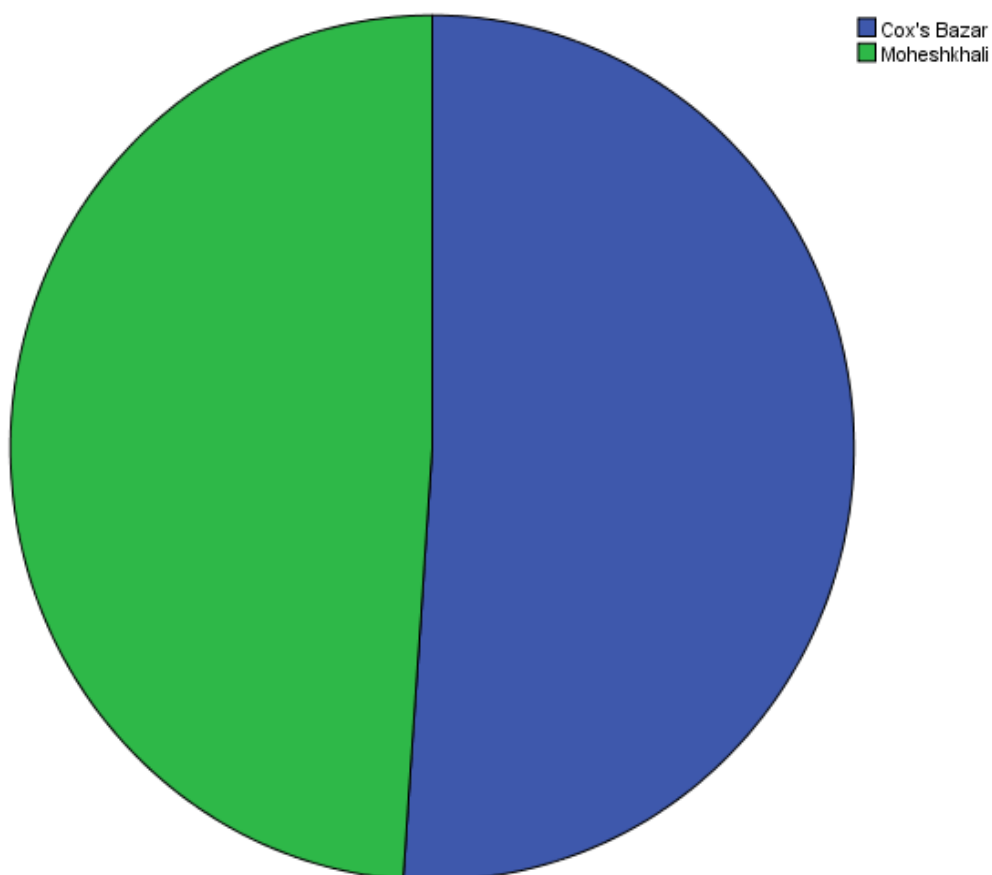


Figure 3: Name of Upazilla (Project location)

The survey comprises 20 unions of 2 Upazillas. The unions that are covered in the survey is Banglabazar, Boro Maheshkhali, Chaufaldandi, Choto Maheshkhali, Dholghatpara, Hoanak, Idgaon, Islamabad, Jalalabad, Jhilwanja, Kalamchora, Khurushkul, Kutubjom, Matarbari, P.M. khali, Paurasabha (1&3 no. ward), Paurasabha (2&4 no. ward), Paurasabha (8,9&11 no. ward), Paurashava and Shaplapur.

Table 4: Union (Project location)

	Frequency	Percent	Cumulative Percent
Banglabazar	20	4.9	4.9
Boro Moheshkhali	20	4.9	9.8
Chaufaldandi	20	4.9	14.7
Choto Moheshkhali	20	4.9	19.6
Dholghatpara	21	5.1	24.7
Hoanak	22	5.4	30.1
Idgaon	28	6.8	36.9
Islamabad	20	4.9	41.8
Jalalabad	20	4.9	46.7
Jhilwanja	23	5.6	52.3
Kalamchora	21	5.1	57.5
Khurushkul	20	4.9	62.3
Kutubjom	20	4.9	67.2
Matarbari	16	3.9	71.1
P.M. khali	20	4.9	76.0
Paurasabha (1&3 no. ward)	20	4.9	80.9
Paurasabha (2&4 no. ward)	18	4.4	85.3
Paurasabha (8,9&11 no. ward)	20	4.9	90.2
Paurashsva	20	4.9	95.1
Shaplapur	20	4.9	100.0
Total	409	100.0	

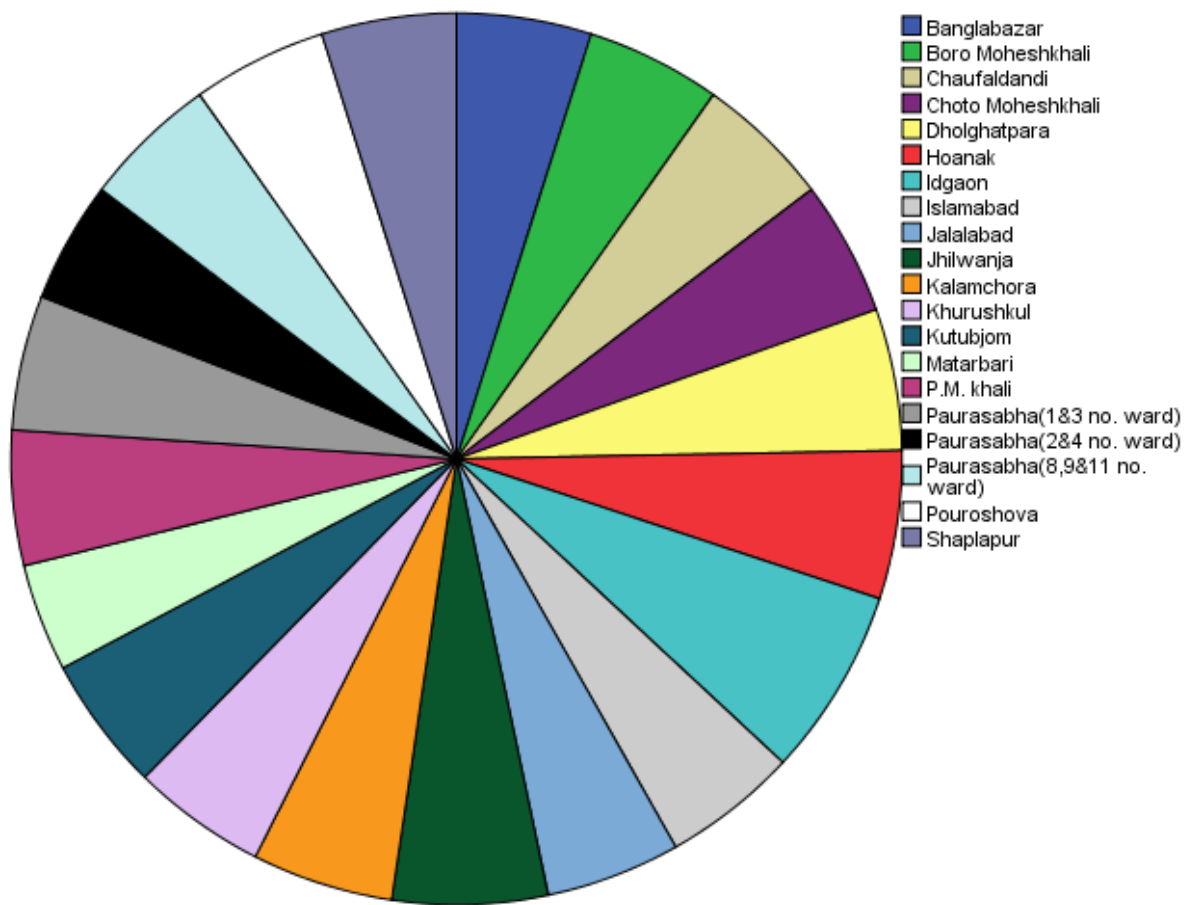


Figure 4: Union (project location)

