

Impacts of Environmental Hazards and Disasters on Urban Poor Community in Dhaka City (1991-2017)

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Abstract: Environmental hazards and disasters are causing impacts on urban poor community in Dhaka city year after year. The inhabitants have to suffer for the impacts various ways due to live in risky housing condition. This paper analyses the casualties and damages of house according to types of the hazards and disasters since 1991 to 2017 to find out their severity. The paper also finds out the socio-economic impacts to affected households for highly impacted hazard and disaster. Data has been collected by questionnaire survey, secondary sources and field observations. The hazards and disasters such as fire, flood, water-logging, diarrhea, cholera, structural collapse etc. are causing many casualties and some of them are causing damages of house and household properties severely. All most of the house owners in the hazard prone urban poor community have to bear the cost of damaged houses for highly impacted hazard and disaster i.e., fire, flood and water-logging. Most of the households have to bear the cost of damaged household goods and materials also for these three hazard and disaster. Various post hazard and disaster related diseases also affect them and they loss earnings in the post hazard and disaster hard situation. These three highly impacted hazard and disaster are the key challenges for the resilience and sustainable development at the urban poor community in Dhaka city. Proper mitigation strategies are necessary to reduce the risks of the hazards and disasters.

Key Words: *Urban Poor Community, Casualty, Damage, Hazard, Disaster, Dhaka city.*

I. INTRODUCTION:

Dhaka city¹ is vulnerable to various environmental hazards² due to its physiography, high population density and climate change effects. Population is increasing rapidly in this city though the land is very scarce. According to UNFPA (2016: 69), the annual average population growth rate was 3.76 percent since 1991 to 2011. A large proportion of the migrated people take shelter at low-cost informal housings or slums for the shortage of affordable housing. Houses of these types of urban poor community³ are poorly constructed, very congested and often situated at low-lying areas. According to CUS (2006: 43), 38.5 percent slums experienced full flooding, 22.4 percent partial flooding and 39.1 percent slums were flood free among the 4966 slums in Dhaka city, which indicates their location in the low-lying areas. The environmental hazards and disasters e.g., fire, flood, water-logging, Diarrhea and cholera etc. have impacts on the inhabitants year after year. A. Islam, et. al (2014: 54) has found that short duration high intensity rainfall is increasing in Bangladesh, which is a profound impact of changing climate. New types of hazards such as dengue and chikungunya are also breaking out in the city. All of these hazards are increasing the risk to the urban poor community. In the Sustainable Development Goals, the United Nations have committed to ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums by 2030 in target one of goal eleven (UN, 2015). The government of the People's Republic of Bangladesh has also adopted various plans and policies for disaster management but the urban poor are affected constantly due to live in risky housing condition yet. In this circumstance, it is necessary to know the impacts for different types of the hazards and disasters, which will be helpful to understand the severity of particular hazard or disaster. This paper analyses the casualties and damages of house according to types of major environmental hazards and disasters at urban poor community in Dhaka city since 1991 to 2017 to find out the severity of particular hazard and disaster. The paper also finds out the socio-economic impacts to households for the highly impacted hazards and disasters. The findings can be useful to take necessary mitigation policy for the sustainable development reducing the risks and ensuring the resilience as the severity of particular hazard or disaster.

II. LITERATURE REVIEW:

In this section, at first some literatures related with hazards at urban poor community in some developing countries has discussed briefly and then, the relevant literatures have reviewed to justify this study's contribution to the previous. The increasing tendency of environmental hazards for the changing climate around the world is a serious challenge for sustainable development. G. Smith (2011: 671) has identified three key challenges of the 21st century in the field of human settlements which are rapid urbanization, the urbanization of poverty and climate change. The author has also indicated that the number of slum dwellers worldwide is expected to increase from one to two billion over the next 25 years and new slum formation is outstripping slum upgrading. Boonyabanha (2005), has analyzed the Baan Mankong (secure housing) program in cities of Thailand, which started in 2003 to reduce fire, eviction and other problems. The author has found that the involvement of Community Based Organizations (CBOs) with the support of other stakeholders can fruitfully upgrade the slums. Roberts (2010) has found the essentiality of the institutional change of Disaster Management Unit from only the responsive (i.e., a relief and welfare) function

¹ Dhaka Metropolitan City refers as Dhaka city, which covers the area of 315.98 square kilometers (BBS, 2014: 58). This area includes both of the Dhaka North City Corporation and Dhaka South City Corporation at present.

