

Research Report
Cyclone Aila and Health Hazards:
A Study on Koyra Upazila of Khulna District,
Bangladesh.
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Executive Summary

Cyclones are the most common natural hazard. The impact of cyclones on the human is related directly to the location and topography of the area, human demographics and characteristics of the built environment. Bangladesh is one of the cyclone prone countries in the world, due to its conical shape and location on the tip of the Bay of Bengal. Cyclone Aila ravaged the south western part of Bangladesh on 25 May 2009. The present study was conducted at seven union parishads of Koyra upazila of Khulna district. A total of 210 people were interviewed using a structured questionnaire. Observations were carried out to obtain peoples' perception and ideas about the health hazards. The primary objective was to assess the prevalence of diseases and illnesses in the study area before and after cyclone periods. The study also aimed at identifying the factors associated with health hazards and their impacts on the people of Aila affected area. The study employed an interview survey using a structured questionnaire.

The study revealed that the people of the study area suffered from a number of diseases and illnesses like diarrhea, dysentery, skin infection, cough, rash, etc. Compare to pre-cyclone aila period, significant increases in the incidence of these diseases occurred after cyclone aila. Ninety-two percent reported diarrhea and nearly 80 percent reported dysentery. Sixty-four percent of the households reported skin infection, 40 percent cough and 61.2 percent reported asthma; about 59 percent and 60.3 percent reported acidity and ear problem respectively. Only in case of rash the incidence rate was slight (before 36.2% vs. after 40.2 %). Sanitary latrine coverage in the aila affected area dropped sharply to % following the aila incident. Eighty-four percent of the households reported usage of unsafe water sources. The incidence of fasting also increased greatly as food taking in sufficient quantity decreased largely after the cyclone aila.

Some demographic factors like age, educational level, occupation and sex were found to be affecting the health of the people. Nearly 42 percent of the people were belonged to the age group of 40-59 years. Though young people are generally more prone to illness and diseases, these illness and diseases were found to be prevalent among the people of all ages. There is no significant relation between ages of the respondent and attacked by diseases. However, the study found significant correlations between pattern of toilet and damage of toilet by aila and household damage by aila and returning home after some days. The study found that household pattern is an important factor affecting the health of the people. The findings show that 94 percent of the households were Katcha.

Management of the health impacts of cyclones is dependent on availability of and access to health facilities and on the capacity of the health system to mitigate or manage those consequences. The study found that availability of doctors and medicine was not sufficient. More than 75 percent of the respondents reported they got available doctors and medicine before Aila, which came down to 38.4 percent after Aila.

The study suggests that through proper prevention and controlling measures as well as health care management the health impacts of cyclones like Aila could be reduced to a great extent. Government alone cannot do this; a concerted and coordinated effort is needed with participation of all relevant stakeholders.

Cyclone Aila and Health Hazards: A Study on Koyra Upazila of Khulna District, Bangladesh

AFROZA PARVIN*

1. Introduction

1.1 Background

Natural disasters such as floods, cyclones, droughts and earthquakes are increasingly the source of immense misery to human lives. It caused economic and human losses and casualties. There are 450-800 major natural disasters each year around the world (Myint et al.2011). According to an estimate, approximately 250 million people are affected by major disasters per year (World Disaster Report 1994); about 95 per cent of global human losses occur in poorer countries (Burton et al. 1993). Small Island and poor countries are more vulnerable to disasters than rich communities because of their lack of resources, infrastructure and effective disaster preparedness system, that is, low resilience and post-event response capacity.¹

Among natural disasters, cyclones have profound damage dimensions, accounting for about 40 percent of the world's natural disasters. One of the most complex and widespread impacts of cyclones is on health. Cyclones bring both short and long term, direct and indirect health risks. Public health consequences associated with tropical cyclones include storm-related mortality, injury, infectious disease, psychosocial effects, displacement and homelessness, damage to the health-care infrastructure, disruption of public health services, transformation of ecosystems, social dislocation, loss of jobs and livelihood, and economic crisis (Shultz, Russel and Espinel 2005) . Cyclone affected people are particularly vulnerable to communicable diseases due to malnutrition, stress, unsanitary living conditions and disruption of health care services.

Bangladesh is a cyclone prone country due to its conical shape and location at the tip of the Bay of Bengal as well as population density and lack of effective and strong control protection system. The country experience at least one major tropical cyclone every year with its destructions (Haque 1997). Coastal zone of this country is the most susceptible to cyclones. Among the 64 districts of this country, 19 districts are known as coastal district.² The country's coastal areas face 24 major cyclones between 1960 and 2009. Among these cyclones, the most devastated are Cyclone 1970, Cyclone 1991, Cyclone Sidr (2007) and Cyclone Aila (2009).³

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¹ According to UNDP (2004), although, on average, the 50 poorest countries are exposed to only 11 percent of the world's natural hazards, they suffer 53 percent of death from disasters each year. In contrast, countries with high levels of human development, despite their exposure to 15 percent of all hazards, account for only 1.5 percent of death toll.

² Roughly 55 percent of the coastal population lives within 100 km of the 710 km-long coastal belt of Bangladesh. The majority of those living in this area are low-income agricultural workers; 70 percent of whom are landless and relatively asset-poor.

³ The southwest coast was also hit by cyclone Rashmi in October 2008.

Cyclone Aila hit the south-western coast of Bangladesh on 25 May 2009, with a wind speed of 120km/h.⁴ It caused widespread and severe destruction to economy and infrastructure. It was estimated that four million people were affected, over 500,000 homes were either completely or partially destroyed, and 445 educational institutions were fully and 4588 were partly damaged. It also caused extensive damage to embankments, livestock, fisheries and crop. More than 1742 kilometers of coastal embankments were damaged and about 150,000 livestock were killed. Despite the serious damage to the economy and infrastructure, the greatest loss caused by Cyclone Aila is human health. A total of 195 people were died with 7105 people injured. A number of health centers were damaged or destroyed, and numerous tube wells were contaminated or damaged. Severe damage to water and sanitary systems and other infrastructure is likely to cause illnesses and health problems such as enteric, respiratory, and skin diseases. The mental and psychological impact of the cyclone is also significant. According to some respondents of the affected area, their family members had experienced or observed psychological problems due to Aila. Local Health care facilities and equipment were also damaged. Cyclone Aila affected 64 upazilas of Khulna district. Koyra upazila is one of the severely affected upazilas in Khulna district.⁵

In Bangladesh there is a substantial literature on cyclones covering issues as the effect of cyclones on economy, agriculture, forestry, responses to cyclones and warning system, effectiveness of cyclone shelters, etc. A little study is found on the effects of cyclones on human health, factors affecting the health impacts of cyclones, etc. This study is an attempt to address the health impacts caused by cyclone Aila on the people of Koyra Upazila of Khulna district.

1.2 Objectives of the Study

The primary objective of this study is to identify as well as examine the extent and prevalence of diseases among the cyclone affected people and to suggest measures for prevention. The specific objectives are:

1. Describe the health impacts of cyclones and factors that affect the health impacts.
2. Describe the people's access to health care services and its implications for health impact.
3. Investigate demographic factors associated with diseases.
4. Provide a comparison of prevalence of diseases between the two situations before and after Aila.
5. Highlight some important findings as well as suggest measures that can be used for the prevention and mitigation of health hazards of cyclone.

⁴ It affected 11 districts and 64 upazillas of southwestern coast of Bangladesh. Among the districts Khulna and Satkhira were severely affected. In Khulna the most affected upazila was Koyra.

⁵ In Koyra, all unions (7) were affected by Aila. Among these unions, two were severely affected (Dakshin Bedakashi and Uttar Bedakashi). In these two unions all households (100%) were damaged. In Koyra, more than 150,000 people were affected, 40,000 households were damaged, 41 people were died and 410 were injured. It also caused severe damage to agriculture, livestock, fisheries and infrastructure. A total of 27350 latrine and 1103 drinking water sources were damaged. For summary of Cyclone Aila damages to Koyra Upazila, see Appendix 1.

