

# Causes & Impacts of Flood Disaster in Bangladesh: Special Focus on Public Health

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## Abstract

**Introduction:** Bangladesh is one of the disaster-prone countries in the world and the flood is the most common natural hazard, because of its geographical characteristics, extensive rivers network, climate change effects, monsoon climate, and the coastal morphology. **Aims:** This study aimed at exploring the causes of flood disasters in Bangladesh and its impacts on socioeconomic and public health. **Methodology:** This study utilized quantitative data from the Centre for Research on the Epidemiology of Disasters (CRED) and other databases. **Results:** From 1985 to 2019 the country has experienced a total of 234 natural disasters and among total disasters, storm and flood are common disasters which represent 51.71% and 31.62% respectively. Within 34 years (1985-2019) the country was flooded 74 times and the 10965 people died with 222371823 people were affected and total economical damage was 12131800 ('000US\$). **Conclusion:** The flood impact in Bangladesh on socioeconomic, public health is significant. After the flood, early health effects are skin infection, pneumonia, respiratory infection and late effects are mosquito-borne illnesses, hepatitis A or E virus infection, and mental disorders.

**Keywords:** *Flood, Causes, Impacts of Flood, Bangladesh, Health Impact.*

## Introduction

The World Health Organization has reported that worldwide around 90000 people are killed and closely 160 million people are affected every year by natural disasters. Natural disasters include earthquakes, tsunamis, volcanic eruptions, landslides, hurricanes, floods, wildfires, and heat waves.<sup>1</sup> Globally, 4000 massive natural disasters had been accounted for estimating 1.5 million deaths during 2005-2015.<sup>2</sup> In the world, Bangladesh is one of the most vulnerable countries in terms of natural and anthropogenic disasters and Floods are a normal phenomenon in Bangladesh. Flood usually occurs during the monsoon season, normal flooding incidents in July and September.<sup>3</sup>

Over the last few decades, climate change acted as a risk factor for increasing flood-related risks in the South Asian region. Scientifically projections confirm that in the main river basins of India, Bangladesh and Nepal will considerably increase risks of flooding.<sup>4</sup> During the monsoon season more than 75% of rain occurs in Bangladesh, due to weak tropical depressions which are brought from the Bay of Bengal into Bangladesh through the wet monsoon winds.<sup>5</sup> Approximately 90 percent of the damage related natural disasters are occurred by floods and associated ruins flows. Floods can damage and destroy homes and farms, displace families, livestock, damage crops, and disrupt agriculture and local business.<sup>6</sup>

According to World Risk Index (WRI) 2011, among the 173 countries, Bangladesh was ranked 6 and the country has been declared the second most disaster-risk country in Asia and vulnerability was 63.41% and WRI was 17.45%. Alarming information in the World Risk Report, 2014 is showing that Bangladesh was ranked 5 where the world risk index is 19.37 %.<sup>11</sup>

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### Materials and Methods

This paper was made through using the secondary data and the information from different peer-reviewed scientific research and gray literature such as reports, media sources. The Emergency Database (EM-DAT) of the Centre for Research on the Epidemiology of Disasters (CRED) was used as a secondary data source. Data was gathered from Emergency Database (EM-DAT) of different disasters occurred in Bangladesh from 1985 to 2019 period.

### Results and Discussion

#### Geographical Background:

Bangladesh covers an area of 147,570 square kilometers and it is located in the northeastern part of South Asia. The population of the country is about 158 million and the population density of 1,070 persons per square kilometer in 2014.<sup>7</sup> Meteorological Department data shows that from 1958–2007 the mean annual rainfall was 2488 mm in Bangladesh (Figure 1). The magnitude of change of annual rainfall of Bangladesh increased at a rate of +5.53 mm yr<sup>-1</sup> estimated by Sen’s slope estimator and the rate of increase was approximately 5.5% per decade.<sup>5</sup> Country has one of the largest river networks in the world with a total number of about 700 rivers including tributaries and a total length of about 24,140 km.<sup>8</sup>

