Study on the Health Status of Coastal People in Bangladesh After Cyclone Sidr and Aila

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Abstract

Bangladesh is recognized as one of the high-risk countries in the world that is prone to natural disasters. Due to its geographical location, topography, high population density, poverty and lower adaptive competence it is considered to be highly vulnerable to natural disasters in the world. This study was devised following the super cyclone Sidr that hit Bangladesh in November 2007 and cyclone Aila that hit in May 2009 to assess the impact of extreme weather event like cyclone on health of the coastal population of Bangladesh. A total of approximately 1000 households were selected by using the multistage cluster sampling technique from both villages. The study result shows that diarrheal, skin disease and mental health problems increased after the cyclones. The multivariable analysis shows that age of the respondents, gender, monthly income and educational level of the household heads and number of living children in the family have statistically significant effect on causing health problems before and after the cyclone Sidr and Aila. It can be concluded that extreme weather events like cyclones Sidr and Aila making the lives of the coastal people more difficult and also it increases the vulnerability in the society for poor people, elderly, children and women. Since this is a fairly unexplored research area, more empirical research work is needed to establish the impact of extreme weather events on health of the coastal people in Bangladesh.

Keywords: Coastal area, Bangladesh, Natural Disaster, Health, Cyclone

Introduction

Coastal area of Bangladesh is highly vulnerable area as it exposed to natural disasters due to recent climate change (Kabir et al, 2014). Bangladesh

has been plagued by innumerable natural disasters over the years. So far the country has faced tropical cyclones, tidal surges, tornados, floods, droughts and river erosion. Over a period of 100 years, 508 cyclones have affected the Bay of Bengal region, 17 percent of which caused landfall in Bangladesh. A severe cyclone occurs almost once every three years. Although the frequency of cyclones is not unusual compared to other cyclone hotspot countries, the impact it causes stands out: 53 percent of the cyclones that claimed more than 5,000 lives took place in Bangladesh (GOB, 2008). The populations of the coastal regions of Bangladesh are living under the poverty line, for example Khulna and Barisal (southern part) and Rajshahi (northern part) and environmental degradation is one of the main reasons for poverty. The main occupations of the coastal people are farming, fishing and agricultural labourers whose livelihoods depend mainly upon the natural ecosystem (Akter, 2009). In recent years, Bangladesh was hit by two consecutive cyclones *Sidr* in 2007 and *Aila* in 2009. Paul (2009) found that cyclone *Sidr* which hit Bangladesh on 15th November 2007 caused 3,406 deaths and over 55,000 people sustained physical injuries. Heavy rain accompanying cyclones and tidal waves due to wind effects caused extensive physical destruction, casualties, damage of crops, livestock and flooding in total 30 districts across the South Western coastal district of Bangladesh (Ministry of Flood & disaster Management, 2008). Cyclone *Sidr* affected nine districts of Bangladesh. The most devastated districts were Bagerghat, Barguna, Patuakhali and Pirojpur (Davidson, 2008). To find out the impact of natural disasters on health of the coastal population, the researcher decided to concentrate on the two major cyclones, which had recently hit Bangladesh, cyclone *Sidr* and *Aila*. There is growing scientific evidence from the literature that natural disasters are directly and indirectly affecting human health. The objective of this research is to assess the health effects of cyclones Sidr and Aila among the coastal people in Bangladesh.

Methods

This is a descriptive cross-sectional study. Data for the study were obtained from cyclone Sidr and Aila affected coastal populations in the South West part of Bangladesh. In Bangladesh, the administration is split into certain classified units and these units are divisions, districts, upazilas and unions and each village is governed by a Union (Haque et al, 2012). Barguna district was affected most by cyclone Sidr in 2007 (Kabir et al, 2014). Amtali upazila (consist of Baliatali and Gopkhali village) of Barguna District for data collection. Khulna was the other district selected for data collection. About 6 upazilas out of 9 in Khulna district was damaged by cyclone Aila in 2009 and Koyra was the most affected upazila (Roy et al, 2009). The Barabari village of Koyra Upazila of Khulna district was selected

for data collection. A multistage cluster sampling design was used. The two districts Barguna and Khulna were the primary units. The sample size was determined by using the following cluster sampling Formula: $n = Z^2 q / r^2 p \times$design effect

n= Required sample size, Z= 95 % Confidence value

p= proportion of target population will be affected by the climate change

q= 1-p

r= relative error which is assumed to be 8% (the lower is the value of r the higher is the sample size; similarly, the higher is the value of r the lower is the sample size)

In the absence of any information on p we assume p= 50%

Z= 1.96, p=. 50, q=. 50, r=8%, assuming design effect =1.5

Putting the above values n is estimated as 600. Now multiplying by design effect 1.5, n will be equal to 900.