1.3 Hypotheses to be Tested

1. There is no correlation between age of the respondents and being attacked by diseases.
2. There is no correlation between occupation of the respondents and pattern of household.
3. There is no correlation between occupation of the respondents and pattern of toilets.
4. There is no correlation between the pattern of household of the respondents and being damaged by Aila.
5. There is no correlation between the pattern of toilet and damage of toilet by Aila.
6. There is no correlation between damage of home and return to home after certain days.
7. There is no correlation between occupation of the respondents and amount of taking food before and after Aila.

1.4 Limitations of the Study

The study has the following limitations.

1. Data on health effects at upazila level are not available.
2. Samples may not always represent the real condition.
3. It is too difficult to determine the health impact of cyclone Aila because of complex definition of health (A state of complete physical, mental, social and spiritual well being).
4. After a long period the respondents forgot much information.
5. The sample size is very small. Data were collected from 210 out of 192,534 population of the study area.

1.5 Organization of the Report

This report comprises 9 sections. Section 1 contains the background, objectives and limitations. Section 2 presents the methodology while section 3 provides a review of some studies relevant to the study subject. Section 4 provides a brief description of the study area focusing on health system and health hazards. Section 5 is concerned with importance of health care services and its implications for health impacts. The impacts of cyclones on health and factors that affect the health impacts are examined in section 6. While section 7 provides the analysis of the findings of the study, section 8 presents the summary of the findings. Section 9 concludes with some recommendations.

2. Research Methodology

2.1 Selection of the Study Area

Koyra upazila was selected for study because the area is prone to cyclones and associated hazards such as storm surges, flooding, etc. due to its proximity to the Bay of Bengal, almost every major cyclone that passes Bangladesh damages the area, a considerable number of poor and illiterate people live near the coastal area and it is among the most severely affected area (by Aila) in Khulna District.

2.2 Data Collection

The study was mainly completed on the basis of primary data that was collected from the study area, Koyra Upazila of Khulna district, using a structured questionnaire. A pilot survey was also conducted for pre-testing the questionnaire. For the study, finally a total of 210 individuals were randomly selected from 7 union parishads (7X30) of Koyra upazila. Thirty people from each union were selected randomly. Out of 210 respondents, 55 percent were male and 45 percent were female. The field survey was conducted during March, 2010. Data was collected from 210 individuals selected for the purpose of the study. Information collected from the people included: disease patterns, access to medical facilities, safe water source and sanitation as well as demographic characteristics of the people. Information on all these indicators was collected using a structured questionnaire. Diseases were recorded as reported by the respondents.

Secondary sources were also used for collecting data. Journals, books, newspapers, articles and electronically available resources were used as important sources of secondary data. For collecting relevant information on the concerned issue, observation of the local people was also carried out. This is a useful tool for understanding people's perception to the impact of a disaster (Mileti 1987, Quarantelli 2002).

2.3 Method of Data Analysis

The data collected were analyzed using different methods, particularly SPSS software (16.0 version). Using this software frequency table, correlations are done. Besides these, simple tabulation, percentage charts and diagrams are used to analyze. Disease impact of the Cyclone Aila is measured by comparing the health condition of the affected families before and after the Cyclone Aila.

3. Literature Review

This section reviews some important relevant literature on health impacts of disasters like cyclones. Though a large body of studies found on the impact of extreme weathers (cyclones, floods, etc) on human health in other countries, particularly developed countries, the literature on health impacts or hazards of natural disasters like cyclone is limited in countries like Bangladesh. Some studies conducted in the context of developed nation showed that outbreaks of infectious diseases following tropical cyclones are rare in developed countries but more common in the developing world. While some studies in developing nations demonstrated no increase in infectious diseases rates following cyclones, in other instances infectious disease outbreaks had been documented.

The studies that found in Bangladesh are mostly covered topics on effectiveness of warning systems, relief and rehabilitation, hazard preparedness, behavior of the coastal people during cyclone hazard periods, and people's attitude, perception to cyclone and their coping strategy, and causes of nonuse of shelters and its on vulnerability (Haque 1995,1997, Haque and Blair 1992, Dove and Khan1995, Hoque et al 1993, Haider 1992, Ahsan and Eusuf 1994, Alam 2002,2003, Care 1991, Brac 1991). These were mainly conducted in the context of vulnerability and local coping with cyclone hazards.

Some notable studies on the health impacts of cyclones are Siddiqui and Eusof (), Unicef (1991), Bern, Sniezek and Marthbor (1993), Paul (2010), and Paul, Khaledur and Chandra (2011).

Paul (2010) examined the extent of human injuries caused by Cyclone Sidr and reported on the circumstances, type and causes of injuries, along with selected risk factors associated with such injuries. The study finds that the respondents sustained various types of injuries and the injury rate was 9.15%. The most common types of injuries were soft-tissue injuries (cuts, bruises, and scrapes) and fracture/dislocations. The most common causes of injuries for survivors were associated with falling trees. Age is significantly correlated with injuries. Several recommendations were suggested to reduce future cyclone-related injuries in Bangladesh.

A study by Unicef assesses the impact on health of the cyclone and tidal wave that struck the southern coast of Bangladesh on 29 April 1991. The study find mortality among the 135 households surveyed (pre-cyclone population 1,123) was 14 per cent. At highest risk of deaths were children of less than 10 years (26 per cent mortality) and women of more than 40 (31 per cent mortality). Almost all deaths occurred as a result of drowning from the tidal wave that accompanied the cyclone. Deaths following the cyclone were few. Diarrhea caused by *Vibrio cholera* and *Shigella dysenteriae* type 1 occurred in the post-cyclone period. No increase in other infectious diseases was identified. The major health effect of this cyclone was acute deaths due to drowning. The study suggests preventing deaths during future cyclones will require increasing accessible shelter.

Siddique and Eusof (1985) in their study analyzed death rates from the two severely affected islands, Urir Char and Sandwip, to determine the risk factors of cyclone-associated mortality. In Urir Char, in which no cyclone shelters existed, the study group lost 40% of the family members in contrast to 3.4% from Sandwip, where at least eight cyclone shelters existed. Individuals who did not seek shelter were at the highest risk. Barriers in seeking safety were physical as well as behavioral. Easy access to shelters was a significant factor in reducing the risk. Deaths could have been averted through improved timing and method of advance warning.

Bern et al. carried out a rapid epidemiological assessment to determine factors associated with cyclone-related mortality and to identify prevention strategies. The study showed that mortality was greatest among under-10-year-olds (26%) and women older than 40 years (31%). Nearly 22% of persons who did not reach a concrete or brick structure died, whereas all persons who sought refuge in such structures survived. The study suggests future cyclone-associated mortality in Bangladesh could be prevented by more effective warnings leading to an earlier response, better access to designated cyclone shelters, and improved preparedness in high-risk communities. In particular, deaths among women and under-10-year-olds could be reduced by ensuring that they are given special attention by families, neighbors, local authorities, and especially those in charge of early warnings and emergency evacuation.

The above studies mainly focus on the primary effects of cyclones. The two recent and more relevant studies are Paul, Khaledur and Chandra (2011) and Isidore et al. (2012).

Paul, Khaledur and Chandra (2011) examined the extent and pattern of illnesses experienced by Cyclone Sidr survivors in the aftermath of its landfall and investigated household and individual-level factors associated with such illnesses. This study found that the post-cyclone incidence of water-borne, respiratory, and other diseases was not unusually high. Only 52 persons suffered Sidr-related illnesses, and their illnesses were significantly associated with household income, and gender and age of the Sidr survivors. A major outbreak of such diseases was largely avoided because of the proper distribution of food and safe drinking water, as well as the timely implementation of health care intervention measures.