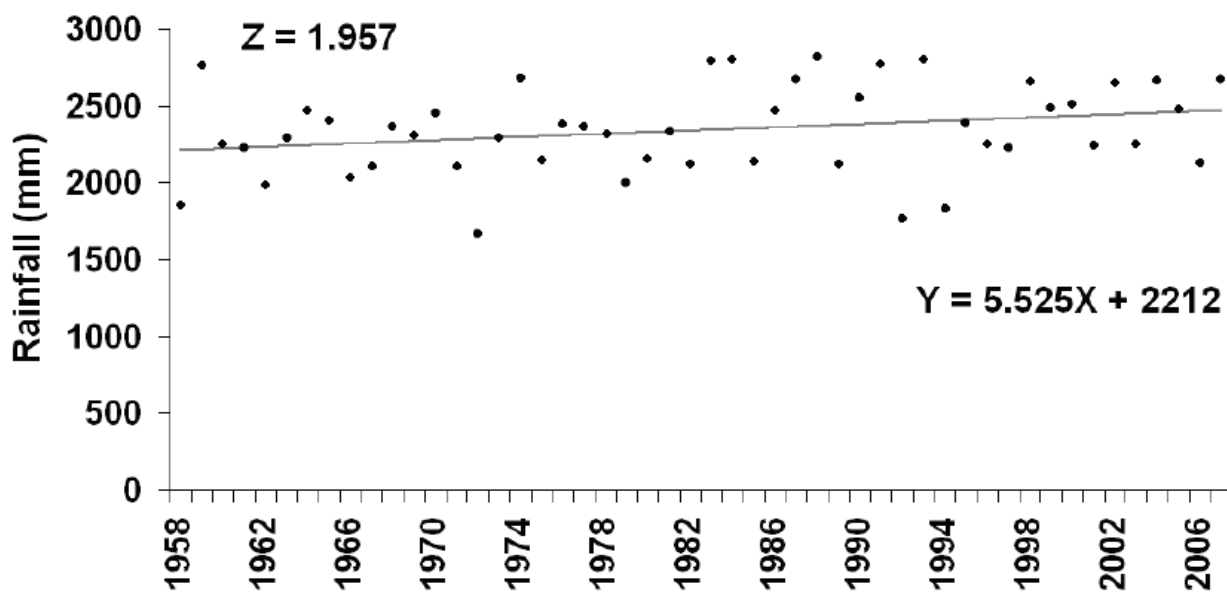


Figure 1: Trend in annual rainfall in Bangladesh over the period 1958–2007.[5]

Due to the geographical location, land characteristics, multiplicity of rivers, coastal morphology, and the monsoon climate, Bangladesh is one of the highly vulnerable countries to natural disasters.<sup>9</sup>

#### Frequency Distribution of Natural Disasters in Bangladesh:

From the record of EM-DAT (CRED) on the different types of disasters, it has been observed that since

1985 somehow every year natural disasters happened in Bangladesh. It is alarming and a matter of thought that the different types and sometime same types of natural disasters happened frequently in Bangladesh (Figure 2). Within 34 years the total frequency of disasters was 234. During this period, the most frequent disaster was Storm 121. Among all disasters, earthquakes and landside were less frequent. Natural disaster flood and the extreme temperature was happened 74 times and 24 times respectively.<sup>10</sup>