² Environmental hazards are "extreme geophysical events, biological processes and technological accidents that release concentrations of energy or materials into the environment on a sufficiently large scale to pose major threats to human life and economic assets," K. Smith and Petley (2008: 12). In general, environmental hazards are unusual natural, technological or man-made incidents which create sufferings to people by obstructing normal functioning of life, livelihood, damaging properties or business and sometimes cause casualties.

³ Urban poor community means the totality of inhabitants who live in different spatial areas with poor housing and environmental condition. The ownership of the land or house may be legal or illegal to the settlers. For example, slums are urban poor communities.

to incorporate both a strategic planning and welfare component for adaptation and local level resilience in Durban city of South Africa. Andavarapu and Arefi (2016) have used Holling's adaptive cycle model to analyze the resilience at Pedda Jalaripeta slum in Visakhapatnam city, India. The authors have found two cycles of resilience in the transformation of the slum with no amenities to a low-income urban neighborhood with all facilities. In the first cycle of resilience, the slum was able to ensure the growth of physical and human capital conserving the social and ecological assets after the destruction of fire in 1983. In the second cycle of resilience, the educated young fishermen's welfare association had thwarted a threat of encroachment filling legal petitions. The authors have found that bonding and bridging social capital are central for building resilience. Elrayies (2016) has found that it is necessary to supply people with required skills, assets, titling of land, housing etc. to overcome the constraint of economic growth for the sustainable slum development. Social sustainability depends on participation, empowerment, community mobilization, cultural values etc. The sustainable use of water, sanitation, solid wastes, and local materials are important to build low-cost informal housing for the environmental sustainability.

Huq and Rabbani (2011) have discussed about the policy and institutional initiative to manage climate change impacts and related disasters in Bangladesh. The authors have stressed on gaining more knowledge on gaps to tackle the emerging challenges of climate change in different regions and sectors. Dewan (2006) has found that housing was the most damaged sector in the flood of 1998 in Dhaka city. The author has also shown that flood forecasting and caution are not so much effective for flood risk mitigation, which has a short coming. Alam and Quaisar (2016) have found that most slum and squatter settlements are located environmentally vulnerable areas out of urban basic services such as safe water, electricity, gas supply, toilet facilities and garbage disposal. The authors have also found that slums are prone to suffer from water-logging and flooding for poor drainage system during the rainy season. Khatun and S. Islam (2015) have found inefficient awareness and preparedness towards disaster among the dwellers in their study on awareness and preparedness for earthquake, fire hazard and water-logging in Dhaka city. Jabeen, Johnson and Allen (2010) have studied the grassroots coping strategies of climatic hazards as flooding, water-clogging and extreme heat at Korail slum in Dhaka city. The authors have found that the slum dwellers use traditional knowledge and resources to reduce the vulnerability and damages. Ahmed (2014) has shown the impacts of some hazards and disasters to find out the factors undermining the resilience in slums of Dhaka city. The author has found that there is a lack of real political commitment for pro-poor policies and there are very few agencies active in cities.

The above literatures, which are reviewed by the author justify that there exists a gap in research to find out the impacts according to types of hazards and disasters and their severity at the urban poor community in Dhaka city.

III. DATA AND METHODOLOGY:

In this study, necessary data were collected from secondary sources, questionnaire survey and field observations. The methods of the data collection and analysis have given below:

3.1 Secondary Data:

Newspapers were selected as the main source of the secondary data due to the availability of reports on all types of hazard and disaster incidents in Dhaka city. At least two national daily newspapers of every day since 1991 to 2017 were searched to find out the hazard and disaster incidents, their location, casualties and damages. The Daily Ittefaq was one of the newspapers, which had seen from January, 1991 to December, 2017. Other newspapers, which were seen as the complement with it, were the Daily Bangla from January, 1991 to September, 1997; Daily Sangbad of 1997; Daily Inqilab of 1998; and Daily Prothom Alo from November, 1998 to December, 2017. These newspapers were seen in the National Library of Bangladesh and the National Archives of Bangladesh. Other secondary sources were also used for the secondary data. The required data were filled in a formatted table and detailed information of severe incidents were noted down separately.

3.1.2 Primary Data:

A questionnaire survey was conducted from December 2016 to March 2017 to collect the primary data. Twelve affected communities were selected randomly as the sample areas among all affected urban poor communities collected from secondary sources, which had at least one record of hazard incident e.g., fire, flood, water-logging etc. since 1991 to 2017. The respondents were also selected randomly from the sample areas. A total of 240 questionnaires were filled up asking twenty respondents (household head or other family members) from each sample area. The sample areas were: Kalsi Balurmah slum, Pallabi police station; Jhilpar slum, Shah Ali police station; Kollyanpur Pura slum, Mirpur police station; Korail slum and Sattola slum of Banani police station; Nobodoy Housing slum, Adabar police station; Katusur Khalpar slum and Pulpar Bottola slum of Mohammadpur police station; Moghbazar Wireless-gate slum, Ramna police station; Shahidnagar Boubazar slum, Lalbagh police station; Nobur slum, Jatrabari police station; and Dhaka Match Factory Colony slum, Kadamtoli police station.