Isidore et al in their interesting paper titled “Preventing and Controlling Infectious Diseases after Natural Disasters” review risk factors and potential infectious diseases resulting from the secondary effects of major natural disasters, classify possible diseases, and give recommendations on prevention, control measures and primary healthcare delivery improvements. The overwhelming majority of deaths immediately after natural disasters are directly associated with blunt trauma, crush-related injuries and burn injuries.

The risk factors for increased infectious diseases transmission and outbreaks are mainly associated with the after-effects of the disasters rather than to the primary disaster itself or to the corpses of those killed. These after-effects include displacement of populations (internally displaced persons and refugees), environmental changes and increased vector breeding sites. Unplanned and overcrowded shelters, poor water and sanitation conditions, poor nutritional status or insufficient personal hygiene are often the case.

They classified diseases as either water-borne, air-borne/droplet or vector-borne diseases, and contamination from wounded injuries. The most documented and commonly occurring diseases are water-borne diseases (diarrhoeal diseases and Leptospirosis). The paper suggests re-establishing and improving the delivery of primary health care.

There remains an absence of research into the whole context of vulnerability to health hazards and coping strategies with such hazards. This study is a little effort to research on the health hazards caused by cyclone Aila and their impacts on the health of the people of cyclone affected area.

4. Description of the Study Area

The purpose of this section is to provide the description on characteristics of the area along with description on health systems and climatic hazards. The study was conducted in all the unions of Koyra upazila under Khulna district. Koyra upazila was selected for the study because the area is prone to cyclones and associated hazards such as storm surges, flooding, etc. due to its proximity to the Bay of Bengal, almost every major cyclone that passes Bangladesh damages the area, a considerable number of poor and illiterate people live near the coastal area, and in houses that are mostly thatched roof with straw and mud walls that increase their vulnerability to natural hazards, especially high velocity cyclones, and it is among the most severely affected area (by Aila) in Khulna District.

Koyra is the largest upazila of Khulna district and occupies an area of about 1775.41 sq km, including 951.66 sq. km of forest. It ranks 5th in terms of number of household and population and 14th in terms of sex ratio and literacy among the all upazilas of Khulna district. It consists of 7 union parishads, 72 mouzas and 131 villages. The most important rivers crossing the study area are Shibsa, Pasur, Kobadak, Dharla, and Malancha. The upazila is bounded by Paikgachha upazila on the north, the Bay of Bengal and the Sundarbans on the south, Dacope upazila on the east, Assasuni and Shyamnagar upazila on the west.

The study area belongs to the Southwestern Region of Bangladesh, which has been subjected to a plethora of hydro-geo-morphological hazards which include poor drainage through its river systems, high rates of sedimentation on river beds, acute low flow conditions during the dry season, salinity ingress along the rivers, cyclonic storm surge, moisture stress in the dry season, rise in sea level, and to a lesser extent, flood (Halcrow-WARPO, 2001). As the region is located in the coastal zone, it is significantly influenced by tidal effects. Majority of the land is within one

meter from mean sea level, a significant proportion of which again falls below high-tide level (Islam, 2005). The Sundarbans is located in this region. It provides various ecosystem services to people living in the SW region and the South-central region. It often takes on the first blow of cyclonic storms rushing to the SW region, thereby reducing the extent of damages.

The average temperature in the surface ranges between 0.5 and 0.6°C. The region receives an average rainfall of about 1980 mm per annum, while about 78.3 per cent of its falls within the four months of monsoon.

The total population of this upazila is 192,534; of which male is 95,993 and female is 96,541. The population density is about 743 per square kilometer, as against the average national density of 839/km². The number of households is 38394. The per household population is about 5.01, which is higher than the average for the country as well as the average of the Khulna district (4.76). A large fraction of the population belongs to two categories: children and old. About 41 per cent of population belongs to age group of below 15 years. The literacy rate of this upazila is 44.5 percent (population 7+yrs); of this, male literacy rate is 53.2 and female 36 percent.

Rice is the single dominant crop in this upazila. The other major seasonal crops are paddy, potato and vegetables. The general occupation of the inhabitants is farming, particularly rainfed paddy cultivation, followed by agricultural labor, commerce and fishing.

The primary economic activity of the majority of the population in the study area is household work, followed by agriculture, other and busyness. Agriculture/forestry/livestock is the major source of income, followed by agricultural labor, business and fishing.

4.1 Health and Health Systems

Like other areas of the country, the health care scene in the study area is not impressive. Access to health care is limited. There are no health service facilities at ward level. A large portion of the population, particularly child and women, suffered acute malnutrition. Malnutrition heightens the susceptibility of low-income populations to disease risk during hazard event. Dysentery, gastric, skin diseases, asthma and eye problem are the most common diseases in this upazila.

Provision of water and sanitation has important bearing on the risk of disease during hazards. Ponds, deep tube wells and tap are the principal sources of drinking water. About 36 percent of the population takes their water from deep tube wells, 54.6 percent takes water from ponds and only 1.15 percent from tap. More than 31 percent and 8.6 percent of people has no toilet facilities. A significant portion of the people has no toilet facilities. Salinity has put severe form of constraints in terms of availability of safe drinking water. Absence of safe sanitation services and supply of safe drinking water has been culminated into rather high rates of water-borne diseases, including skin diseases and reproductive health disorders.

In Koyra upazila both public and private sector health services are present. The only government hospital offering health care is located at upazila headquarters. Data was not available on the number of private practices. It is assumed that the private sector is not prominent; it is seldom utilized by the lower-income poor population, particularly rural.

4.2 Natural Hazards

The major natural hazards for Koyra upazila is the passage of tropical cyclones, floods, etc. Flooding from high seasonal (non-storm) rainfall also occurs in most years but tends to be a localized problem. Flash floods can occur in some localities.

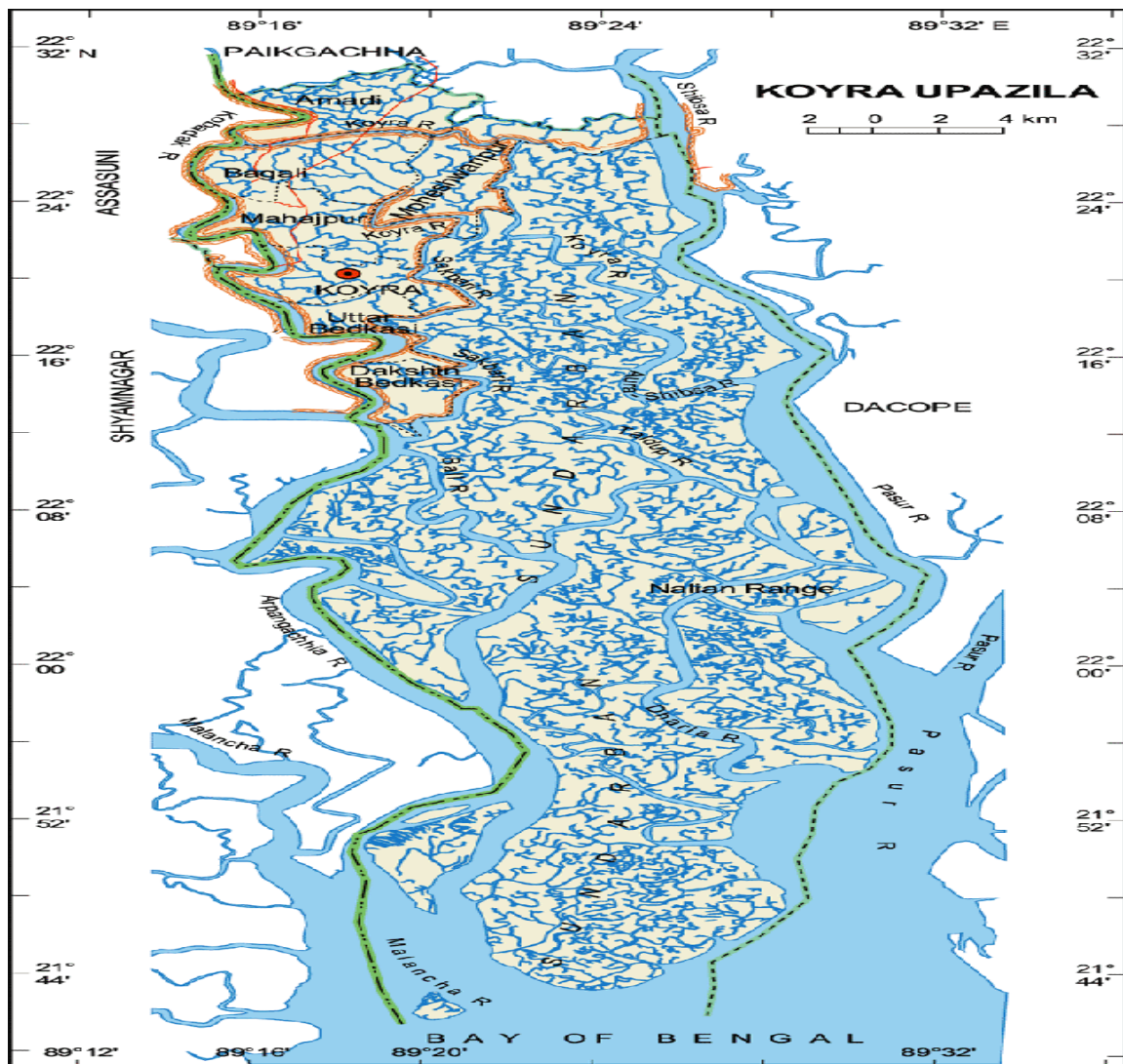
The focus is here on hazards caused by cyclones. These include storm surge damage along coastlines, wind destruction, high water levels and flooding from extreme rainfall. The highest risk areas are low lying areas situated near the coast. As well as bringing risk of death, injury and