Considering non-response rate of about 10% the sample size was determined approximately 1000.

The cluster is census enumeration area. A total of approximately 1000 households were selected by using the simple random sampling technique as tertiary units from the upazilas (secondary units) of these two districts. Data was collected using questionnaire survey from December 2011 to January 2012. The questionnaire was divided into 4 sections such as sociodemographic and household information, effects of natural disaster on household, effects of natural disaster on health and the last section was on pre-and post Sidr/Aila effects. The head of the household or family was given priority to respond to the questions. In the absence of the head, another other senior member of the family was given the opportunity. Particularly on health-related questionnaire all members of the family answered some question and on average an interview lasted for 30-45 minutes. To minimise the recall bias different questions were asked to the participant.

Data was analysed using the statistical package of social sciences (IBM SPSS) software version 21.

Variables used in the analysis

In this research variables are classified into two categories: (1) Demographic variables (2) Socioeconomic variables

Demographic variables

There are four demographic variables used in this analysis. These are:

1. The age of the household members (at the time of interview) in completed years. The age of the household head are classified into three groups on the basis of their age, i.e. below 5 years, 5-17 years and 18 years

and above. It is understood that climate change has variable impacts on different age groups.

2. Gender of the household member is another demographic variable used in this research. Various literature on climate change and its impact has emphasized gender.

3. The number of children living in the family is categorized into four groups: none, 1 child, 2 children and 3 children or more.

4. The religion of the household head variable is classified into two categories: Muslim and Hindu.

5. Survey area: In this research the survey area is divided into categories: Cyclone Sidr affected area and cyclone Aila affected area.

Socioeconomic variables

The following socioeconomic variables are used in this research:

1. The level of education of the household head: in this research the level of education has been classified into three categories (i) no education (ii) primary education and (iii) secondary education and above.

2.Access to Television is defined as the dichotomy of yes and no.

3. Access to radio is also classified into two categories yes and no.

4.Electricity connection in the household is categorized in this research as yes and no.

5. Household monthly income is a very important factor in terms of climate change adaptation and health care. The household monthly income was classified into two income groups <=3000 Taka and > 3000 Taka. (Taka is the name of the currency in Bangladesh. 1 USD= 77.95 Taka as of 26 October 2013)

Here, occurrence of health problems before and after the disaster has been considered as the dependent variable. The occurrence of health problems before and after the disaster was measured by comparing the health problems faced by an individual before and after the disaster. If the health problems were higher after the disaster, then it was taken in to the consideration. The dependent variable is binary which is the occurrence of the health problems before and after the disaster. Its value is one whereas the occurrence of no health problem before and after the disaster is valued at zero. The independent variables used in this model are: age of the household head, gender of the member, number of children living in the family, religion of the household and survey area, level of education of household head, access to television, access to radio, electricity connection in the household, access to mobile phone and household monthly income. Considering all the variables in the Logit Model, we have:

⇨ $\ln\left(\frac{\rho_i}{1-\rho_i}\right)$= β_0 + β_1 age + β_2 gender + β_3 number of children+ β_4 religion +β_5 survey area+ β_6 level of education+ β_7 access to television+ β_8 access to radio+…

Where $P_{i=}$ Probability that health problems occurred before and after disaster

1-P_i = Probability that no health problem occurred before and after disaster

β_0 = Constant and β_1, β_2, β_3, β_4, β_5, β_6, β_7 are the co-efficients are to be estimated.

Results

Table 1 shows background characteristics of the respondents. About 52 % respondents are from cyclone Sidr affected areas and 48.2% respondents are from cyclone Aila affected areas. About 87.6% of respondents of the Household heads are male, 72.6% of households are Muslim followed by 27.4% of households are Hindu. The majority of the household heads (36%) are aged over 50 years and only 22.6 % are below 30 years. In both the cyclone-hit areas, 92% of household heads are married; only 4.8% household heads are widowed. About 73.9% respondents are educated. Among them 43.5% respondents have studied up to primary level and 25.2 % respondents have completed their secondary education. The statistics show that 44.2% of respondents have/had been living in the affected areas from 21 to 40 years and 15.6% respondents have/had been residing in the area for 61 to 80 years.