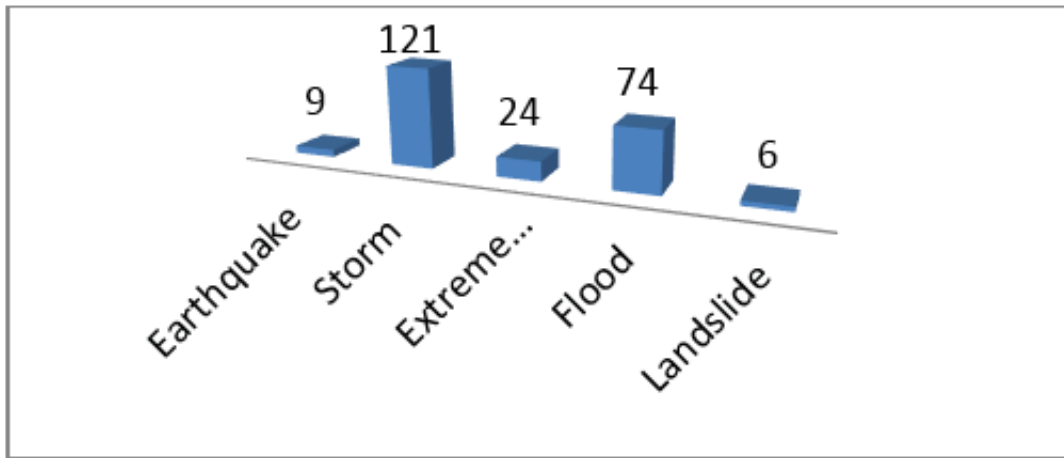


Figure 2: Frequency of Natural Disaster in Bangladesh from 1985- 2019. [10]

**Frequency and types of Flood in Bangladesh:**

Flood is becoming an annual natural phenomenon in Bangladesh. Every year in different parts of the country is drowned by the flood. Since 1985, the country experienced the highest frequency of flood (five times) in the year 1999. Last three decades, the average

frequency of flood disasters was two times each year. Some of the years, the flood happened three times, and 1994, 1995 years it happened four times. In Bangladesh, the flood can be categorized in three ways as Monsoon flood, Flash flood and Tidal/Coastal flood. Within 34 years, county has undergone Riverine flood (77.59%), Flash flood (18.97%), and Tidal/Coastal flood (3.45%) (Figure 3).

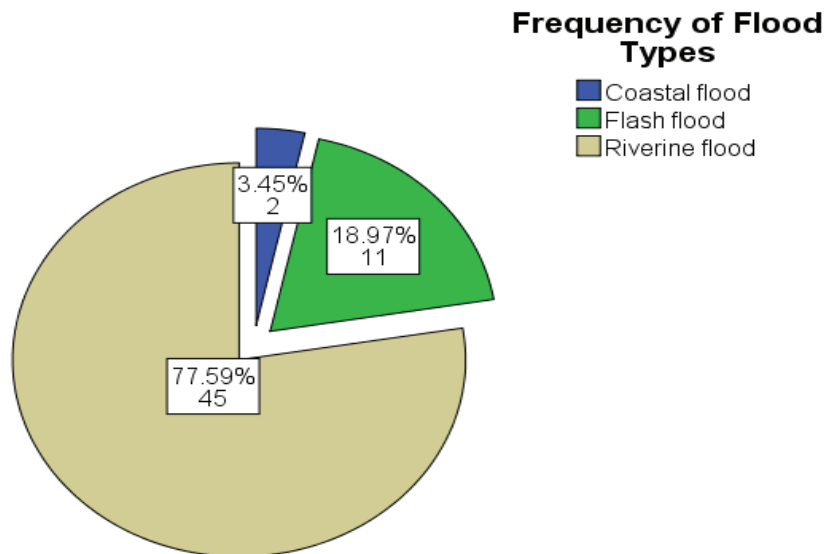
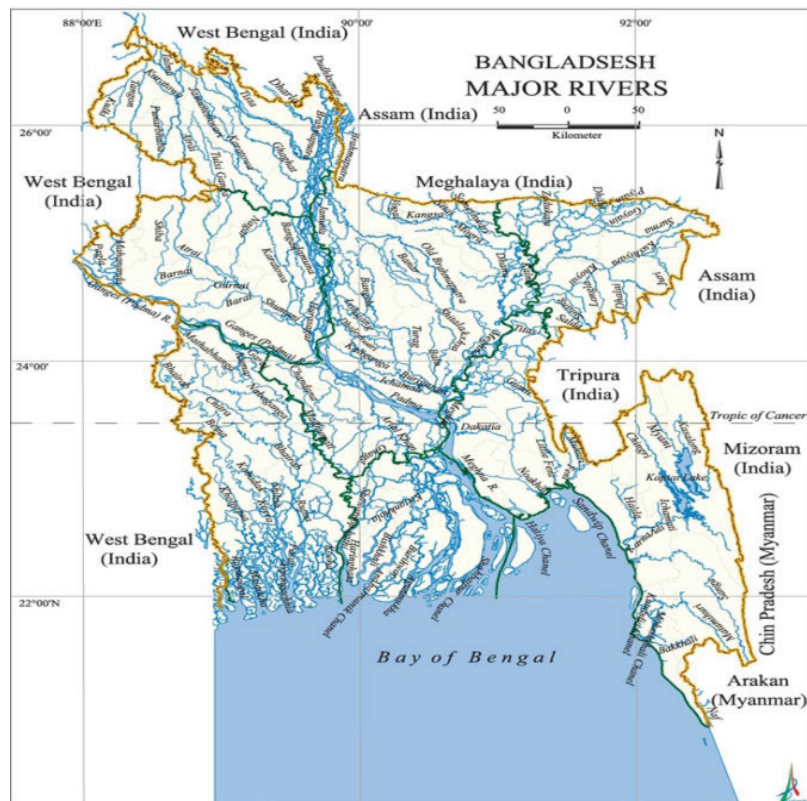