disease, and damage to homes and infrastructure, these hazards have major effects on the livelihoods of the poor. Many subsistence crop farmers are at particular risk because the growing season for their crop coincides with the storm season. Catches of fish can decline following major tropical cyclones, and high winds and waves threaten to damage fishing boats and shrimp farms.

The major cyclones and floods that have been recorded in Khulna district since the 1960, including 15. Of the more recent tropical cyclones is the Cyclone Sidr, category 4 storm, which hit the region in 2007, with winds up to 250km/hr. It brought widespread disaster to Khulan region. Damage was estimated at between billion US dollars and over ---homes were destroyed. Two years later Cyclone Aila hit in May 2009 as a Category 1 storm, and again caused immense damages. All unions of this upzila in the study had been severely affected by Aila.

This upazila is frequently affected by storms and floods, flash floods, tornadoes, etc throughout the year. To assess the magnitude and prevalence of illnesses and diseases, particularly communicable, caused by cyclone Aila, seven union parishads of Koyra upazila have been selected as study areas which were badly affected by the category 1 cyclone named Aila.

Map of the Study Area



Source: www.Google.com

6. Natural Disasters and Health Care Services: Implications for Health Impacts⁶

In Bangladesh the major diseases, particularly communicable, prevalent following the natural disasters like cyclones are diarrhea, dysentery, typhoid, cough, fever, skin infection, etc. These are responsible for high mortality, particularly among children. Malnutrition is also common, particularly among women and children. Sanitation is also poor. The prevalence of these diseases can be reduced through proper health care programs along with preventive and controlling measures.

A large number of people in rural Bangladesh primarily depend on government provided basic health services. Though much attention was paid to the expansion of primary health care facilities in rural areas over the years, namely union health centers, these services were insufficient and limited to meet the local health demand and to mitigate the hazards caused by cyclones. There is only 1 public hospital for each upazila. The people needed a long time to reach their nearest health centers.

Cyclones caused serious damage to infrastructure (road, communications, health infrastructure, etc.) and property. All these have significant health impacts and caused an increase in demand as well as a dramatic drop of supplies for health services. The people who were injured and who could survive the cyclone uninjured all face increased health risks. Due to increased health risks, health problems like cold, fever, diarrhea, skin infection, rash, mental and psychological problems arise.

The supplies for health care services decreased as health care facilities were severely damaged by the cyclones and storm surges. The cyclone mostly affected rural public health facilities that serve more remote and rural populations, namely UHCs and resulted in the disruption of health services to the majority of the rural population and the poor who rely on these facilities and were most affected by the cyclone. The reasons for serious damage of public health care facilities were severity of the cyclone and storm surge, weak structure and sub-standard construction and engineering techniques used to build the facilities, lack of government support and funding for rural facilities.

Damage to health facilities was also accompanied by losses in equipment, medical supplies, vehicles, and ambulances. Human resources in health are also significantly affected. For example, several health professional in the areas affected by the cyclone lost their lives or ran away, decreasing the supplies of health workers in rural areas.

The number of doctors and health professionals, based in rural areas, after the cyclone decreased significantly. Most housing quarters of public health professionals in affected rural areas totally collapsed, many become homeless and are more likely to leave the rural areas for towns to stay. Indeed, the government has insufficient trained health professionals to replace those who died or injured by the cyclone, or those who ran away or needed to leave the rural areas due to the cyclone.

Due to damaged health facilities, equipment, medical supplies and losses of health professionals, there is a sharp drop in crucial health services offered to people in the rural areas affected by the cyclone.

⁶ This portion is heavily drawn on Sutayut Osornprasop, Globalization of Natural Disasters and Its Implication of Health Care Services: Case Study of Cyclone Nargis in Myanmar, World Bank.

7. Health Impacts of Cyclones and Factors Affecting the Health Impacts

7.1 Health Impacts of Cyclones

This section describes the health impacts of cyclone and related hazards. Cyclones generate three types of major hazards: strong winds, heavy rainfall and strong surges. These are also called as devastating components of cyclones. These three components created various types of health risk effects.

Heavy winds cause damage to life and properties and carry debris which causes injuries to people. Heavy rains associated with cyclones lead to flash floods, a major cause of deaths. Fresh floods cause pollutants to enter the water system and contaminated the surface and water system. Storm surges cause coastal flooding, particularly in low-lying lands. It caused greater damages to soil salinity and sanitations. Floods pose hazard to existing sanitation and drinking water systems.

However, cyclones impact on health can be divided into two types: direct and indirect. Direct impacts include injuries, drowning, and death result from building collapse, wind strewn debris, and flooding. Drowning is the major cause of deaths. Deaths due to drowning are associated with the inadequate evacuation and preparation of the population. Death also caused by physical damage to buildings and trees, which results in trauma. The major injuries are cuts, puncture wounds and –trauma caused by flying particles.

Indirect impacts occur as a result of damage to the local infrastructure (health, roads, communications, buildings, etc), population displacement and ecological change. Damage to water and sanitation networks, lack of food and housing and access to health care result in a significant increase in cases of gastroenteritis and other infectious diseases. The indirect impacts include: infectious diseases, malnutrition, poverty related diseases and diseases associate with displaced population. Direct and indirect impacts can lead to impairment of the public health infrastructure, psychological and social effects and reduced access to health care services.

Cyclones also have some long term effects. These include: mental health problems, disability, and social disruption. Mental problems may derive from physical health problems or from personal losses, social disruption and economic hardship. Disability may be associated with the exacerbation of chronic diseases such as asthma, ear problem.

In short, the health impacts of cyclones include:

- physical injury
- impacts on mental health
- increased risk of water related and infectious diseases due to disruption of water supply and sewage systems, population displacement and overcrowding
- release and dissemination of dangerous chemicals from storage sites and waste disposal sites into flood waters
- increase in food shortages and malnutrition due to destruction of crops and contamination of irrigation of cropland waters
- increase of vector borne diseases due to destruction of protective housing

7.2 Factors Affecting the Health Impacts

The impacts of cyclones on the human are related to the location and typography of the area, cyclones type, human demographics, characteristics of the infrastructure and management of health care.