According to the survey, 44.5% respondents said that they need to go to cyclone shelter after 30 minutes of long walking. This is very risky in the disaster period as people did not get much time to protect themselves.

Table 5: Distance of nearby cyclone shelter from your house

	Frequency	Percent	Cumulative Percent
More than 30 minutes	182	44.5	44.5
Less than 30 minutes	227	55.5	100.0
Total	409	100.0	

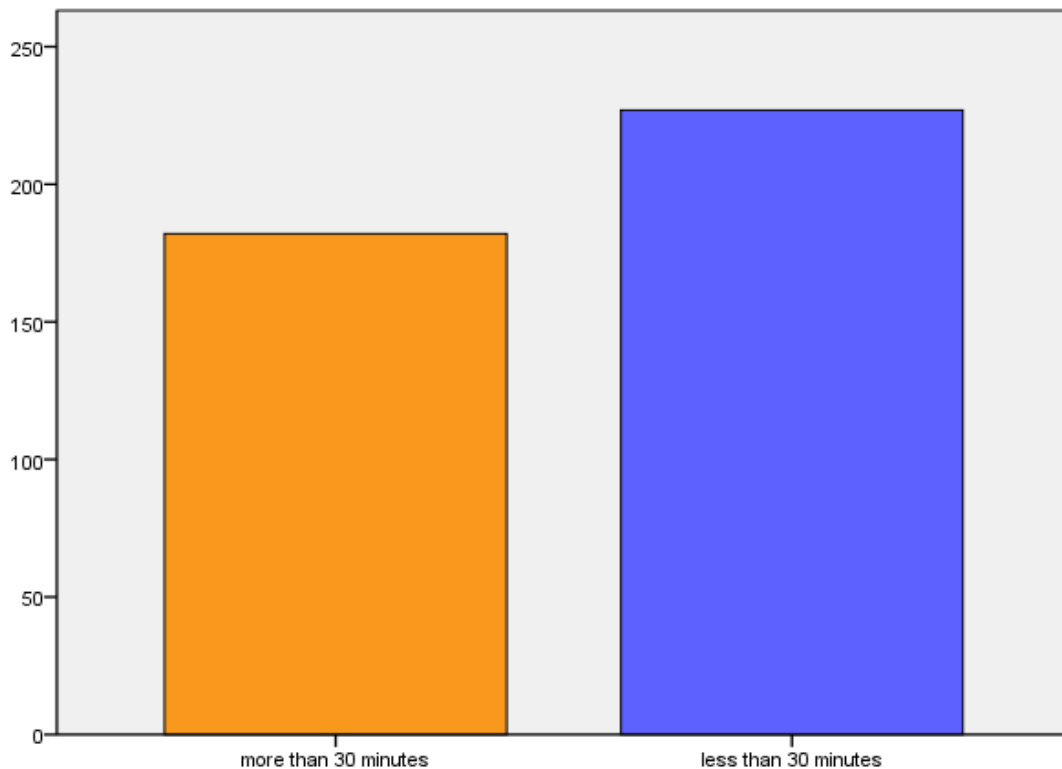


Figure 5: Distance of nearby cyclone shelter from your house

While staying in the cyclone shelter, people may get affected by different kinds of diseases. The result shows that there were variations in diseases. Almost all the respondents face more than one disease during their staying in the shelter. The respondents mainly face diarrhea, fever and skin disease which is 29.1%. Although, Diarrhea, dysentery and fever tends to affect 20% of the respondents.

Table 6: Diseases faced during staying in the shelter

	Frequency	Percent	Cumulative Percent
Fever	1	.2	.2
Diarrhea, dysentery and skin disease	37	9.0	9.3
Diarrhea and skin disease	54	13.2	22.5
Diarrhea, fever & skin disease	119	29.1	51.6
Diarrhea, dysentery & fever	82	20.0	71.6
Diarrhea, dysentery, fever & skin disease	54	13.2	84.8
Diarrhea & dysentery	29	7.1	91.9
Diarrhea, fever, skin disease & Malaria	33	8.2	100.0
Total	409	100.0	