Figure 3: Frequency of Flood in Bangladesh on the Basis of their Types.[10]

### Causes of Flood in Bangladesh

The main reason for flood in Bangladesh is due to extensive rainfall in the catchment areas of the rivers. In the North part of Bangladesh, the monsoon belt with the Himalayas makes the region of heavy rainfall. During

the 5 months from May to September, approximately 80% of the rainfall occurs. The main river of the country—the Brahmaputra-Jamuna, the Ganges, the Meghna, and other smaller rivers are carried about 90% of water which is entered from outside the country (Figure 4).<sup>12</sup>



**Figure 4: Major Rivers Map of Bangladesh.[8]**

Although, the primary cause of the flood is heavy rainfall in the catchment area of the rivers. There are some other factors which may associate to develop the floods, those are (i) general low topography of the country with major rivers draining through Bangladesh including a congested river network system, (ii) rainfall in the upstream country or the mainland, (iii) snow-melt in the Himalayas, (iv) river siltation or landslides that reduces the carrying capacity of the rivers and develop the flood, (vi) human intervention of the environment such as deforestation in the catchment area that increases the downstream water flow, (vii) slowing down of the river outflow by tidal and storm, (viii) construction of barrages and protective works close to the banks of the river and (ix) tectonic anomalies those change the river flow or morphology.<sup>12</sup>

### Effects of Natural Disasters from 1985- 2019

In Bangladesh, storms, floods, and earthquakes are a common disaster. Within 34 years most frequent disaster was storm 121 times (51.71%) and the second most frequent disasters were flood 74 times (31.62%). Among those five disasters, most of the damage was occurred by the flood which worth was 12131800 ('000 US\$) and second and third disasters were storm and earthquake respectively. Majority of people was died and affected by floods and storms. Within 179769 deaths 165970 and 10965 people were lost their life due to storms and floods respectively (Table 1). Earthquake and extreme temperature disasters less frequently happened in Bangladesh but the total economic losses by the earthquake is noticeable 500000 ('000 US\$).