Table 1 Distribution of respondents by their characteristics

Variables	Frequency	Percent
Survey Area		
Sidr	504	51.8
Aila	469	48.2
Gender of the Household Head		
Male	853	87.6
Female	120	12.3
Age of the Household Head		
<30	220	22.6
30-39	196	20.1
40-49	202	20.8
50 above	355	36.5
Religious Status		
Muslim	706	72.6
Hindu	267	27.4

Marital Status		
Married	890	91.5
Single	20	2.1
Divorced	10	1.0
Separated	6	0.6
Widowed	47	4.8
Educational Status		
Yes	719	73.9
No	254	26.1
Level of Education		
Primary Education	424	43.5
Secondary Education	246	25.2
Higher Secondary Education	29	2.9
Higher Secondary Education above	20	2.1
Living in this area		
Less than a year	9	0.9
1-20 years	79	8.1
21-40 years	430	44.2
41-60 years	297	30.5
61-80 years	152	15.6
81-100 years	6	0.6

The logistic regression analysis shows that age, gender and religion of household member, access to electricity, monthly income, education level of the household head and number of living children in the family have a statistically significant effect on the occurrence of health problems before and after the disasters (Sidr and Aila). The odds ratio of the coefficient age indicates that household members whose aged 18 years and above their health problems is about eight times higher compared to the children aged under five years irrespective of before and after disaster. The analysis reveals that those households who had access to television compared to those who had no access to television were 20 percent higher chance of being affected by health problems before the disaster and those who had access to television were 66 percent less likely to have morbidity. The odds ratios also demonstrate that access to radio and TV are positively related with occurrence of health problems. These results are contrary to the Researcher's expectations and may be attributed to the small number of households possessing TV and radios and possibly the confounding effects of the radio and TV failed to capture expected direction of the relationships. Access to electricity is negatively associated with health problems as supported by the odds ratio. Households with electricity are 29% less likely to experience health problems that those who did not have access to electricity connection. Income status of the household has an important impact on the health problems. The higher the income the lower the probability of health problems. For example, households whose income are Taka 3000 and above

their health problems are 19% lower than those households whose income is less than Taka 3000.The number of children in the households is positively associated with health problems. The higher is the number of children the higher the likelihood that they will suffer from health problems. As expected education level of the household head is negatively correlated with the health problems. The higher is the education level of the household head the lower the probability they will suffer from morbidity. For instance, household heads who had secondary education, had a 34% less probability of suffering from health problems than those who had no education.

Table 2 Odd ratio from logistic regression analysis assessing the association between explanatory variables and occurrence of health problem before and after the natural disaster

Variables	Categories	Odd ratio (95% C.I. for Odd ratio)	
		Occurrence of health problems before the disaster	Occurrence of health problems after the disaster
Age of household member	<5 yr	1.00	1.00
	5-17 yr	6.31 (4.03-9.87)	2.53 (1.80-3.56)
	18 yr +	7.89 (5.10-12.22)	2.72 (1.99-3.71)
Gender of the member	Male	1.00	1.00
	Female	0.88(0.77-1.00)	0.78 (0.64-0.95)
Religion of household head	Muslim	1.00	1.00
	Hindu	0.72 (0.60-0.86)	1.76 (1.26-2.44)
Access to Television	No	1.00	1.00
	Yes	1.20 (0.87-1.66)	0.34 (0.22-0.54)
Access to Radio	No	1.00	1.00
	Yes	1.18 (0.96-1.46)	1.15 (0.82-1.62)
Electricity connection in the household	No	1.00	1.00
	Yes	0.71 (0.59-0.87)	1.33 (1.00-1.78)
Household monthly income	<=3000	1.00	1.00
	>3000	0.81 (0.70-0.92)	0.65 (0.53-0.80)
Number of children living in the family	None	1.00	1.00
	1 Child	1.35 (1.10-1.65)	1.11 (0.83-1.48)
	2 Children	1.40 (1.14-1.72)	1.38 (1.03-1.84)
	3 Children	1.27 (0.99-1.62)	1.30 (0.92-1.85)
Level of education of household head	None	1.00	1.00
	Primary	0.70 (0.60-0.83)	1.02 (0.80-1.30)
	Secondary	0.66 (0.55-0.79)	0.93 (0.71-1.21)
Mobile Phone	No	1.00	1.00
	Yes	1.14 (0.97-1.33)	1.29 (1.03-1.61)

Survey area	Sidr	1.00	1.00
	Aila	1.11 (0.94-1.31)	1.92 (1.48-2.48)
	Constant	0.10	2.04
	-2 Log likelihood	5091.4	2819.3
	Model Chi-square	202.2 ρ-value=< 0 .000	170.1 ρ-value=< 0 .000

The logistic regression analysis also suggests mobile phones are not an important determinant of health problems since the odd ratio is found to be positive. The further analysis of logistic regression shows that males are more vulnerable to health problems after the disaster. It is revealed from the logistic regression coefficients that females were 12 percent less likely to have morbidity before the disaster while after the disaster females were 22 percent less likely to suffer from health problems. Similarly, religion of the household head shows that Hindus have a 28% reduction in health problems compared to Muslims. As compared to Sidr area, respondents from Aila area had 2 times a higher risk of getting health problems after the natural disaster. The value of log likely -2 Log likelihood Chi-square suggests model is well fitted and statistically significant ρ-value=< 0 .000.