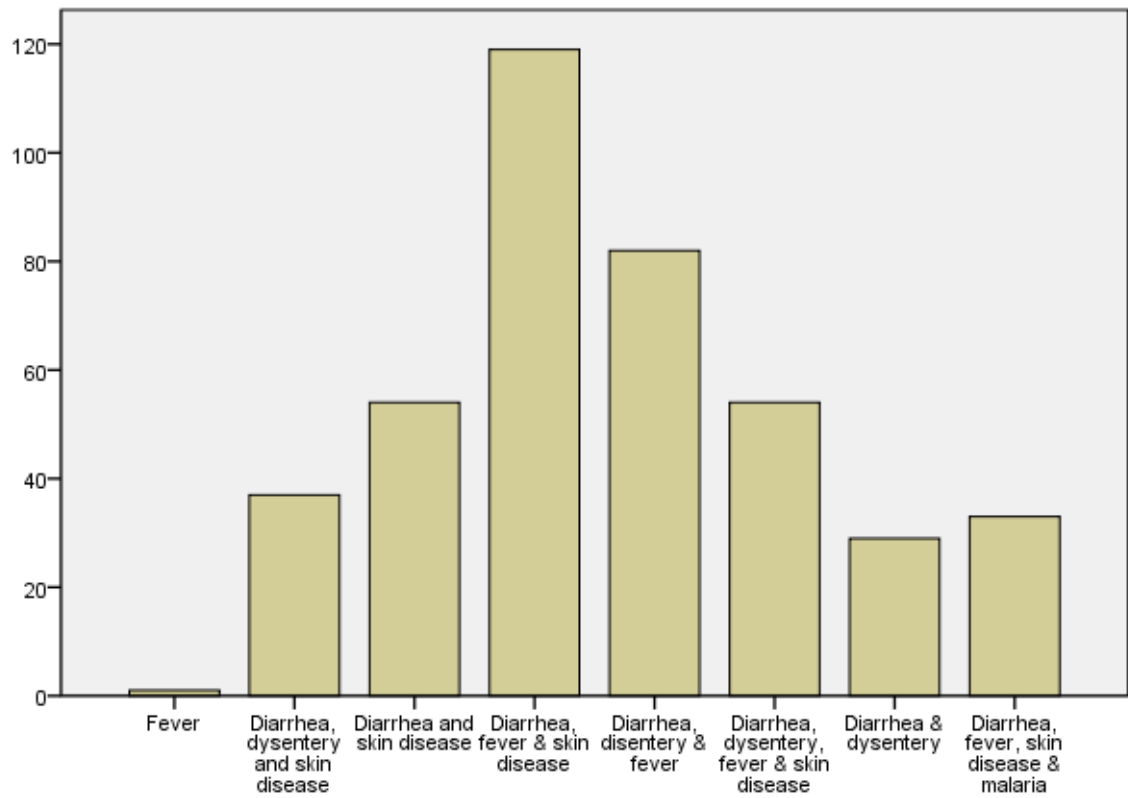


Figure 6: Diseases faced during staying in the shelter

The source of drinking water is very much necessary in a cyclone shelter. The majority of the respondents which is 64.5% said that there is no proper source of drinking water in that particular cyclone shelter. Only 35.5% respondent said that they have source of drinking water in their cyclone shelter.

Table 7: Source of drinking water in the shelter

	Frequency	Percent	Cumulative Percent
Yes	145	35.5	35.5
No	264	64.5	100.0
Total	409	100.0	

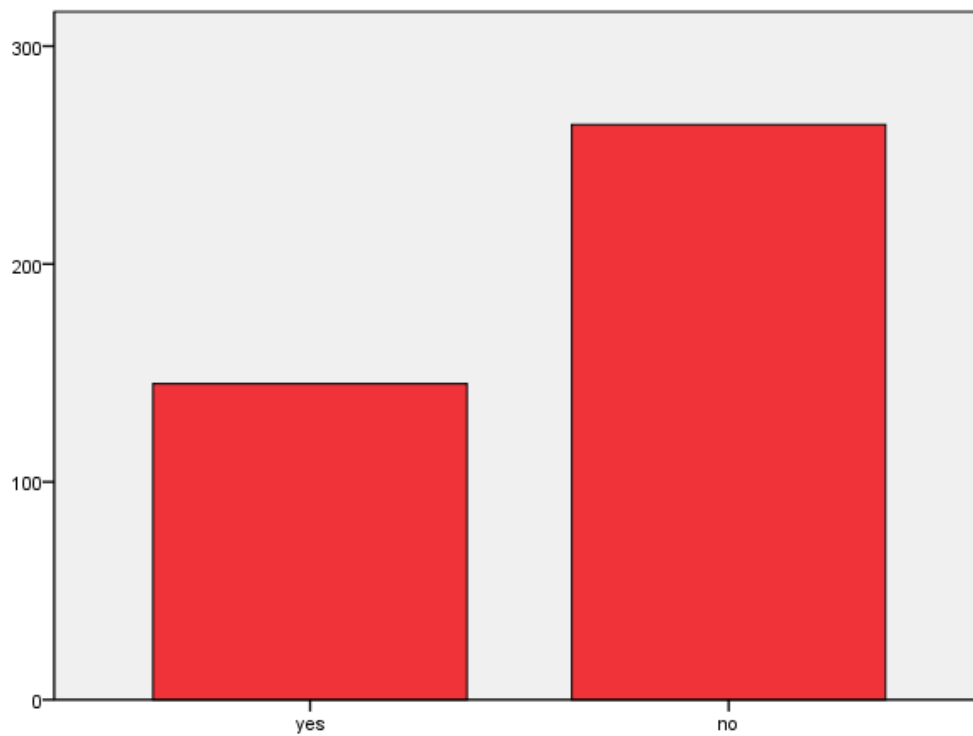


Figure 7: Source of drinking water in the shelter

There are many particles which can be found in the water of the cyclone shelter. According to the respondents, the main particle found in the water is dust which is 38.4%. The second highest compound found in the water of the shelter is iron and dust both which is 35.2%. Only iron is another problem of the water of the cyclone shelters which is 19.8%.

Table 8: Problem of the water in the shelter

	Frequency	Percent	Cumulative Percent
Iron	81	19.8	19.8
Dust	157	38.4	58.2
Iron and dust	144	35.2	93.4
Dust & others	24	5.9	99.3
Iron & others	3	.7	100.0
Total	409	100.0	

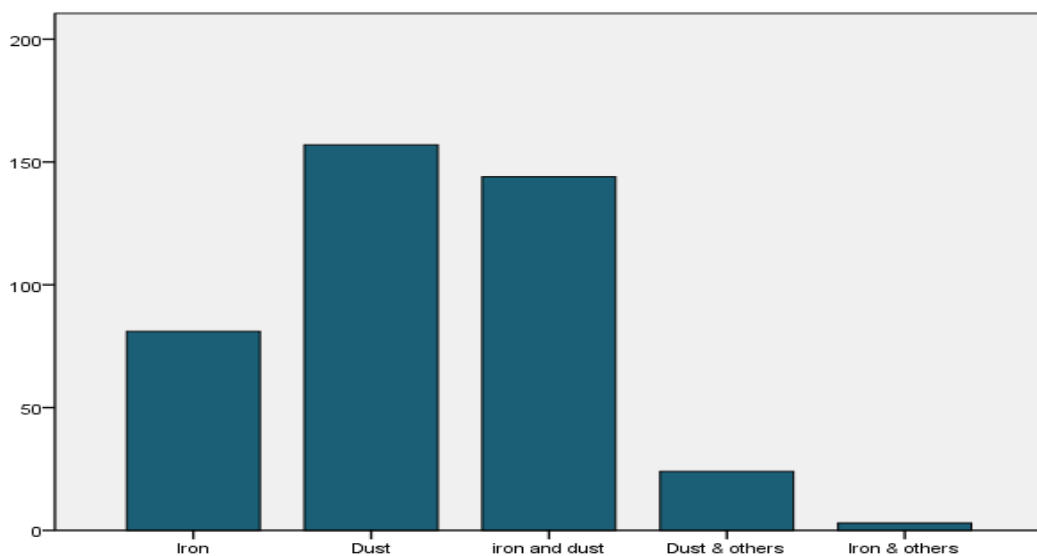


Figure 8: Problem of the water in the shelter

Different organizations visit cyclone shelters at different times. The question is if the organization come to check the water quality of the cyclone shelter or not. Among the respondents, 54.3% said that that the organizations actually check the water quality of the shelter. The rest of the people which is 45.7% responded negatively.