3.3 Field Observation:

Field observations were done immediately after the recent hazard incidents and occasionally to know the actual situation of the affected urban poor community. When a field observation was done, information from the affected community people have gathered with conversations as well as some photographs have taken off.

IV. FINDINGS:

4.1 Casualties and Damages of House According to Types of the Hazards and Disasters (1991-2017):

Environmental hazards arise not only for the locality but also for the global phenomenon. Paul (2011: 15-20) has classified environmental hazards into five types as natural hazard, social hazard, biological hazard, technological hazard and chronic hazard, which are based on the interaction both of causes and origins of the hazards. Following this typology, major environmental hazards and disasters, which had occurred at urban poor community in Dhaka city since 1991 to 2017, have categorized as below:

1. Natural hazard: flood, heavy rainfall⁴, water-logging, cyclone, Northwester, heat wave, cold wave and earthquake;

⁴ Heavy rainfall is the precipitation rate >7.6 mm (0.30 in) per hour, or between 10 mm (0.39 in) and 50 mm (2.0 in) per hour and when the precipitation rate is >50 mm (2.0 in) per hour is violent rain (Wikipedia, 2018).

2. Social hazard: fire (intentional) and conflict;
3. Biological hazard: Diarrhea, cholera, malaria, dengue and chikungunya;
4. Technological hazard: fire and structural collapse; and
5. Chronic hazard: air pollution and water pollution.

Number of casualties and damaged houses according to types of the hazards and disasters since 1991 to 2017 have analyzed below.

4.1.1 Casualties and Damages of House by Natural Hazards and Disasters:

Flood:

Six floods had occurred as disasters since 1991 to 2017 in Dhaka city. Although the number of casualties and damaged houses in the Table-1 represents the impact on all inhabitants in the city, the urban poor were affected highly by these floods. They become more affected than others due to live mostly on ground level in informal houses, which are more flood prone than other housings. According to the Table-1, 23 people had died for the flood in 1998, 9 people in 2007 and 3 people in 2004. The table also shows that 74,160 houses were damaged during the flood in 1995 and 262,163 houses in 1998. Dewan (2006: 165) has found that more than 59 % households' houses were affected highly during the flood of 1998 in Dhaka city.

Table-1: Casualties and Damages of House by Flood in Dhaka City (1991-2017)

<i>Year of Flood</i>	<i>Number of Death</i>	<i>Number of Damaged House /Room</i>	<i>Affected Population</i>
1995	0	74,160 ^a	445,570 ^a
1996	0	ND	300,000
1998	23	262,163 [*]	2,000,000 [*]
1999	0	ND	ND
2004	3	ND	124,000 ^b
2007	9	ND	1,500,000

^aData indicates the impact in Dhaka district, ^bData indicates the population took Shelter in camps

Source: Daily Ittefaq (January, 1991-December, 2017); Daily Bangla (January, 1991-September, 1997); Daily Sangbad (January-December, 1997); Daily Inqilab (January-December, 1998); Daily Prothom Alo (November, 1998-December, 2017), *Nishat et al. (2000: 59-100)

It is found that 2,000,000 people were affected in the flood of 1998, 1,500,000 people in 2007, 445,570 people in 1995, 300,000 people in 1996 and 124,000 people in 2004 (Table-1). The impacts of the flood in 1998 were more than the other floods because the prevalent and prolonged characteristics of it was more than the other floods. It had inundated more than half of the city and its duration had been about two and half a month (15 July to 30 September). So, flood is a severe hazard in the urban poor community for large number of casualties and huge damages of house.