Discussion

In this research, male respondents accounted for 87% and the vast majority of respondent were aged 50 years and above. About 74% of household heads revealed that they were educated and their main occupations were farming and fishing. A cross-sectional study conducted by Nesha *et al*, (2014) on people's perception about climate change and its adverse effect on rural Bangladesh reported that the age of the participants of the research was between 30 and 65 years, with about 51% respondents being female. Their main occupations were housewife, farming and private job. Similar findings are shown by Haque *et al*, (2012) and Karim *et al*, (2013). The monthly income of the respondents is less than 3000 Taka. This is consistent with other studies by Alam (2012) and Haque *et al*, (2012). Both *Sidr* and *Aila* affected people are aware of the fact that natural disasters due to climate change is affecting their health. Similar results were found by Bhuiyan and Khan (2011). The respondent household informed that the prevalence of skin diseases followed by infectious diseases and mental illness in the affected area. Paul *et al*, (2010) found in their study that after *Sidr* 38% suffered diarrhoeal diseases, 12% suffered from typhoid and 4 % skin diseases. When compared with the pre-and post effects of *Sidr* and *Aila* on diseases with the family members of the respondents' household it

became clear that the prevalence of some diseases were very higher in the post cyclone period and some infectious diseases like diarrhoea which were not common before the cyclone, increased in incidence. Diarrhoeal disease outbreak occurred after the 2004 floods in Bangladesh, 1988,1998 and 2004 floods in Bangladesh, 2004 Tsunami in Indonesia, 2005 earthquake in Muzzafardbad Pakistan, floods in Mozambique 2000, floods in China and in USA after Hurricane Allison in 2001 and Katrina 2005 reported in WHO (2006), Schwartz *et al,* (2006), Ding *et al,* (2013) and Kondo *et al*, (2002). The chi-square analysis of this research displays that the percentage of diarrhoea was higher among individuals whose households' head had no formal education. This is consistent with another research on post cyclone Sidr illness in coastal Bangladesh where the researchers showed that the illness rate was higher among the illiterate population than the literate (Paul *et al*, 2010). Bhunia and Ghosh (2011) in their research after cyclone Aila in Sundarban of West Bengal, India reported an increased number of diarrhoea cases due to contaminated drinking water. Other health problems that are found significant in this research are respiratory problems, skin diseases, food poisoning, hepatitis and mental health problems. Waterborne diseases and skin infections were also reported in a study in the Delta State of Nigeria related to flooding (Emaziye, 2013). Hepatitis A and E were reported after the 2004 Tsunami in Indonesia (WHO, 2006), respiratory problems reported after the Tsunami and earthquake 2005 in Pakistan (WHO, 2006) and (Baqir *et al*, 2012). Dysentery cases were identified after flooding in Xinxian City, China (Ni *et al*, 2014). Diarrhea, skin and eye infections were identified in Pakistan after flood (Baqir *et al*, 2012). It also implies that irrespective of the type of disaster health problems following the occurrence of natural calamity is common. People of local communities should be provided primary health care support and knowledge in such situations to protect themselves from diarrhoea, skin diseases, food poisoning. Loss of family members, and a loss of employment due to damage to agricultural land and livestocks and reduced fish production are one of the contributing factors responsible for mental disturbance among the coastal communities. Similar results are in line with researches by Rahman *et al,* (2014), Swim *et al,* (2009) and Kazdin (2009).

Conclusion

There is limited research on understanding the likely health impacts on coastal population of natural disasters. The research gaps and other information provided in this research leads to a great number of potential research ideas. Knowledge and awareness on natural disasters like cyclones related threats should be made available for the coastal population. In addition, research should be carried out to assess the current knowledge and

awareness of natural disasters and its impact of the coastal communities to address the gaps. To reduce the vulnerability of costal communities' capacity building programmes should be run at household levels to adapt with disasters and different livelihood strategies. Adaptation measures at community level will help local people to strengthen their barriers against disasters. The coast of Bangladesh is a densely populated area and relocation of coastal people is not possible due to land availability. So it's a high priority that local people should know about the management natural disaster impacts. The coastal zone should be protected where it is environmentally viable. This research has collected information on the other members of the households by questioning the head of the households. This has its inherent limitations as it relies on the knowledge of the respondents. The small sample size of the research is another limitation because it does not allow generalization of the descriptive findings.

Ethical Approval

The study protocol was approved by Middlesex University Ethics Review Committee.

Competing Interests

The authors declared that there are no potential competing interests with respect to the research, authorship, and/or publication of this paper.

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