Table 9: Organizations come to check the water quality or not

	Frequency	Percent	Cumulative Percent
Yes	222	54.3	54.3
No	187	45.7	100.0
Total	409	100.0	

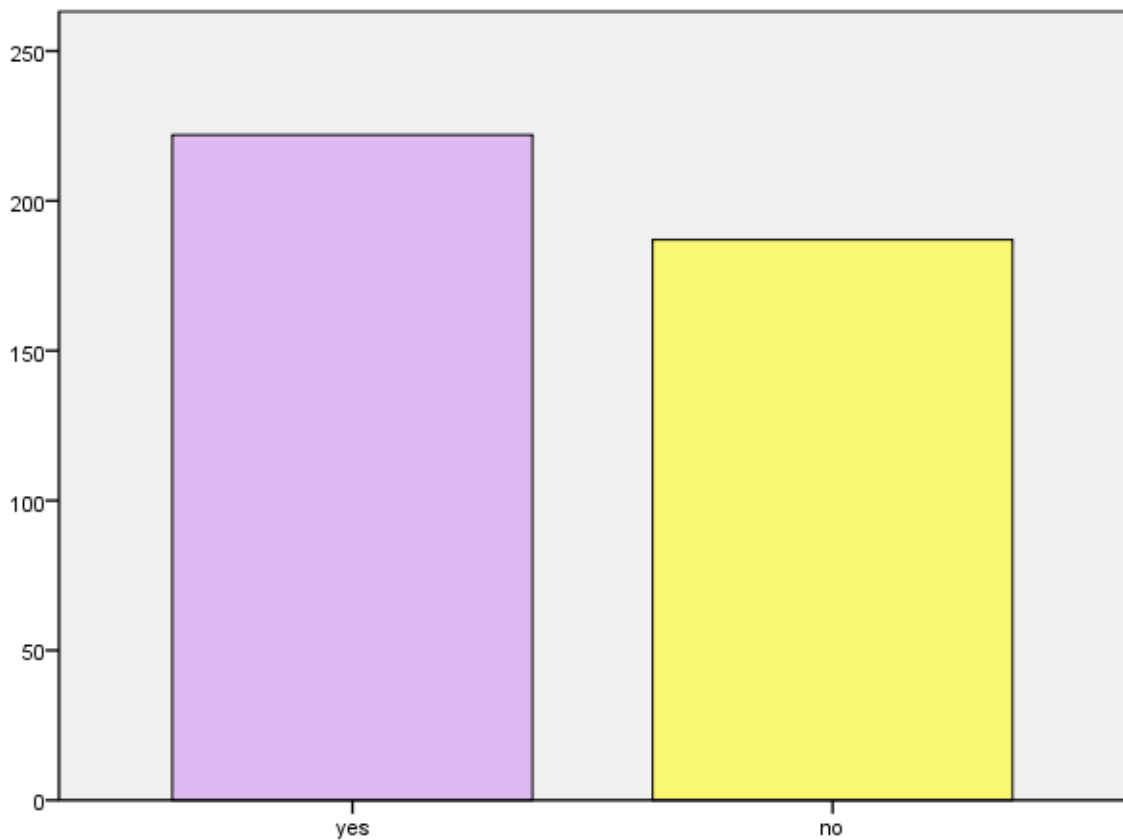


Figure 9: Organizations come to check the water quality or not

For supplying pure drinking water in cyclone shelter, different organizations play an important role. Though 58.4% respondents said few organizations supply drinking water in those cyclone shelter but 41.6% respondents disagreed with the fact and said that they don't find any organization of similar kind.

Table 10: Drinking water is supplied by any organization or not

	Frequency	Percent	Cumulative Percent
Yes	239	58.4	58.4
No	170	41.6	100.0
Total	409	100.0	

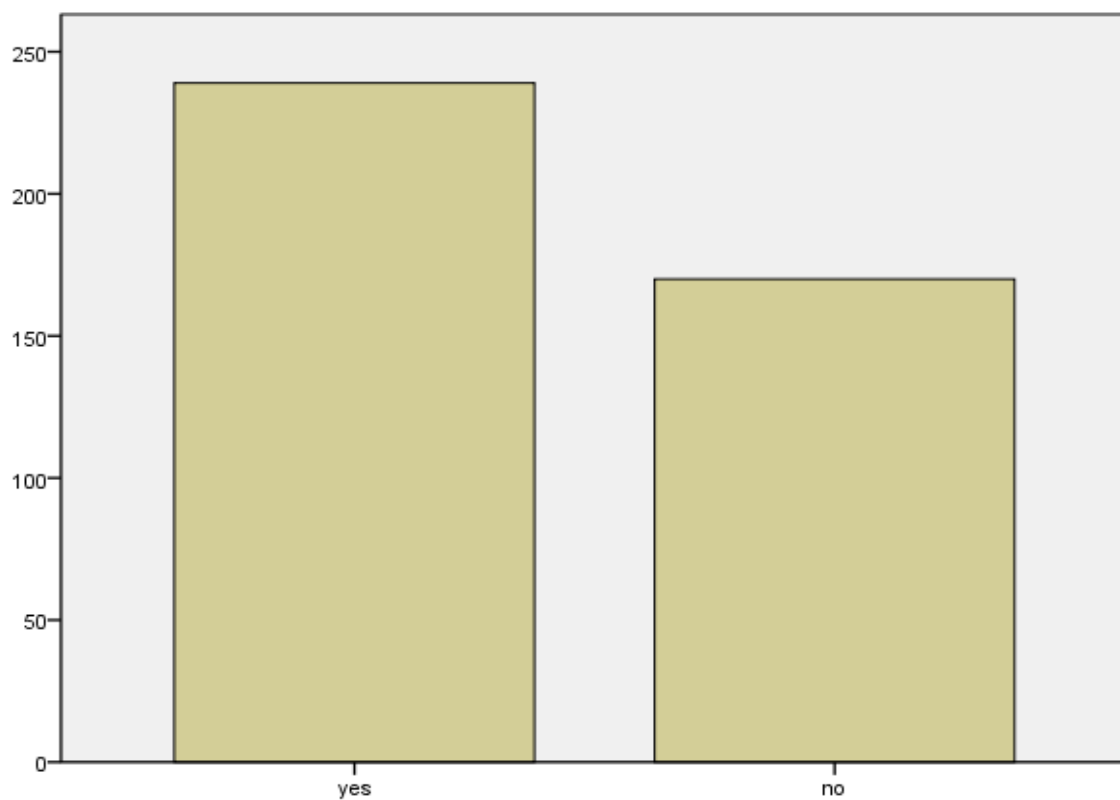


Figure 10: Drinking water is supplied by any organization or not

Rain water collection helps to reuse that water in the daily usage of the cyclone affected people. Most people which is 312 out of 409 said that there is no scope of rain water collecting in the shelter. Contrarily, only 23.7% which is 97 out of 409 said that they have this facility of collecting rain water.