Heavy Rainfall and Water-logging:

It is known that heavy rainfall is the major cause of water-logging and both of them affect the urban poor various ways. The major incidents of heavy rainfall and water-logging those had affected the urban poor as follows:

On 15 September 1991, 120 millimeters heavy rainfall had recorded from 6 am to 2 pm (6 hours) in Dhaka city (Daily Ittefaq, 1991: 1). Many houses had water-logged at different places after this heavy rainfall. The amount of rainfall was 78 millimeters for 12 hours from 6.00 am to evening on 23 August in 1993 (Daily Bangla, 1993a: 1 and Daily Ittefaq, 1993: 1). This rainfall and the rainfall of the following day had created water-logging at many slums situated in the low-lying areas (Daily Bangla, 1993b: 1), which had damaged houses and household properties owned by hundreds of thousand people. The amount of heavy rainfall was recorded 71 millimeters from Wednesday 12 am (12 August) to Thursday 6 am and 107 millimeters heavy rainfall was recorded from 6 am to 9 pm on 13 August in 1998 (Daily Ittefaq, 1998: 1). These heavy rainfalls had worsened the sufferings of flood affected people who had to take shelter at camps during the flood in 1998.

Highest amount of 341 millimeters heavy rainfall within a day (24 hours) in the last 51 years had recorded on 13 September 2004 in Dhaka city (Daily Prothom Alo, 2004a: 1). This heavy rainfall had created huge water-logging around the city, which had damaged many houses and household properties due to submerged in water for some days (Figure-1). Hafiz (2011: 217) has mentioned that many people, especially children, died in this incident for an overnight subsiding of squatter settlement. According to Bangladesh Meteorological Department, 118 millimeters heavy rainfall was recorded from 6 am to 12 pm on 24 August 2007 that also created severe water-logging in the city (Daily Prothom Alo, 2007a: 1).

An incident of 333 millimeters heavy rainfall within nine hours had recorded on 28 July in 2009 (Daily Prothom Alo, 2009a: 1). This heavy rainfall had water-logged several hundred thousand people for some days at the low-lying areas including Mirpur, Pallabi and Lalbagh in the city (Daily Ittefaq, 2009: 1 and Daily Prothom Alo, 2009b: 1-20). Eight people had died for electrocutions with under water electric line and drowning for this heavy rainfall (Daily Prothom Alo, 2009c: 1). The amount of heavy rainfall was 56 millimeters from 7 am to 9 am (two hours) on 23 May in 2013 (Mahmud, 2013: 1), which had also created water-logging in the city. On 01 September 2015, 42 millimeters heavy rainfall had recorded only in one and half hour duration from 11 am (Daily Prothom Alo, 2015a: 1). In 2017, 123 millimeters heavy rainfall had recorded from 12.45 pm to 3.30 pm on 03 August for around three hours only (Daily Prothom Alo, 2017a: 1) and 78 millimeters heavy rainfall had recorded from 6 am to 12 pm on 11 September (Daily Prothom Alo, 2017b: 1). These heavy rainfalls had created prolonged water-logging at many areas, which had also damaged the houses and household properties of many people. So, water-logging is a severe hazard for casualties and huge damages of house almost every year.



Figure-1: Water-logged Moghbazar Wireless-gate slum after the heavy rainfall in 2004 (Source: Author)

Other Natural Hazards and Disasters:

Other natural hazards and disasters include cyclone, Northwester, heat wave, cold wave and earthquake. It is found that six people had died and hundreds of people had injured by the cyclone Sidr of 2007 in Dhaka city (Sweety, 2007: 1). Many informal houses had damaged by this cyclone in the city, where mostly the urban poor lived. Eleven people had died and fifty people had injured on 27 May in 2000 when a two-storied slum house of 60 rooms collapsed by a Northwester at Jafrabad of Mohammadpur (Daily Ittefaq, 2000: 1). This slum house was built on very poor structure and situated on the marshy land. A heat wave continued in Bangladesh for around 23 days from 6 April in 2016, when the temperature was 5° to 6° Celsius more than the normal temperature (Mahmud, 2016: 1). Two labors had died for the extreme heat, one of them at Badda and another one at Kamrangirchar during this heat wave (Daily Prothom Alo, 2016a: 9). News of cold wave have found in the years of 2007, 2011, 2014 and 2016 in the city. The urban poor especially the children and older people suffer from pneumonia, cold fever and respiratory diseases for this hazard. There is not found any impact for the recent earthquakes on the urban poor, however people of this city had become panicked largely for the tremor and after-shocks of the Nepal-earthquake on 25 April in 2015 (Daily Prothom Alo, 2015b: 1). The urban poor are in huge risk of earthquake related fire for the poor condition of electric line, gas line and the congested housing.