7.2.1 Cyclone type

Cyclones are of various category and types. Each category caused damage and impacts differently. Injury and death and drowning are caused by windblown debris, flowing particles, falling trees, collapse of houses, electric shock, etc.

7.2.2 Location and topography of the area

Location is an important factor determining peoples vulnerability to health hazards associated with cyclones. Areas near to the sea, low-lying areas (affected by riparian flood and gradual inundation) are more vulnerable to storm surge, which is the main cause of death. Steep and mountainous terrains experience landslides/mudslides which is a major cause of mortality.

7.2.3 Demographic characteristics

Demographic characteristics include age, education, gender, occupation, housing pattern, etc. According to Ikeda (1995), disaster can impact differently on people depending on their age, class, gender and social status.

The most affected communities are of low educational level, low social status (poor community). Women, Children, aged, disable people are prone to different types of illnesses and diseases. Female are generally more vulnerable than man and the incidence of illness and diseases is less among the educated.

Scattered settlements near to the coast and linear settlements along the coastal embankments (straw and bamboo houses) are more susceptible to cyclonic sea surge. Houses on the inner part of the island and coastal areas are less susceptible to severe cyclonic winds and sea surges.

7.2.4 Pattern of infrastructure

Infrastructure characterized by weak structure, poor designed, substandard construction and techniques are more susceptible to damage, mostly collapsed by cyclones. Strong and good structured facility withstand with the cyclone much better than the poor quality structure.

7.2.5 Health care Facility

Cyclone resulted in the destruction or severe damage to the health care facilities which in turn decrease or disrupt the health care services to the people, mostly rural poor. The areas that are least equipped with health care facilities are increasingly at risk of affected by hazards associated with disasters. Damage to health facilities includes losses in equipment, medical supplies, vehicles and ambulances.

8. Analysis and Results

This section presents the analysis of research findings from the study. Analysis and results have been done in three sections: demographic analysis, factor basis analysis and correlation analysis.

8.1 Demographic Analysis

It includes the age and sex composition, educational status and occupational patterns of the respondents. These are influential factors affecting the health impacts of cyclones. Table 7.1 outlines the some major demographic characteristics of respondents in the study area.

8.1.1 Age

Age is one of the important factors to get the reliable date, which in turns makes the findings of the research more authentic. The age group ranges from 20-29 to 60+ years. Out of 210

respondents, the largest % belonged to the age group of 40-49 years, followed by the age groups of 30-39 years and 60+ years. Only 15.23 percent represents the age group of –years. In general, young age group and females are prone to different types of diseases.

8.1.2 Occupation

Most of the respondents are engaged in agriculture, followed by non agricultural laborer. The least in service. Among the female respondents, majority is housemaker; only few are involved in fishing.

8.1.3 Educational Status

Education is one of the most influential factors affecting the people's health. It helps people to take more care about their health. Moreover, the incidence of illnesses and diseases is less among the more educated people. As shown in Table 7.1, 56.21% respondents were not literate. Forty percent studied up to primary level, 1.42% up to secondary level and 1.9% degree and above. The data presented in table 7.1 indicate that 43.79% of the total respondents are literate, indicating there is some access to information, particularly cyclone warning and health.

8.1.4 Sex

Sex is an important factor affecting the health status of the respondents, particularly women. The number of male respondents is larger than female respondents in this study. Among the respondents, 55 % are male and 45 % are female. In general, females are more prone to different types of diseases rather than males.

TABLE 7.1
Select Demographic Characteristics of the Sample Population

Particular	%
Age group	
20-29	15.23
30-39	25.75
40-49	28.09
50-59	13.32
60+	17.61
Sex	
Male	55
Female	45
Education	
No Schooling	56.21
Primary	40
Secondary	1.42
Higher Secondary	.476
Degree and above	1.9
Occupation	
Farming	44
Fishing	15
Business	13
Service	2
Day labor	15
others	11

Source: Direct questionnaire survey, March 2010

8.2 Factor Basis Analysis

8.2.1 Health Hazards Due To Pattern of Household, Sanitary/Toilets Level and Water Usage

Pattern of household is one of the most important factors determining people’s vulnerability to cyclone and thus to cyclonic hazards. It also determines the human health status. It is common that kutchra houses are more susceptible to severe cyclonic wind, storm surges, etc.; these houses consist of straw, bamboo. As shown in Table 7.2, % of the respondents of the study area lived in Katchra houses. Only % lived in pucca houses. It is interesting to note that % of the respondents do not have any house. They mostly lived either in open space, on embankments or on the road side, mostly in jhupri.

TABLE 7.2
Household Pattern of the Respondents

Household Pattern	Percentage (%)
Pucca	0
Semi pucca	5.714
Katchra	93.49
Jhupri	.5
No home	.30
Total	100 (N=210)

Source: Direct questionnaire survey, March 2010

In the study area, about 94 percent of the households were damaged, mostly katchra houses. Following Cyclone Aila, a majority of the residents from the study area sought some sort of shelter. % of the residents sought shelter in cyclone shelter centers, % went to a, % ----.However, % of the respondents did not seek shelter (Table 7.3). The reasons may be: they would be safer in their house, storm would not be severe, no place to go, not enough time to reach the shelters, etc.

TABLE 7.3
Seek Shelters

Shelter place	%
Cyclone Center	21
School	4
Relatives’ house	9.5
Roadside	40
Embankments	12.67
Union council	12.3
Do not seek shelter	.53

Source: Direct questionnaire survey, March 2010

One of the important causes for increased health risks is low sanitation level. Availability and pattern of sanitation/toilet have great impact on human health. There is a popular slogan: Make hygienic toilet and stay safe. In the study area, 90 percent respondents had toilets before aila. Among them 97.62 percent were unhygienic (katchra toilets) and the rest were hygienic toilets (sanitary latrines), indicating how severe the condition of sanitary system. Use of unhygienic toilets lead to many diseases like urinary tract infection. The study area had a high coverage of

latrines before aila, a large number of which were heavily damaged due to aila. About 88 percent of the toilets were severely damaged; only 2.4 percent were not damaged.

Due to damage of the toilets, respondents had to use different places as toilet. Most of those who lost their latrines defecated openly. % defecated on the roadside, % riverside, % embankments and % on the branch of trees. It is found that only 31.5 % respondents could reconstruct their toilets.

TABLE 7.4
Availability, Type, Damage and Use Pattern for Defecation of Latrines

	%
Pattern of latrines	
Sanitary	5
Pucca	10
Katcha	45
Open places	40
Availability of Latrines	
Yes	90
No	10
Damage of Latrines	
Yes	87.61
No	2.39
No toilet and no damage	10.00
Places used for Defecation	
Roadside	28.71
River Bank	23.41
Embankment	5.85
Bush	8.29
Branch of trees	.48
other	33.26
Reconstruction of Latrines	
Yes	31.53
No	68.47

Source: Direct questionnaire survey, March 2010

A major cause for increased health risks (water borne diseases) is unsafe water usage. Cyclonic storm surges contaminated the water sources and damaged the sewage system. Moreover, fecal contamination of livestock and crops also leads to the spread of infectious diseases. As can be seen from Table 7.5, out of all respondents about 84 percent of the respondents water sources were damaged. As a result, they had to use water, particularly drinking purposes, from the unsafe sources.

TABLE 7.5

Damage of the Drinking Water Sources

State	Percentage (%)
Yes	83.93
No	16.07
Total	100 (N=210)

Source: Direct questionnaire survey, March 2010.