Table 11: Rain water collection system in the shelter

	Frequency	Percent	Cumulative Percent
Yes	97	23.7	23.7
No	312	76.3	100.0
Total	409	100.0	

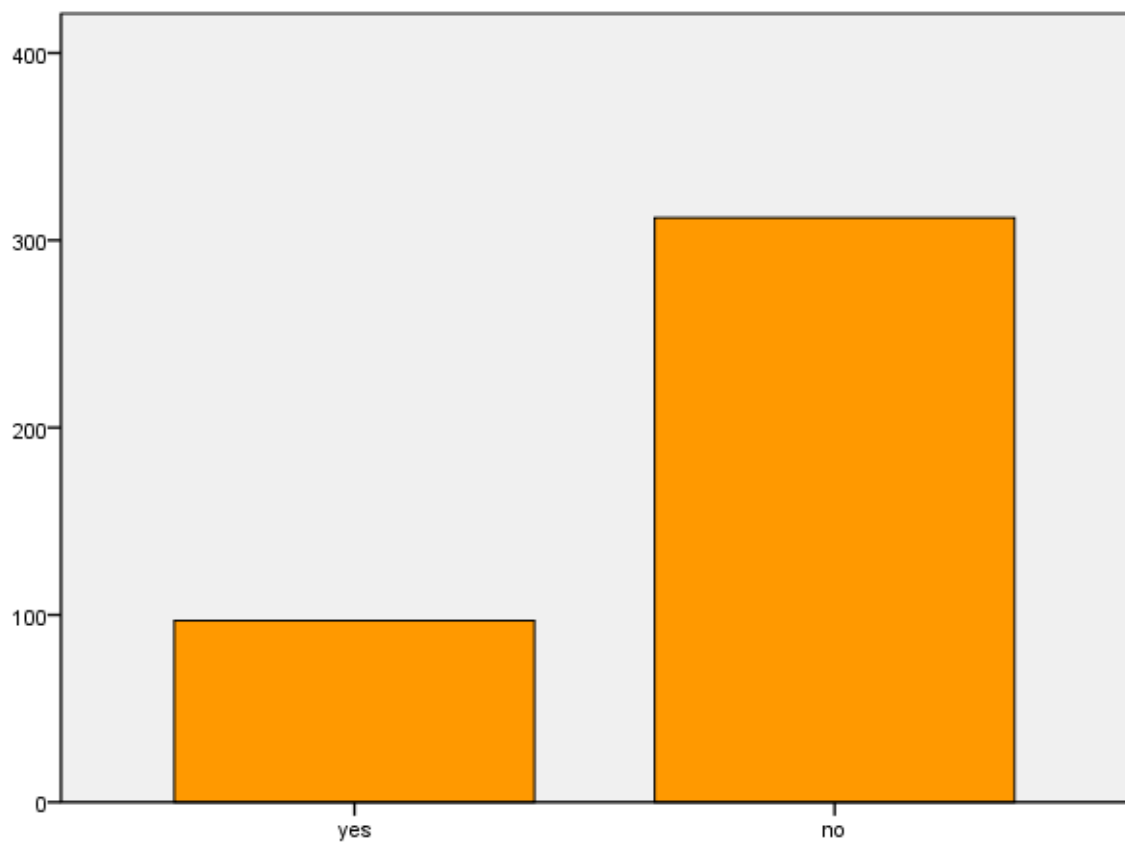


Figure 11: Rain water collection system in the shelter

In the study, around 409 coastal people of Cox’s Bazar were asked about the sanitary latrine facility in the shelter because sanitary latrine is very much essential to remain healthy as it protects us from various types of diseases. Majority, to be specific 66.7% of the respondents said that they do not get proper sanitary latrine facility in the shelter. On the contrary, 33.3% of the respondents found good sanitation facility in the shelter.

Table 12: Sanitary latrine facility in the shelter

	Frequency	Percent	Cumulative Percent
Yes	136	33.3	33.3
No	273	66.7	100.0
Total	409	100.0	

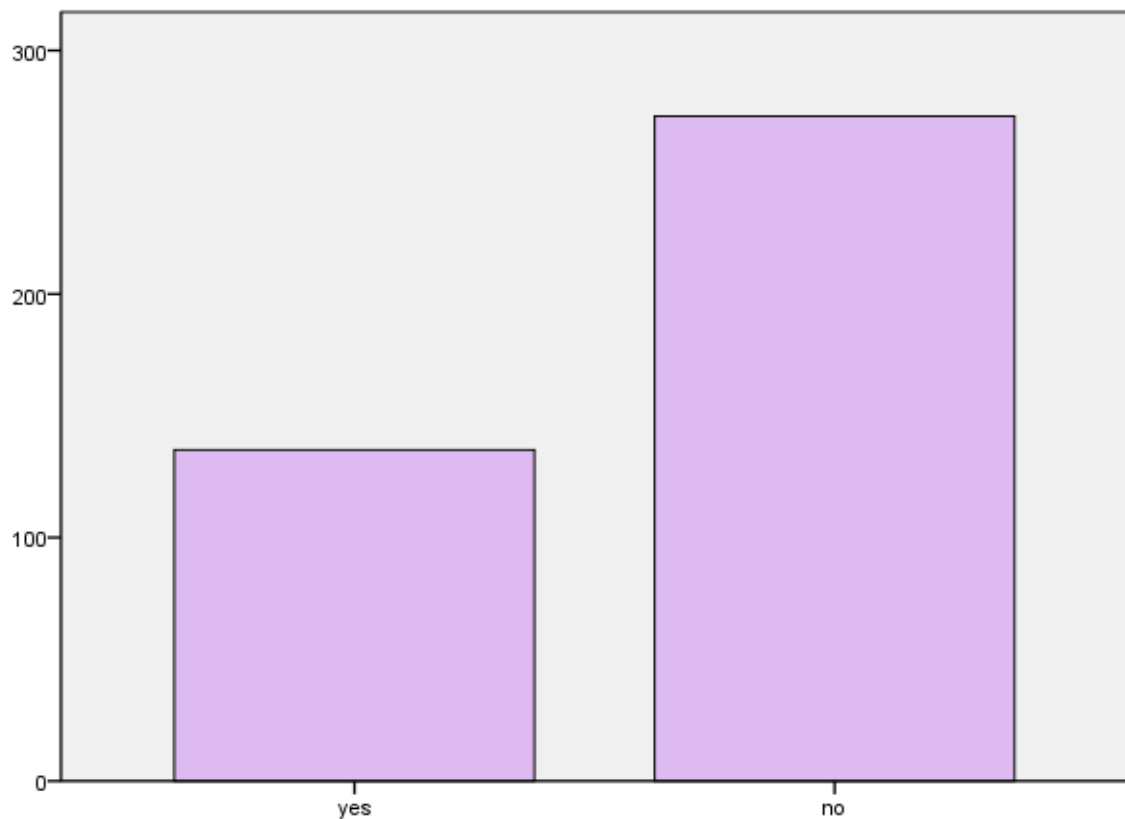


Figure 12: Sanitary latrine facility in the shelter

In this study, to cover all aspects of cyclone shelter in the coastal area of Bangladesh, the participants of the survey were asked about the management committee of shelter whether they were sincere towards their responsibilities or not. In the result a mixed opinion was received. A little more than half of the participants, to be exact 51.3% think that the committee is doing their duties properly and rest of the participants which is 48.7% said that the performance of the committee towards their duties is not up to the mark.