4.1.2 Casualties and Damages of House for Social Hazards:

Social hazards have found as intentional fire and conflict at urban poor community. In a conflict between two criminal groups at Moghbazar Banshpotti slum, about 2000 houses were burned and around 25 people had become burn injured and wounded for handmade bomb attack by a criminal group on 24 January in 2001 (Daily Prothom Alo, 2001: 1 and Daily Ittefaq, 2001: 1). The slum dwellers cannot remove their household goods and properties due to fear of criminal attacks. In another incident of conflict between Bihari⁵ people of Kurmitola Bihari Camp and local people at Kalshi of Pallabi, ten Bihari people had died by burn when they had locked in home and more than 50 people were injured including the police on 14 June in 2014 (Daily Prothom Alo, 2014 and Daily Ittefaq, 2014: 1). In addition, around ten houses had burned and some houses and shops were demolished by miscreants. A fire incident burned 21 houses and nine shops at Kollyanpur Pura slum on 22 January 2016, which was alleged as intentional fire for eviction because the violent slum eviction drive was failed for stay order by the High Court on the previous day (Daily Prothom Alo, 2016b: 1).

4.1.3 Casualties for Biological Hazards:

Diarrhea and Cholera:

Diarrhea and cholera had caused huge impacts during the floods in 1998, 2004 and 2007 in Dhaka city. The urban poor had affected hugely by these diseases but there is not any data of them separately. In this city, 284 people had died for Diarrhea and other causes and 191,867 people had attacked with Diarrhea and other diseases in the flood of 1998 (Nishat et al. 2000: 233). Although the data of total Diarrhea patient of last two floods have not found, the number of Diarrhea patients in the pick days gives an idea. The number of Diarrhea patients had picked to 1026 within 24 hours on 30 July in Dhaka district during the flood of 2004 (Daily Prothom Alo, 2004b: 1). The number of Diarrhea patients had risen to 1045 within 24 hours on 14 August at International Centre for Diarrheal Disease Research, Bangladesh (ICDDR, B) during the flood of 2007 (Daily Prothom Alo, 2007b: 1), which is more than double in a normal day. A large proportion of them were cholera patient. According to the ICDDR, B, 80 percent of Diarrhea affected people over five years old were cholera patient who have admitted there during the flood in 2007 (Daily Ittefaq, 2007: 1).

Diarrhea had also outbreak during heat wave in recent years. The number of Diarrhea patients had picked to 963 at different hospitals in the country on 18 April 2017 when a heat wave pushed up Diarrhea patients, in which 613 patients were admitted to the ICDDR, B (The New Nation, 2017: 1). The urban poor also attacked with Diarrhea other times of the year due to insecure drinking water. A total of 663 people had attacked with Diarrhea in Kollyanpur Pura slum and 2 people of them had died in the first week of November in 2011 in such a cause (M. Islam, 2017: 204). So, Diarrhea and cholera are severe hazards in the urban poor community for large number of casualties and sufferings of the people.

⁵ Stranded Pakistanis live in refugee camps who had opposed the independence of Bangladesh in 1971. They had come to this country from Bihar state during the partition of India in 1947. Many of them have got citizenship and voting rights since 2008.

Dengue, Chikungunya and Malaria Fever:

Although there is not any separate data of urban poor community infected by dengue, chikungunya and malaria, they are more sufferer for these diseases than other people in the reality. The yearly number of dengue affected people ranges from 375 to 6,232 since 2000 to 2015 in Dhaka city and the highest number of deaths were 93 in 2000 (Palma, 2015: 1). Chikungunya had outbreak enormously as a new biological hazard in 2017. According to a survey by the Institute of Epidemiology, Disease Control and Research, about one person of per eleven had attacked with chikungunya fever in the city (Daily Ittefaq, 2017). The affected people cannot do earning activities for several days due to huge physical effect. Malaria had outbreak after the flood in 2004. Fifteen children had found attacked with malaria out of 72 children admitted in Shishu Hospital during this flood (Daily Prothom Alo, 2004c: 1). So, the biological hazards such as dengue and chikungunya have severe impacts on the urban poor.

4.1.4 Casualties and Damages of House by Technological Hazards:*Fire Hazard:*

According to the Table-2, a total of 233 fire incidents have found at urban poor community in Dhaka city since 1991 to 2017. Among them, highest 16 incidents had occurred in each of 2001 and 2017. Then 15 incidents had occurred in 2004 and 14 incidents in 2016. Two to twelve incidents had occurred in the remaining years. The table depicts that 18 people had died by fire incidents in 1999. Then, 13 people had died in each of the years 1992 and 1993, 11 people in each of the years 1996 and 2012, 9 people in 2004 and 8 people in each of the years 1995, 2016 and 2017. A total of 137 people had died for fire hazard since 1991 to 2017. The table also shows that highest 206 people had injured for fire in 1998. Then 150 people had injured in each of the years 1999 and 2002, 143 people in each of the years 1995 and 2006, 101 people in 2000 and 100 people in 2001. A total of 1,514 people had injured for fire hazard since 1991 to 2017.