8.2.2 Health Hazards Due to delayed onset, that is, extended stays in Shelters

Delayed onset means extended stays in crowded shelters with insufficient sanitary facilities, disruption and contamination of food and water supplies, and low immunizations rates. It is a major cause of infectious diseases like typhoid and paratyphoid fever, infectious hepatitis, gastroenteritis and measles. In the study area, it is found that 68.4 percent of the respondents could not return home after cyclone aila, some could not even after more than one year.

8.2.3 Health hazards due to changes in Food Taking Behavior

The food taking behavior of the study area people changed significantly. As can be seen from Table 7.6, 94.5 percent of the respondents took sufficient food before aila, which stood at 5.23 after aila. As a result, incidence of fasting increased greatly. It was found that 67.7 had to pass 1-2 days without food, 24.9 percent 3-4 days and 7.4 percent 4 and above days (Table 7.7). The major causes of insufficient food taking may be loss of income from damages to crops, property, etc. Malnutrition causes various diseases as well as stress.

TABLE 7.6

Comparison of Amount of Taking Food before and after the Aila

State	Before	After
	Percentage (%)	Percentage (%)
Sufficient	94.76	5.23
Insufficient	5.24	94.77
Total	100 (N=210)	100 (N=210)

Source: Direct questionnaire survey, 2010.

TABLE 7.7

No. of Days Passed without Food by the Respondents

Days	Percentage (%)
1-2	67.72
3-4	24.86
4+	7.40
Total	100 (N= 189)

Source: Direct questionnaire survey, 2010.

8.2.4 Access, non-access to health care facility and unwillingness to take treatment

A significant proportion of the respondents (43.3 percent) who were affected by different diseases did not go to hospitals for taking treatment. About 57 percent went to doctors/hospitals in the case of their illnesses and diseases (Table 7.8).

Availability of medicine and doctors is also important to manage the post hazards of the cyclone. The findings of the present study reveal that 75.1 percent of the respondents reported they got available doctors and medicine before aila, which came down to 38.4% after Aila (Table 7.8). Timely treatment reduces the risks of diseases.

TABLE 7.8

Comparison of Availability of Doctors and Medicine before and after the Aila

State	Doctors		Medicine	
	Before	After	Before	After
	Percentage (%)	Percentage (%)	Percentage (%)	Percentage (%)
Available	75.12	38.38	72.27	31.18
Unavailable	24.88	61.62	27.73	68.81
Total	100 (N=210)	100 (N=210)	100 (N=210)	100 (N=210)

Source: Direct questionnaire survey, March 2010

8.2.5 Diseases and Illnesses Impacts of Cyclone Aila

The most severe impact of the cyclone aila is on the health of the people of affected area. About 95.2 percent people were affected by various diseases after cyclone aila, only 4.8% did not affected. Waterborne diseases are the most common in the study area due to contamination of water sources. Table 7.9 presents data regarding the prevalence of various types of diseases and illnesses among the people of the affected area. Different types of diseses and illnesses affect the health differently.

Diarrhea

Diarrhea and dysentery are the major causes of morbidity. Prior to the cyclone aila, 3.1 percent and 22.8 percent of the respondents were suffered from diarrhea and dysentery, after aila this has increased to 92 percent and 79.5 respectively.

Asthma

It is widely assumed that the incidence of asthma increase in the aftermath of cyclone as a consequence of exposure to winds, cold conditions and prolonged humidity. It is one of the major causes of morbidity and mortality, particularly among children under 5. As shown in Table 7.9, asthma incidence in the study area was lower (25.4%) during pre cyclone period, which increased greatly to 54 percent after cyclone aila incident—a 50 percent increase in the incidence of asthma.

Skin diseases

Skin diseases were found to be prevalent among the people after cyclone aila. As can be seen from Table 7.9, only 19.6 percent people reported suffered from skin diseases before aila, which rose to 63.4 percent after aila.

Cough

As shown in Table 7.9, there was a significant increase of the percentage of respondents affected by cough, rising from 24.6 percent in pre cyclone aila to 61.2 percent in post cyclone aila.

Rash

The risk of rash was not increased significantly. Prior to aila, 36.2 percent respondents reported the incidence of rash, which increased slightly to 40.2 percent after cyclone aila.

Other health problems

Ear problem was widely spread among people in the study area. 60.3 percent respondents complained of ear problem after aila, which was 36.6 percent before aila. The study also found that 47.3 of the respondents complained of weight loss after aila, which was 20.5 percent before Aila. Acidity was also prevalent significantly among the respondents (before 34.8 percent vs. after 58.5 percent).

TABLE 7.9
Incidence of Diseases Reported by the Respondents

	Before Aila	After Aila
Diarrhea	3.1	92.0
Dysentery	22.8	79.5
Skin Diseases	19.6	63.4
Asthma	25.4	54.0
Cough	24.6	61.2
Acidity	34.8	58.5
Rash	36.2	40.2
Ear problem	36.6	60.3
Loss of weight	20.5	47.3

Source: Direct questionnaire survey, March 2010

8.3 Correlation Analysis and Hypotheses Testing

Hypothesis 1 stated that there is no correlation between age of the respondents and being attacked by diseases. As the p-value is greater than .05, the null hypothesis is supported, indicating any person of any age can be attacked by any disease and that happened to Aila affected area. People of different ages were suffered from different diseases.

TABLE 7.10A
Age of the Respondents and attacked by any disease

		Age of the respondents	Have you been attacked by any disease?
Age of the respondents	Pearson Correlation	1	-.026
	Sig. (2-tailed)		.705
	N	210	210
Have you been attacked by any disease?	Pearson Correlation	-.026	1
	Sig. (2-tailed)	.705	
	N	210	210

Hypothesis 2 stated that there is no correlation between occupation of the respondents and pattern of household. However, the null hypothesis is supported as the p-value is greater than .05. That means any person may have any type of house regardless of his occupation. Rather household pattern may have a relationship with income.

TABLE 7.10B
Occupation of the Respondents and Pattern of Household

		Occupation of the respondents	Pattern of household
Occupation of the respondents	Pearson Correlation	1	-.104
	Sig. (2-tailed)		.135
	N	210	210
Pattern of household	Pearson Correlation	-.104	1
	Sig. (2-tailed)	.135	
	N	210	210

Hypothesis 3 predicted that there is no correlation between occupation of the respondents and pattern of toilet. This is also supported as the significance level is greater than .05. The results show very sad picture because we want to believe that when people belongs to well occupation they make sanitary toilet. But the Aila affected is not behaving in this normal pattern.

TABLE 7.10C
Occupation of the Respondents and Pattern of Toilet

		Occupation of the respondents	Pattern of toilet
Occupation of the respondents	Pearson Correlation	1	.043
	Sig. (2-tailed)		.537
	N	210	210
Pattern of toilet	Pearson Correlation	.043	1
	Sig. (2-tailed)	.537	
	N	210	210

Hypothesis 4 indicates that there is no correlation between pattern of household and damage of household by Aila. This hypothesis is not significant as the significance level is less than .05, suggesting that those whose household pattern is strong (pucca/adha pucca) is damaged less and vice versa.

TABLE 7.10D
Pattern of Households and Damage of Households

		Pattern of household	Damage of household by Aila
Pattern of household	Pearson Correlation	1	-.019
	Sig. (2-tailed)		.00781
	N	210	210
Damage of household by Aila	Pearson Correlation	-.019	1
	Sig. (2-tailed)	.00781	
	N	210	210

Hypothesis 5 stated that there is no correlation between pattern of toilet and damage of toilet by Aila. This is not also significant as the significance level is less than .01. That means the toilets those were not strong and sanitary were damaged a lot and vice-versa.

TABLE 7.10E
Pattern of Toilet and Damage of Toilet

		Pattern of toilet	Has your toilet been damaged?
Pattern of toilet	Pearson Correlation	1	.348**
	Sig. (2-tailed)		.000
	N	210	206
Has your toilet been damaged?	Pearson Correlation	.348**	1
	Sig. (2-tailed)	.000	
	N	206	206

** . Correlation is significant at the 0.01 level (2-tailed).

Hypothesis 6 stated that there is no correlation between damaged by Aila and returning home after some days. This is rejected as the p value is less than .01. Thus it appears that there is very significant correlation between damaged by aila and returning home after some days.