Table 13: The proper completion of the duty by the school management committee

	Frequency	Percent	Cumulative Percent
Yes	210	51.3	51.3
No	199	48.7	100.0
Total	409	100.0	

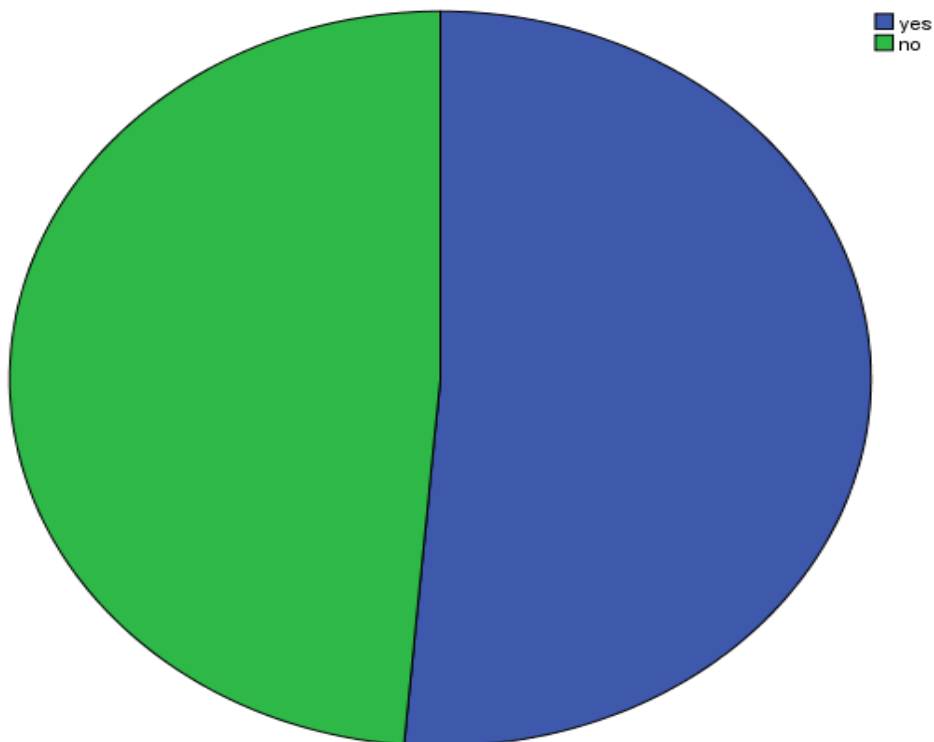


Figure 13: The proper completion of the duty by the school management committee

The satisfaction of the people of the cyclone shelter depends on the facility provided in the shelter. According to the survey, 17.6% people are satisfied with the facility of the shelter whereas 82.4% are not that much satisfied with the facility.

Table 14: People's perception or satisfaction level with the facility of the cyclone shelter

	Frequency	Percent	Cumulative Percent
Yes	72	17.6	17.6
No	337	82.4	100.0
Total	409	100.0	

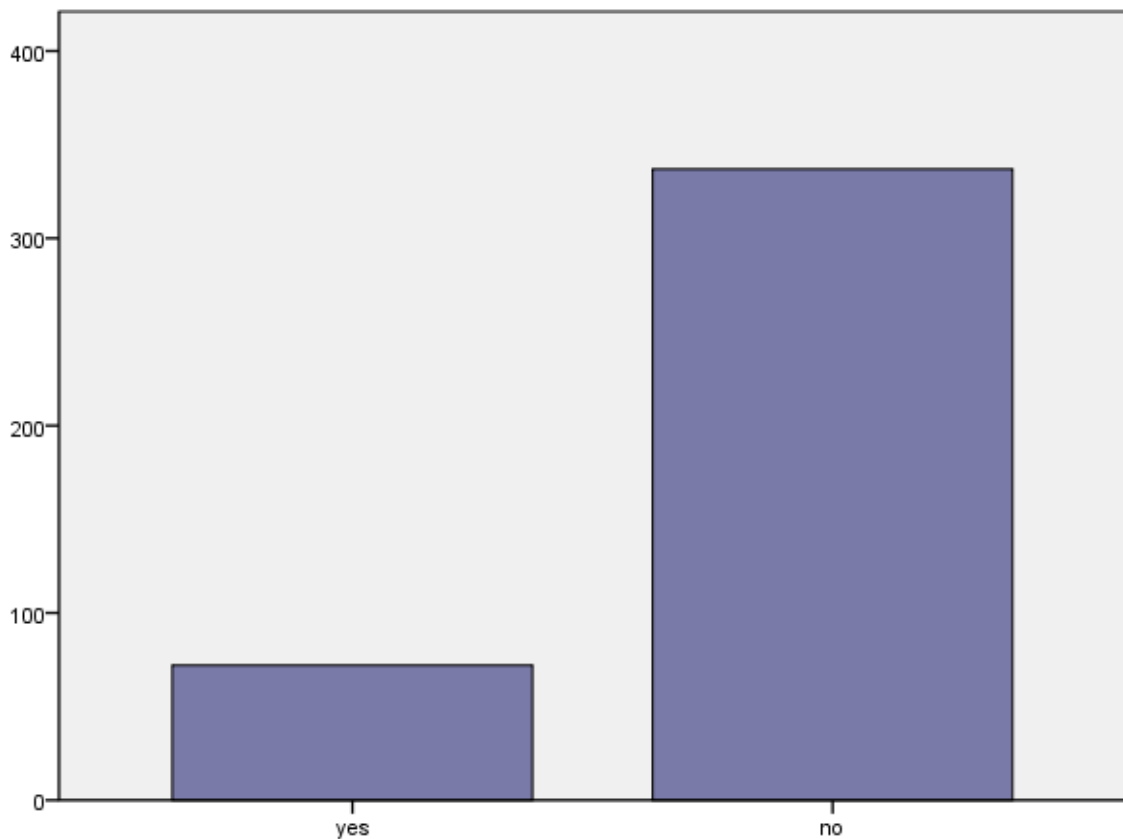


Figure 14: people's perception or satisfaction level with the facility of the cyclone shelter

Water logging increases the sufferings of the people of the affected area. Water logging can be stay for different durations and periods. To know about water logging and their duration, respondents were asked this question. According to 42.5%, water logging stayed for 3 days. The other 36.5% said that water logging stayed for 7 days or 1 week. Then, 18.3% said that water logging stayed more than 1 week. The minority which is 2.7% reported about no water logging at all.