Table-2: Casualties and Damages of House for Fire Hazard at Urban Poor Community in Dhaka City (1991-2017)

<i>Year of the Hazard</i>	<i>Number of Incidents</i>	<i>Number of Death</i>	<i>Number of Injuries</i>	<i>Number of Damaged House or Room</i>
1991	9	0	3	146
1992	9	13	51	856
1993	8	13	77	3,476
1994	9	1	16	1,415
1995	11	8	143	4,029
1996	11	11	41	11,073
1997	10	6	10	1,900
1998	5	6	206	2,612
1999	6	18	150	7,575
2000	11	1	101	4,355
2001	16	3	100	8,097
2002	6	1	150	3,283
2003	4	2	10	1,366
2004	15	9	32	7,584
2005	3	0	0	215
2006	6	1	143	4,761
2007	6	2	12	1,375
2008	4	2	4	3,401
2009	2	1	0	1,400
2010	4	0	50	496
2011	9	1	15	658
2012	8	11	86	3,236
2013	10	3	43	1,389
2014	9	2	3	853
2015	12	6	24	1,747
2016	14	8	16	1,283
2017	16	8	28	1,281
Total	233	137	1,514	79,862

Source: Daily Ittefaq (January, 1991-December, 2017); Daily Bangla (January, 1991-September, 1997); Daily Sangbad (January-December, 1997); Daily Inqilab (January-December, 1998); Daily Prothom Alo (November, 1998-December, 2017)

The number of damaged houses or rooms is the key indicator of economic loss for fire hazard in the urban poor community (Figure-2). According to the Table-2, highest 11,073 houses or rooms had damaged by fire incidents in 1996. Then, 8,097 houses or rooms had damaged in 2001, 7,575 houses or rooms in 1999 and 7,584 houses or rooms in 2004. The number of damaged houses or rooms ranges from 146 to 7,575 in the remaining years. A total of 79,862 houses or rooms had damaged for fire since 1991 to 2017. The fire is a severe hazard for casualties and huge damages of house in every year.



Figure-2: Korail Boubazar slum after the fire incident on 16 March in 2017 (Source: Author)

Structural Collapse:

Five incidents of structural collapse have found since 1991 to 2017 at urban poor community in Dhaka city (Table-3). The incident of collapse of a wall of Dhaka Electric Supply Authority (DESA) station at Pallabi had caused 3 deaths, 3 injuries and damages of 8 houses in 1998. A five-storied building had collapsed on four three storied tin-shed houses in South Begunbari of Tejgaon Industrial Area in 2010, which had caused 25 deaths, 20 injuries and damages of 160 rooms. In another severe structural collapse, 28 rooms of a two-storied informal house had slid down into water and clay of a pool of water at Rampura in 2015. It had caused 12 deaths and 30 injuries. Although the numbers of structural collapse are not so high it is also a severe hazard for large number of casualties in a single incident.

Table-3: Casualties and Damaged Houses by Structural Collapse at Urban Poor Community (1991-2017)

<i>Year of Incidents</i>	<i>Location of Structural Collapse</i>	<i>Number of Death</i>	<i>Number of Injury</i>	<i>Number of Damaged House or Room</i>
1998	DESA Station, Section-12, Pallabi	3	3	8
2010	South Begunbari, Tejgaon Industrial Area	25	20	160
2011	Moneswar Road, Hazaribagh	1	1	1
2015	Jhilpar, Malibagh Chowdhury Para, Rampura	12	30	28
2016	Mohammadbad, Kadomtoli	0	5	2

Source: Daily Ittefaq (January, 1991-December, 2017); Daily Bangla (January, 1991-September, 1997); Daily Sangbad (January-December, 1997); Daily Inqilab (January-December, 1998); Daily Prothom Alo (November, 1998-December, 2017)

4.1.5 Casualties for Chronic Hazard:

Water and air pollution have found as the chronic hazard. The urban poor are affected by various diseases for supplied water, which become contaminated easily due to poor supply system. In a study, it is found that 99 percent water used by slum population in Dhaka contains fecal contamination, which causes various Diarrheal diseases and consequently malnutrition mostly to children (The Daily Star, 2017: 3). The urban poor residing near to Shyampur-Kadomtoli industrial area are affecting for water and air pollution from re-rolling, color and other industries. The dark water discharged from these industries spread to the railway side and Nama-shyampur slum area of Kadomtoli police station. Surface water of this area contains 150 times to 200 times higher amount of sulphate than the tolerable stage (Saha, 2017: 1). These industries not only pollute the water but also the air. People at Dhaka Match Factory Colony slum of this area had found suffering from respiratory and skin diseases during the survey. These kinds of pollution hazards are affecting the inhabitants incessantly and felling them in serious illness.