**Table 1: Effects of Natural Disasters from 1985- 2019**

Disasters Types	Number of Events	Percentage	Total Deaths	Total Damages('000 US\$)
Earthquake	9	3.85%	45	500000
Storm	121	51.71%	165970	6013485
Extreme temperature	24	10.26%	2524	
Flood	74	31.62%	10965	12131800
Landslide	6	2.56%	265	
Total	234	100%	179769	18645285

**Social and Economical impacts of floods:**

Floods in developing countries in the world are a greater threat to human life, health, and well-being than in developed countries. Commonly, two-thirds of deaths directly related to flood events are caused by drowning and one-third by physical trauma, heart attack, electrocution, and animal bites.<sup>13</sup> The effects of flooding in Bangladesh are severe in both rural and urban areas affecting the majority of the population, infrastructures, and family assets and their life. Within 34 years flood affected total population were 222371823 and total affected area was 751112 km<sup>2</sup> (Table 2).

**Impacts on Personal Security:**

In the flooding areas, day labors sometime starve to death due to staying a long period of time without work or due to sickness. In 1988, 1998, and 1999 floods in Bangladesh hundreds of industries, especially garments factories went underwater. By that time, water destroyed raw materials, machines which were worth millions of Dollars and some factories never came into production. In that situation, thousands of workers went unemployed and the country was living dependent on foreign aid.<sup>14</sup> The most important urban sectors that affected severely by the floods include urban infrastructure, houses, industry, trade, commerce and utility services etc.<sup>15</sup>

**Impacts on Buildings and Infrastructures:**

Study shows that impact of the flood on housing

infrastructure and households can be extensive. Fast-flowing floodwaters are able to wash away entire slums village while the slowly rising water damages buildings and infrastructures. Most of the houses in the rural area of Bangladesh are built with “Mud Walls”, “Coconut leaf Walls” and “Tin Walls”. Flood collapses leaving people in the village and their asset exposed and vulnerable. About 32% of the total population in Bangladesh lives in slums setting and therefore a large number of people are left homeless and stranded for days due to flooding.<sup>4</sup>

**Impacts on crops and animals:**

The economy of Bangladesh is agriculture-dependent and agriculture construct about 18.6% of the country’s GDP and employs around 45% of the total labor forces. The majority of the poor people in this country live in areas of high risk to floods and landslides and most of them are depending on local natural resources. Rice and wheat are stapled foods of Bangladesh.<sup>4</sup> One of the special types of rainfed rice; Aman has grown in Bangladesh and this rainfed rice is highly efficient to river floods. During the 1998 floods in Bangladesh, 82% of deepwater Aman, 69% of Aus rice production, and 91% of transplanted Aman were lost and the country became food insecure (Figure 5). The whole mushroom industry in Bangladesh was seriously affected by the floods of 1998 and in 2007 floods causing huge loss of foreign currency.<sup>4</sup>



Figure 5: 1998 Flood Affected Areas in Bangladesh.[8]

### Impacts of Flood on Public Health

During the flood, water supply and sanitation conditions become dangerously hampered. In every flood all toilets and about two-thirds of the tube-wells become unusable. At the same time people owing to using hanging latrines or a boat and defecating directly into water bodies and in this way, most people pollute that water. Therefore, the majority of people suffer from different water-borne diseases. Impacts of floods on health are immediate, medium, and long term and it can be extensive. In Bangladesh, the major impact of floods is death and the deaths are caused by drowning, water-borne diseases, diarrhea, snakebites(Tables 3).<sup>16</sup>

Table 3: Different Effects of Flood on Health

Immediate Effects	
▪	Drowning
▪	Trauma
▪	Hypothermia
▪	Electrocution
▪	Carbon monoxide poisoning
Early (Less than 10 days after event)	
▪	Cutaneous infection
▪	Aspiration pneumonitis or pneumonia
▪	Viral respiratory infections
▪	Gastroenteritis
Late (More than 10 days after event)	
▪	Leptospirosis
▪	Mosquito-borne illnesses
▪	Cutaneous infection
▪	Hepatitis A or E virus infection
▪	Mental health disorders and depression.