TABLE 7.10F
Damage by Aila and Returning Home

		Have you been damaged by Aila	After how many days you went back home?
Have you been damaged by Aila	Pearson Correlation	1	.202**
	Sig. (2-tailed)		.003
	N	210	210
After how many days you went back home?	Pearson Correlation	.202**	1
	Sig. (2-tailed)	.003	
	N	210	210

** . Correlation is significant at the 0.01 level (2-tailed).

Hypothesis 7 posited that there is no correlation between occupation and amount of food taking. This is supported in the case of occupation of the respondents and amount of food taking after aila but it is not supported in the case of occupation of the respondents and amount of food taking before aila.

TABLE 7.10G
Occupation of the Respondents and Amount of Food Taking

		Occupation of the respondents	Amount of food taking before Aila	Amount of food taking after Aila
Occupation of the respondents	Pearson Correlation	1	.159*	-.025
	Sig. (2-tailed)		.021	.714
	N	210	210	210
Amount of food taking before Aila	Pearson Correlation	.159*	1	-.176*
	Sig. (2-tailed)	.021		.011
	N	210	210	210
Amount of food taking after Aila	Pearson Correlation	-.025	-.176*	1
	Sig. (2-tailed)	.714	.011	
	N	210	210	210

*. Correlation is significant at the 0.05 level (2-tailed).

9. Summary of the Findings

This section provides the summary of the analysis of findings. The findings are summarized as follows:

1. Out of all respondents 28.09 % (highest) belong to the age group of 40-49 year. Only 13.32% is aged more than 50-59 years. 56.21% of the respondents do not have any education of any type. Of those who are literate, a vast majority had education below. Fifty five percent of the respondents are male. The proportion of agricultural labor force is the most; other occupational groups are non agricultural laborer, service holder, farming, fishing and business.

2. The household pattern of the respondents is very weak; most of the houses are Katcha (made of straw and bamboo) (93.89%), which are more susceptible to severe cyclonic wind, sea surges. 0% lived in the pucca houses. In the study area 95.71% of the households were damaged during Aila.
3. The cyclone affected area had a high coverage of latrines before the cyclone, a large number of which were heavily damaged. Before aila 90% of the respondents have latrines, but after aila 87.61% toilets were damaged. In the study area, most of the toilets (93.8) are Katcha (unhygienic). Only 10% respondents have access to pucca latrines.
4. In the study area 87.61% toilets were damaged. As a result, they use roadside, riverbank, embankment, garden, branch of trees and other places for defecation. Thus the defecation practice is very unhygienic. The study shows that 68.47% of respondents could not repair their toilets, which led to outbreak of diarrhea.
5. The study area people suffer from diseases like diarrhea, dysentery, cough, asthma, skin diseases, acidity, eye problem and weight loss. More than 95.2% of respondents reported health problems after cyclone aila. Nearly 92% reported diarrhea and dysentery 79.5, 54% asthma, 63.4% skin infection, 40.2% rash and 47.3 % reported weight loss.
6. A comparison of the prevalence of diseases after aila with the before aila reveals that prevalence of diarrhea, dysentery, asthma, cough, skin infection has increased significantly, in some cases 50% increase, after aila, while the prevalence of rash has remained unchanged or increased slightly. Diseases like diarrhea, dysentery caused to deaths and sicknesses, while diseases like gastric, skin disease cause suffering to the people and do not lead to deaths.
7. Major sources of drinking water are tube well, followed by well, tap water, pond, river and others. The cyclone aila caused severe damage to water sources of the study area. These water sources were contaminated by all kinds of solid waste and debris as well as salt water inundation from the tidal surges. About 83.93% of the respondents reported their water sources were damaged and contaminated. This forced them to use unsafe sources. Almost 80% of the respondents reported usage of unsafe water sources.
8. Health care service utilization rate by the respondents is higher in pre-cyclone period than in post cyclone period. 57 percent of the respondents went to hospitals for treatment but a significant portion did not go to hospitals. Those who went to hospitals, only 38.38% respondents got doctors and medicine available, which was 75.12 % before aila.
9. Aila damages most of the houses in the study area. Majority of the people took shelter beside the road, followed by Embankments. A large number of people (65%) could not return to their homes after one year.
10. All the respondents in the study area used to take food 3 times a day before Aila. The situation has reversed after aila. 94.77% reported they took insufficient food and thus suffering from malnutrition. Even most of them sometimes passed days without food and thus they became very sick.
11. Demographic variables like household pattern, toilet type, damage of the home and occupation of the respondents are found to be highly correlated to damage by Aila, damage of toilets by Aila, return to home after certain days and amount of taking food respectively.

10. Conclusions and Recommendations

Cyclones result in two types of effect: primary and secondary or after-effects. The focus is here on secondary effects. The risk factors for increased infectious diseases transmission and outbreaks are mainly associated with the after effects rather than to the primary disaster or its primary effects.⁷The secondary effects include displacement of people into unplanned and overcrowded shelters, cross contamination of water sources with faecal material and toxic chemicals, due to destruction of sanitary and sewage system, collapse of health facilities and health care system, disruption of surveillance and health programs and destruction of farming activities (scarcity of food).

The study showed that communicable diseases like diarrhea, dysentery, asthma, cough, skin infection, etc are widespread and prevalent among the people of the study area. However, the incidence rates for all types of diseases are not same. Incidence rates increased greatly for all diseases except rash. The diseases that the people of the study area suffered from are the result of secondary effects. Therefore, measures recommended are mostly directed towards mitigating the risk factors associated with after effects.

10.1 Cyclone Shelters

During cyclone, a significant portion of people do not like to go safe places or cyclone shelters because they do not have sufficient safe places or cyclone shelters, if they go to shelter leave their properties and goods then they will not get it back again, relative distance of the shelters from home and lack of cyclone experiences. Those who went to a shelter they also face problems like there was not enough room to move Stay at home creates severe life risk (deaths, injuries) in the disastrous situation. So, it is necessary to build sufficient number of properly designed, located and accessible cyclone shelters⁸ so that people can take shelter during cyclone. In the study area it is also found that along with formal cyclone centers informal centers like schools, mosques and private brick built homes were also used as shelters⁹. About 21% of residents sought shelters in an informal cyclone shelter. Government and private financed schools, mosques should be built in higher ground and proper places with maintaining quality and standard.

Not only shelters but roads and transportation are also important during cyclone. According to the survey, communication system in the study area is not well developed. It is found that communication systems may influences 50% of travel time to go to cyclone shelters (Islam et al. 2004).

10.2 Drinking Water and Sanitation

Cyclone causes serious damages to the water supply and sanitation system. As drinking and water services damaged and contaminated due to submergence and contamination by onrush of saline water and surge, people are compelled to use polluted water and thus suffer from diarrhea and

⁷ Isidore et al.(2012) observe, --that disaster does not transmit infectious diseases, that the primary cause of death in the aftermath of a disaster is non-infectious, that infectious disease outbreaks result secondarily from exacerbation of disease risk factors. According to them, the risk factors are population displacement from no endemic to endemic areas. Overcrowding (close and multiple contacts), stagnant water after flood and heavy rains, insufficient/contaminated water and poor sanitation condition, high exposure and proliferation to disease vectors, insufficient nutrient intake/malnutrition, low vaccination coverage and injuries.

⁸ Study found that fifty percent of family members were killed in an area without shelter access, in contrast to 3.4 percent in area with available shelters (siddiqui and Eusof 1987, also see).