4.2 Socio-economic Impacts to Households for Highly Impacted Hazard and Disaster:

Fire, flood and water-logging have identified as the three highly impacted hazard and disaster for their socio-economic impacts by the respondents. The socio-economic impacts for them have analyzed below:

4.2.1 Per House Owner's Average Cost for Damages of House:

According to the Table-4, 65 house owners have responded that their houses had highly damaged for fire, 10 house owners' houses for water-logging and 12 house owners' houses for flood. Although the total number of house owners are 91 (37.92%) of 240 households, 9 house owners have responded that their houses had not damaged but 5 respondents have included who are not house owners during the survey but their owned houses had damaged in the past. The Table-4 depicts that per house owner has to bear 112,123.08 Taka cost in average for damages of house for the fire, 14,100 Taka for the water-logging and 51,666.67 Taka for the flood at urban poor community in Dhaka city.

Table-4: Per House Owner's Average Cost for Damages of House by the Highly Impacted Hazard and Disaster

<i>Highly Impacted Hazard and Disaster</i>	<i>Number of House Owner</i>	<i>Total cost of Damages of House in Taka</i>	<i>Per House Owner's Average Cost for Damages of House in Taka</i>
Fire	65	7,288,000	112,123.08
Water-logging	10	141,000	14,100.00
Flood	12	620,000	51,666.67

Source: Field Survey December, 2016-March, 2017

4.2.2 Per Household's Average Cost for Damages of Household Goods and Materials:

According to the Table-5, 124 households have responded that their household goods and materials had highly damaged for fire among the 240 households. Then, 67 households' household goods and materials had highly damaged for water-logging and 38 households for flood. The remaining 11 households have responded that their household goods and materials had not damaged. The Table-5 shows that per household has to bear 70,423.39 Taka cost in average for damages of household goods and materials for the fire, 5,977.61 Taka for the water-logging and 23,421.05 Taka for the flood at urban poor community in Dhaka city.

Table-5: Per Household's Average Cost for Damages of Household Goods and Materials by the Highly Impacted Hazard and Disaster

<i>Highly Impacted Hazard and Disaster</i>	<i>Number of Households</i>	<i>Total Cost for Damages of Household Goods and Materials in Taka</i>	<i>Per-household's Average Cost for Damages of Household Goods and Materials in Taka</i>
Fire	124	8,732,500	70,423.39
Water-logging	67	400,500	5,977.61
Flood	38	890,000	23,421.05

Source: Field Survey December, 2016-March, 2017

4.2.3 Impacts of Post Hazard and Disaster Diseases on Household Members:

According to the Table-6, 68.75 percent households have responded that their members had attacked by post-hazard related diseases among the 240 households and 31.25 percent households have responded negative.

Table-6: Percentage of Household Members Attacked by Post Hazard and Disaster Diseases

<i>Response</i>	<i>Number of Household</i>	<i>Percentage of Household</i>
Yes	165	68.75
No	75	31.25
Total	240	100

Source: Field Survey December, 2016-March, 2017

The Table-7 depicts that 31.17 percent household members were attacked by fever, 29.96 percent by diarrhea and 18.22 percent by skin diseases among the household members who had attacked by post hazard and disaster related diseases. Then, 2.02 percent household members were attacked by typhoid, 1.62 percent by cholera and 1.21 percent by each of pneumonia and cold stress, and 0.81 percent by each of jaundice, malaria and heat stress. The table also shows that 12.15 percent household members were attacked by other diseases e.g., mental illness, chicken pox, heart disease, respiratory disease, tetanus etc. The households have to bear the cost for these diseases.

Table-7: Types of Post Hazard and Disaster Diseases Attacked the Household Members

<i>Types of Post Hazard and Disaster Diseases</i>	<i>Numbers of Attacked Household Members</i>	<i>Percentage of Attacked Household Members</i>
Diarrhea	74	29.96
Cholera	4	1.62
Jaundice	2	0.81
Fever	77	31.17
Skin Disease	45	18.22
Typhoid	5	2.02
Malaria	2	0.81
Dengue Fever	0	0.00
Pneumonia	3	1.21
Heat Stress	2	0.81
Cold Stress	3	1.21
Others (Mental illness, chicken pox, tetanus, heart and respiratory disease etc.)	30	12.15
Total	247	100.00

Source: Field Survey December, 2016-March, 2017

4.2.4 Loss of Earnings for the Hazard and Disaster:

The Table-8 shows that 42.08 percent respondents have to loss earnings for 1-15 days, 16.25 percent for 16-30 days and 11.25 percent for 46-60 days in the post hazard and disaster situation. Then, 8.33 percent respondents have to loss earnings for 76-90 days, 3.75 percent for 31-45 days, 3.33 percent for 61-75 days, and 5 percent for above 90 days.