In the 2007 monsoon floods in Bangladesh, Snakebites were one of the most significant causes of death estimated to be the second after drowning. Those causes were contributed to more deaths than even diarrheal and respiratory diseases.<sup>17</sup>

**Mortality:**

The mostly identified flood deaths are those that happen acutely from drowning or trauma, for example being hit by objects in fast-flowing waters. In 1988 Bangladesh floods, data showed that diarrhea was the

most frequent (27%) cause of death, but again the effect of the flood was not separately measurable from seasonal influences.<sup>18</sup>

From 1985 to 2019 in the Emergency Events Database shows that 10965 people were died by floods although, most people were affected by floods in the years 1987, 1988, 1993, 1995, 1998, 2004, and 2007 (Table 4). Those years the frequencies of floods were two times or three times and in 1999 the frequencies were five times. Gradually deaths and flood affected population number had reduced due to some measures had taken by Government.

**Table 4: Most Flood Effected Years and its various Impacts.**

Most Effected Year	Total Deaths	Affected People	Economic damage (US\$ 000)
1987	2280	29700000	1057500
1988	2440	45000000	2137000
1991	265	2990000	150000
1993	194	15751613	-
1995	741	14718331	375300
1998	1050	15000050	4300000
2004	761	36871700	2200000
2007	1230	13851440	114000
2014	59	3200447	160000
2017	144	8086025	628000
2019	114	7600000	75000

**Diarrhea Diseases:**

During 2000-2006, there were 16551 diarrhea cases reported in the flood-protected area, while the number of cases was 2.9 times higher in the unprotected area.<sup>19</sup> The existence of diarrhea risk after flooding may also be influenced by local environmental conditions and also variation in disaster management and adaptation strategies.<sup>20</sup>

The long-term rise of infection in the post-flood period may be due to the existence of low hygiene and sanitation status in the flood-affected communities.<sup>21</sup>

Potential persistent poor nutrition of the flood-affected population may also be suffered in the post-flood excess of diarrhea. In the presence of malnutrition, chronic or persistent diarrhea could develop secondary to other infections.<sup>22</sup>

**Fecal-oral and Vector-borne diseases:**

In flood situations, there is potential for increased fecal-oral transmission of disease, in particular areas where the population does not have access to clean water and sanitation facilities. Some Published studies have reported post-flood increases in cholera,

cryptosporidiosis, nonspecific diarrhea, poliomyelitis, rotavirus, and typhoid, and paratyphoid.<sup>23</sup> There is a complex relationship between flooding and vector-borne disease. Many important infections are transmitted by mosquitoes and the mosquitoes can breed in or close to stagnant or slow-moving water.<sup>24</sup>

### **Acute Respiratory Infection:**

In 2001-2006, there were a total of 23,163 and 11,310 acute respiratory infections from non-flooded and flooded areas, respectively, in children under 5 years. The acute respiratory infection rates appeared higher in flooded compared with the non-flooded area.<sup>25</sup> 1998 floods in Bangladesh, health problems among flood victims after diarrhea (27%), respiratory problems (14%) were the second most common. In the 1988 flood, acute respiratory infection was also the second most common cause of illness (17%) and among the victim's death (13%).<sup>26</sup>

### **Conclusion**

This paper presented that Bangladesh is a highly disaster-prone country and every year country faces floods frequently. Each flood has a huge devastating effect on life, livelihood, and the country's economy. The country faces a long term impact in various sectors after the flood. Flood prone area has to provide stronger shelter, pure water facility, and sanitation structures which can withstand floods better. Bangladesh's government and non-government organizations always come up to mitigate the impact of the flood but still need a comprehensive flood management plan and its implementation.

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**Conflict of Interest:** Nil

**Ethical Clearance:** The study was dependent on recorded data from EM-DAT database as institutional rules. So, the study did not look for any individual consent.

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