Table 15: Water logging and duration of water logging

	Frequency	Percent	Cumulative Percent
No	11	2.7	2.7
Yes, stays for 3 days	174	42.5	45.2
Yes, stays for 7 days	149	36.5	81.7
Yes, stays for more than 7 days	75	18.3	100.0
Total	409	100.0	

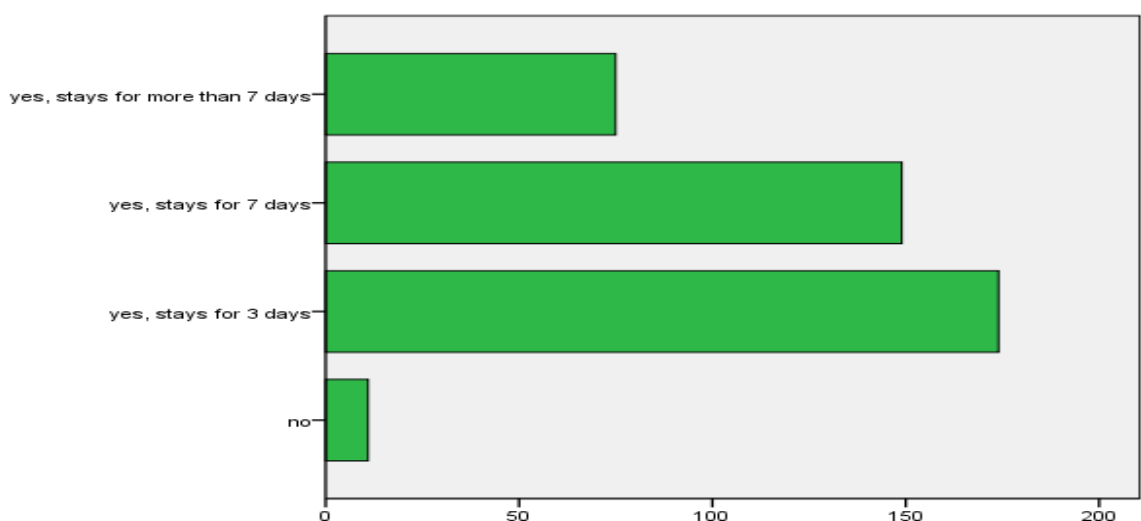


Figure 15: Water logging and duration of water logging

Chapter 4

Recommendations

After analyzing the health, hygiene and water sustainability in the cyclone shelter, the following activities can be suggested to improve the conditions of the cyclone shelters in Cox's Bazar and Maheshkhali and make those shelters more acceptable to the mass people-

- Many shelters do not have enough number of the toilet according to the people that is needed to maintain hygiene and also save people from various type of diseases. Also, separate toilet for women and men is very much necessary to ensure safety. All these need to be improved.
- A number of volunteers should be increased by giving the local people proper training of managing the diseases that may cause in any cyclone situation so that they can respond at the time of emergency.
- School management committees can organize different types of awareness program regarding disaster period, associated diseases and so on. Disaster management committee and school management Committees should be concerned about the maintenance and sustainability of the shelters both in the disaster period and when functioning as school.
- Careful monitoring is needed to reduce the abusive incidents to the women and children, disabled persons and minor people of the cyclone shelter so that the equilibrium of the shelter is maintained and everyone can live there without any fear and peacefully.
- For water supply, most of the shelters depend on tube well. If any problem occurs or water source gets contaminated during disaster, people do not have any other option for water especially for drinking water. Rain water harvesting (RWH) system is the

easiest way to get rid of this kind of situation. Installment of RWH system will reduce the water crisis in the cyclone shelter.

Chapter 5

Conclusion

Environment stands as problematic and challenging in the coastal area of Bangladesh, where children and women face many problems regarding their health status. This study revealed that people have to face various types of health issues, poor sanitation, different diseases that make their life more life threatening afterwards. Safe water and sanitation provides enhancement of the standard of life through upgrading physical conditions of the mass people which is not being possible in the over populated cyclone shelters of the south coastal regions of Bangladesh. Due to lack of proper health facilities, they are not capable to cope with the frequently changing environment which is worsening their health condition day by day.

There is a proper guideline for maintaining the cyclone shelter which is “Cyclone Shelter Construction, Maintenance and Management Policy 2011” published by the Ministry of Disaster Management and Relief and in that document the health issue and water quality issues are prioritized by the policy makers. Proper instructions about the process of building and maintaining health secured and hygiene cyclone shelters are written in here with details. These procedures are to be followed to ensure the healthy condition of the refugees in the shelter. Otherwise unhygienic conditions of the shelters provoke the spread out of the numerous diseases which can trouble the lives of the entire population of the region and raise the concern of maintaining the post-disastrous situation. Though the refugees are saved from the sudden impact of the cyclone, the found conditions of the cyclone shelters can mark a life-long traumatized suffering for them. All the cyclone shelters, water and hygiene facilities thus are required to be ensured and maintained under the proper government policy.

Chapter 6

Future Work

The outcome of the study suggests that the health and hygiene condition of the people situated in Cox's Bazar Sadar and Maheshkhali are not up to the mark in the cyclone or any disastrous period. For the future prospect, the assessment of health severity and disease probability and rates of the cyclone affected zone of other districts can be done. There are also many scopes to conduct future research in health prospects due to of water and sanitation system so that the major reason for occurring different diseases during staying in the shelter can be identified and the government and the non-governmental organizations can feel the necessity of giving a proper solution to this problem.

Chapter 7

References

- Ahamed, S., Rahman, M. M., & Faisal, M. A. (2012). Reducing Cyclone Impacts in the Coastal Areas of Bangladesh: A Case Study of Kalapara Upazila. In *Journal of Bangladesh Institute of Planners* (Vol. 5). Retrieved from <http://en.wikipedia.org/wiki/Cyclone>
- Arya. (n.d.). What are the essential Characteristics of Cyclone? Retrieved September 29, 2019, from <http://www.preservearticles.com/geography/characteristics-of-cyclone/2354>
- Chinnaraja, V., Santhanam, P., & Dinesh Kumar, S. (2015). Impact of Thane cyclone on the heavy metal distribution in water, sediment, plankton and fish (*Mugil cephalus*) in selected areas along the Tamil Nadu, Southeast coast of India. In *Indian Journal of Geo-Marine Sciences* (Vol. 44).
- Chowdhury, M. M. A., Jahan, M., Jisan, M. A., Kabir, R., Haq, M. I., & Hossain, M. J. (2015). *a Study of Cyclone Shelters in the Coastal Bangladesh: an Assessment From Gender Perspective*. (July). <https://doi.org/10.13140/rg.2.1.2284.6564>
- Dasgupta, S., Huq, M., Khan, Z. H., Murshed, M., Ahmed, Z., Mukherjee, N., ... Pandey, K. (2011). *Cyclones in a Changing Climate: The Case of Bangladesh*.
- FSC Contingency Planning -- Map of Cyclone Prone Areas | Food Security Cluster. (2014). Retrieved September 29, 2019, from <https://fscluster.org/bangladesh/document/fsc-contingency-planning-map-cyclone>
- Haider, M. Z., & Ahmed, M. F. (2014). Multipurpose uses of cyclone shelters: Quest for shelter sustainability and community development. *International Journal of Disaster Risk Reduction*, 9, 1–11. <https://doi.org/10.1016/j.ijdr.2014.03.007>