Table-8: Loss of Earning Days for the Hazard and Disaster

<i>Loss of Earning Days</i>	<i>Number of Respondents</i>	<i>Percentage of Respondents</i>
No Loss	24	10.00
1-15 Days	101	42.08
16-30 days	39	16.25
31-45 Days	9	3.75
46-60 Days	27	11.25
61-75 Days	8	3.33
76-90 Days	20	8.33
Above 90 Days	12	5.00
Total	240	100

Source: Field Survey December, 2016-March, 2017

The table-8 also depicts that 10 percent respondents have not loss the earnings in the post hazard and disaster situation.

V. DISCUSSION:

It is found that flood, water-logging, Diarrhea and cholera, dengue, chikungunya, fire and structural collapse have severe impacts on the urban poor community among the five main types of environmental hazards and disasters. The severity of flood depends on the prevalent and prolonged characteristics. The casualties and damages of house were very high in the flood of 1998 because its prevalent and prolonged characteristics were more than other floods. The severity of water-logging depends on the amount of heavy rainfall, prevalent and prolonged characteristics. The risk of flood and water-logging is increasing due to the incremental tendency of heavy rainfall for the changing climate. The urban poor have to face the impacts of fire as a social hazard for the lacking of protection from the law enforcing agencies. It is found that many people had died and a lot of people are suffering from Diarrhea and cholera for flood, insecure drinking water and excessive heat due to climate change effects. They are also suffering from dengue and chikungunya which has relations with increasing heat and precipitation due to the changing climate. The casualties and sufferings for the biological hazards will rise if the proper mitigation strategies are not taken. Fire is a severe technological hazard for both of casualties and damages but there is not any strategy to reduce the risk of fire hazard at urban poor community through building back better. In most cases, the damaged houses are rebuilt as they were previously or the affected households are driven away from the vacant places after the hazard. The displaced people build new slum houses in other places as the previous. They are in risk of recurrent impacts for these reasons. Although the numbers of structural collapses are not so high, one severe incident can cause a lot of casualties as like as in South Begunbari of Tejgaon industrial area. The risk of structural collapse is increasing for the formation of low-cost informal housing with very poor structure at the low-lying areas. Fire, flood and water-logging are the three highly impacted hazard and disaster for their socio-economic impacts at the urban poor community according to the respondents. It is found that the numbers of house owners and the per house owner's average cost for damages of house for the fire hazard are higher than other two highly impacted hazard and disaster. Then, the number of house owners and the per house owner's average cost for damages of house for the flood are higher than the water-logging. The number of households and per household's average cost for damages of household goods and materials for the fire are also higher than the flood and water-logging. The number of households for the damage of household goods and materials for water-logging are higher than the flood but the per household's average cost for damages of household goods and materials for the flood is higher than the water-logging. These three hazard and disaster also cause post hazard or disaster related diseases and loss of earnings to a large proportion of households. So, they are the most severe hazard and disaster for a lot of casualties and damages, and huge cost for the socio-economic impacts They are the key challenges for the resilience and sustainable development at the hazard prone urban poor community in Dhaka city.

VI. CONCLUSION:

Many hazards and disasters have impacts on the urban poor community in Dhaka city. Among them, fire, flood and water-logging are the three most highly impacted hazard and disaster. The inhabitants are affecting hugely for casualties, damages and socio-economic impacts for these three hazards. They will be affected recurrently if the proper mitigation strategies are not taken. Mitigation strategies are necessary emphasized on the risk of the three highly impacted hazard and disaster as well as other severe hazards i.e., diarrhea and cholera, dengue, chikungunya, and structural collapse. The house owners should be encouraged to rearrange the houses block-wise separating by roads to reduce the risk of fire hazard. It is necessary to provide safe water, sewerage, drainage and pumping facilities as well as resilient housing to reduce the impacts of flood and water-logging. Awareness should be increased about the biological hazards by public hygienic education programs. It is the government's responsibility to engage all stakeholders including the CBOs to reduce the risk and increase the resilience for the sustainable development. Last but not least, the government should be earnest to reduce the socio-economic impacts with proper compensation when the impacts are unavoidable.

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