⁹ Koyra upazila has only cyclone shelters for the whole population in the area.

other water borne diseases. To mitigate the post cyclone sufferings and loss of lives the water and sanitation sector should be given proper care. The tube-well installation should be made in such a place and elevation that these will not go underwater during the cyclone and can be recovered immediately after the cyclone. Ponds should be protected by raising the embankment of the ponds at the level of storm surge.

10.3 Relief and Rehabilitation

Due to lack of proper distribution system and monitoring people who most suffer do not get sufficient food assistance. A study shows that due to appropriate and effective health relief and rehabilitation after the 1991 cyclone, it was possible to control the spread of communicable diseases and mortality post cyclone (Rahman and Bennisish 1993). A well managed, monitored relief and rehabilitation program is needed to incorporate all the sufferers from cyclones.

10.4 Monitoring and Surveillance of Disease

Monitoring is important to check for disease outbreaks after cyclones and to safeguard the health of vulnerable groups before, during and after the cyclones. The monitoring functioning of the health sector has to be improved. As health sector and public health depend on support sectors and their capacity to cope during events – roads, transport, electricity, water and shelter infrastructure that affect the ability of health services to function effectively, capacity of health systems should be improved to mitigate health impacts and to deliver health care properly. Moreover, reconstruction or renovation of local public health facilities needs to be undertaken. The quality and quantity of health personnel in rural areas also needs to be improved significantly.

10.5 Preparedness is the key

Preparedness is the aggregate of all measures and policies taken by humans before an event occurs that reduces the negative impact that otherwise would have been caused by the event (Sundnes and Birnbaum, 2003). Emergency health preparedness includes activities such as risk assessment, planning, hazard monitoring, early warning, and population protection measures. The objectives of preparedness for health emergencies are (Lechat, 1985): Prevent morbidity and mortality, Provide care for casualties, Manage adverse climatic and environmental conditions, Ensure restoration of normal health, Re-establish health services, Protect staff, and Protect public health and medical assets.

The actions required to meet these needs are: 1. Preventive measures (e.g., building codes, floodplain management), 2. Protective measures (e.g., early warning, community education, evacuation, shelter), 3. Life-saving measures (e.g., rescue, relief) and 4. Rehabilitation (e.g., resettlement, rebuilding)

These measures may be taken to protect human health from the hazards of cyclones. It will likely take generations to restore the Aceh province (Indonesia) to pre-event levels, even with the assistance of nearly all of the richest nations on Earth. The world can no longer afford to sustain these significant losses in human development caused by these types of catastrophic natural disasters. *Preparedness is the key to preserving human health* in the wake of cyclone and tsunami disasters.

In fine, it can be said that cyclones like Aila cannot be avoided or prevented but the hazards, particularly health hazards, that caused cyclones could be minimized or reduced to a great extent, through effective preventive, controlling and surveillance measures as well as appropriate and effective public health care management.

References

- Alam, E. (2002) *Post cyclone adjustment Process: The case of Sandwip, Bangladesh*. Unpublished MSc Thesis, Department of Geography and Environment, University of Dhaka, Bangladesh.
- Alam, M.E. (2003) 'Post cyclone adjustment process: basic needs perspective'. *Oriental Geographer*. 47(2). pp. 47–60.
- Alam, E., Bhuiyan, R.H. and Akbar, M.T.(2003) 'Cyclone disaster in coastal Bangladesh: local knowledge and indigenous coping strategies'. *Bhugal Patrika (A Journal of Geography)*. 22. pp. 124-133.
- Ali, A. (2006) 'Vulnerability of Bangladesh to climate change and sea level rise through tropical cyclones and storm surges'. *Water, Air and Soil Pollution*. 92(1 and 2). pp. 171–179.
- Ahsan, R.M. and A.Z. Eusuf (1994) 'Determinants of spatial and gender differences in coastal cyclone shelter use in Island and Mainland Areas in Cox'sBazar'. *Oriental Geographer*. 38 (1 and 2). pp. 44–58.
- Bern C, Sniezek J, Marthbor GM. Risk factors for mortality in the Bangladesh cyclone of 1991. *Bull World Health Organ* 1993;71:73–8.
- CARE (Cooperation for American Relief Everywhere) (1991) *After the Storm: Bangladeshi Response to the Cyclone*. CARE-Bangladesh, Dhaka.
- Dove, M.R. and M.H. Khan (1995) 'Competing constructions of calamity—the April 1991 Bangladesh cyclone'. *Population and Environment*. 16(5). pp. 445–471.
- Haque CE. Climatic hazards warning process in Bangladesh: experience of, and lessons from, the 1991 April cyclone. *Environ Manage* 1995;19:719–34.
- Haider, R. (ed.) (1992) *Cyclone '91 Revisited: A Follow-up Study*. Bangladesh Centre for Advanced Studies (BCAS), Dhaka.
- Haque, C E 1997, Atmospheric Hazards Preparedness in Bangladesh: A Study of Warning, Adjustments and Recovery from the April 1991 Cyclone, *Natural Hazards*, vol.16, pp181–202.
- Haque, C.E. (1995) 'Climatic hazards warning process in Bangladesh—Experience of, and lessons from the 1991 April cyclone'. *Environmental Management*. 19(5). pp. 719–734.
- Haque, C.E. (1997) 'Atmospheric hazards preparedness in Bangladesh: a study of warning, adjustments and recovery from the April 1991 cyclone'. *Natural Hazards*. 16(2–3). pp. 181–202.
- Haque, C.E. and D. Blair (1992) 'Vulnerability to tropical cyclones-evidence from the April 1991 Cyclone in Coastal Bangladesh'. *Disasters*. 16(3). pp. 217–229.
- Hoque B.A. et al. (1993) 'Environmental health and the 1991 Bangladesh cyclone'. *Disasters*. 17(2). pp. 143–152.
- Ikeda, K. (1995) 'Gender differences in human loss and vulnerability in natural disasters: a case study from Bangladesh'. *Indian Journal of Gender Studies*. 2(2). pp. 171–193.
- Islam, M.A. (1974) *Human Adjustment to Cyclone Hazards: A Case Study of Char Jabbar*. The Natural Hazards Research Working Paper Series. No. 18. Natural Hazards Centre, Boulder, CO.

- Islam, R I 2006, „Managing Diverse Land Uses in Coastal Bangladesh: Institutional Approaches“, in C T Hoanh , T P Tuong, J W Gowing & B Hardy (eds), *Environment and Livelihoods in Tropical Coastal Zones*, pp.237-248. CAB International.
- Mileti DS, O’Brien P. Warnings during disaster. *Soc Probl* 1992; 39:40–57.
- Mileti DS. *Disasters by design*. Washington, DC: Joseph Henry Press, 1999.
- Mileti D.S. (1987) ‘Sociological methods and disaster research’. In R. Dynes, B. de Marchi and C. Pelanda (eds.) *Sociology of Disasters: Contribution of Sociology to Disaster Research*. Franco Angeli, Milan. pp. 57–69.
- Nyan Win Myint et al. (2011) Are there any changes in burden and management of communicable diseases in areas affected by Cyclone Nargis? *Conflict and Health* 5:9.
- Quarantelli, E.L. (2002) ‘The Disaster Research Center (DRC) field studies of organized behaviour in the crisis time period of disasters’. In. R.A. Stallings (ed.) *Methods of Disaster Research*. Xlibris Corporation, Philadelphia, PA. pp. 94–126.
- Rahman, M.O. and M. Bennish (1993) ‘Health related responses to natural disasters: the case of the Bangladesh cyclone of 1991’. *Social Science and Medicine*. 36(7). pp. 903–904.
- Shultz, J M, Russell, J& Espinel, Z 2005, „Epidemiology of Tropical Cyclones: The Dynamics of Disaster, Disease, and Development“, *Epidemiologic Reviews*, vol. 27, no. 1, pp 21-35.
- Siddique AK, Eusof A. Cyclone deaths in Bangladesh, May 1985: who was at risk? *Trop Geogr Med* 1987; 39:3–8.