- Hossain, N. (2018). The 1970 Bhola cyclone, nationalist politics, and the subsistence crisis contract in Bangladesh. *Disasters*, 42(1), 187–203. <https://doi.org/10.1111/disa.12235>
- Islam, A. S., Bala, S. K., Hussain, M. A., Hossain, M. A., & Rahman, M. M. (2011). Performance of coastal structures during cyclone Sidr. *Natural Hazards Review*, 12(3), 111–116. [https://doi.org/10.1061/\(ASCE\)NH.1527-6996.0000031](https://doi.org/10.1061/(ASCE)NH.1527-6996.0000031)
- Kabir, R. (2014). *The impacts of cyclones Sidr and Aila on the health of the coastal people of Bangladesh*.
- Karim, M. F., & Mimura, N. (2008). Impacts of climate change and sea-level rise on cyclonic storm surge floods in Bangladesh. *Global Environmental Change*, 18(3), 490–500. <https://doi.org/10.1016/j.gloenvcha.2008.05.002>
- Mahmood, M. N., Dhakal, S. P., & Keast, R. (2014). The state of multi-purpose cyclone shelters in Bangladesh. *Facilities*, 32(9–10), 522–532. <https://doi.org/10.1108/F-03-2012-0082>
- Mallick, B. (2014). Cyclone shelters and their locational suitability: An empirical analysis from coastal Bangladesh. *Disasters*, 38(3), 654–671. <https://doi.org/10.1111/disa.12062>
- MoDMR. (2012). *Cyclone Shelter Construction , Maintenance and Cyclone Shelter Construction , Maintenance and Management Policy 2011*.
- Paul, B. K., & Rashid, H. (2017). Preface. In *Climatic Hazards in Coastal Bangladesh*. <https://doi.org/10.1016/b978-0-12-805276-1.05001-8>
- Paul, S. K. (2011). Determinants of Evacuation Response To Cyclone Warning in Coastal Areas of Bangladesh : a Comparative Study. *Oriental Geographer*, 55(01), 57–83.
- Rahmadhy. (2012). Characteristics of Cyclones. Retrieved September 29, 2019, from <https://www.trussty.com/2012/02/characteristics-of-cyclones.html>

Rahman. (2008). *Preparedness for Cyclonic Disaster in coastal areas of Bangladesh and Impact assessment of cyclone SIDR.*

Razzak Moral, A., Hamidul Bari, Q., Abdul Jabbar, M., Tariqul Islam, S., & Hasibul Hasan, M. (2019). Health Vulnerabilities among the Disaster Affected Children in Coastal Area of Bangladesh. *IOSR Journal of Environmental Science*, 13, 17–24.
<https://doi.org/10.9790/2402-1312031724>

Sayato, Y. (1989). WHO Guidelines for Drinking-Water Quality. *Eisei Kagaku*, 35(5), 307–312. <https://doi.org/10.1248/jhs1956.35.307>

Shultz, J. M., Russell, J., & Espinel, Z. (2005). Epidemiology of tropical cyclones: The dynamics of disaster, disease, and development. *Epidemiologic Reviews*, 27, 21–35.
<https://doi.org/10.1093/epirev/mxi011>

Skymet Weather Team. (2017). What is a cyclone? | Skymet Weather Services. Retrieved September 29, 2019, from <https://www.skymetweather.com/content/weather-faqs/what-is-a-cyclone/>

Street, D. S., Adamson, P., Yo, Y., & Hoy, S. (2019). *Final report Final report*. 3(May), 1–14.

WHO | The determinants of health. (2010). *WHO*.

Chapter 8

Annex

A Survey Assessments of Health and Hygiene Sustainability in the Cyclone Shelters Situated in Coastal Zone of Bangladesh (Cox's Bazar Sadar and Maheshkhali)

তারিখঃ

খানা প্রধান এর নামঃ

খানা প্রধান এর মোবাইল নম্বরঃ

ঠিকানাঃ

গ্রাম		ইউনিয়ন	
উপজেলা		জেলা	

Section 01: General Information

A1. আপনার এলাকায় কোন ঘূর্ণিঝড় আশ্রয়কেন্দ্র আছে কি?

(ক) হ্যাঁ (খ) না

A2. আপনার এলাকায় কতগুলো ঘূর্ণিঝড় আশ্রয়কেন্দ্র আছে?

A3. আপনার বাড়ি থেকে নিকটবর্তী ঘূর্ণিঝড় আশ্রয়কেন্দ্রের দূরত্ব কতটুকু?

(ক) ৩০ মিনিট এর বেশি (খ) ৩০ মিনিট এর কম

Section 02: Facilities

B1. আশ্রয়কেন্দ্রে নিরাপদ পানীয় জল এর উৎস আছে কিনা?

(ক) হ্যাঁ (খ) না

B2. আশ্রয়কেন্দ্রে স্বাস্থ্যসম্মত পায়খানা আছে কিনা?

(ক) হ্যাঁ (খ) না

B3. আশ্রয়কেন্দ্রে মেয়েদের জন্য আলাদা বাথরুম আছে কিনা?

(ক) হ্যাঁ (খ) না

B4. ঘূর্ণিঝড় আশ্রয়কেন্দ্রে মহিলাদের জন্য আলাদা কক্ষ আছে কিনা?

(ক) হ্যাঁ (খ) না

B5. ঘূর্ণিঝড় আশ্রয়কেন্দ্রে গর্ভবতী মা দের জন্য আলাদা রুম আছে?

(ক) হ্যাঁ (খ) না

B6. ঘূর্ণিঝড় আশ্রয়কেন্দ্রে পানি সংরক্ষনের (Rain water harvesting) ব্যবস্থা আছে কিনা?

(ক) হ্যাঁ (খ) না

B7. স্কুল ব্যবস্থাপনা কমিটি তাদের দায়িত্ব ঠিকমত পালন করে কিনা?

(ক) হ্যাঁ (খ) না

B8. আপনারা ঘূর্ণিঝড় আশ্রয়কেন্দ্রের সুবিধা-অসুবিধা নিয়ে সন্তুষ্ট?

(ক) হ্যাঁ (খ) না

B9. কি কি ধরনের সুবিধা ঘূর্ণিঝড় আশ্রয়কেন্দ্রে থাকা দরকার বলে আপনি মনে করেন?

B10. ঘূর্ণিঝড় আশ্রয়কেন্দ্রে অবস্থানরত অবস্থায় অথবা বাসায় যাবার পর আপনারা কি ধরণের রোগবলাই এর সম্মুখীন হন?

- a. Diarrhea b. Dysentery c. Fever d. Skin disease e. Malaria f. Typhoid
g. Fungal infection h. Urinary tract infection i. Others

B11. আশ্রয়কেন্দ্রের পানিতে কি কি সমস্যা আছে?

- (ক) Arsenic (খ) Iron (গ) Dust (ঘ) others

B12. পানির মান পরীক্ষা করতে কোন সংস্থা এসেছিল কিনা?

- (ক) হ্যাঁ (খ) না

B13. যদি এসে থাকে, কি ধরনের সংস্থা এসেছিল ?

- (ক) Private (খ) Govt. (গ) Others

B14. সাইক্লোন শেলটারে খাবার পানি সরবরাহের জন্য কোন সংস্থা কাজ করেছে কিনা?

- (ক) হ্যাঁ (খ) না

B15. ঘূর্ণিঝড় আশ্রয়কেন্দ্রের আশে পাশে কোন ধরনের জলাবদ্ধতা হয় কি না? হলে তা কতদিন থাকে?

- (ক) না (খ) হ্যাঁ, ৩ দিন থাকে (গ) হ্যাঁ, ৭ দিন থাকে (ঘ) হ্যাঁ, ৭ দিনের বেশি থাকে