COMMUNICATIONS

CYCLONE DEATHS IN BANGLADESH, MAY 1985: WHO WAS AT RISK

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Abstract. In May 1985, a cyclone from the Bay of Bengal struck the coastal islands of Bangladesh. In spite of early detection of atmospheric turbulence and the history of severe cyclones in the area, an estimated 11,000 people lost their lives.

In a natural experiment, cyclone death rates from the two severely affected islands, Urir Char and Sandwip, were analysed 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 behavioural. 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.

Key words: natural disasters; shore protection; coastal signals; estuaries; Bangladesh

Introduction

On May 23, 1985, the Bangladesh Space Research and Remote Sensing Organization computer detected the formation of a cyclone storm moving northward in the Bay of Bengal [1]. Slightly less than 36 hours later, the storm reached the coastal islands of southeastern Bangladesh. In spite of the early detection of atmospheric turbulence and the history of severe cyclones in the area, an estimated 11,000 people lost their lives. An epidemiologic investigation of this disaster was conducted in order to determine the risk factors of cyclone-associated mortality and help to establish priorities for future preparedness.

The 50,000 sqkm delta in the Bay of Bengal at the outfall of the Ganges, the Brahmanputra and the Meghna Rivers is inhabited by over 10 million people. These rivers deposit enormous quantities of silt in the northern portion of the Bay of Bengal each year, forming temporary islands, or 'chars', which are constantly being altered by accretion and erosion. Their fertile soil attracts poor, landless migrants who are willing to tolerate severe weather conditions in exchange for economic self-sufficiency. This char area, along with coastal Bangladesh, has been the site of cyclones and tidal waves that, in the recent past, have caused 22,000 deaths in 1963; 65,000 deaths in 1965 [2]; and 500,000 deaths in November, 1970 [3]. As a result, some cyclone shelters had been built, particularly on the more populated, more permanent chars such as Sandwip island where, in addition, the Bangladesh Red Cross maintains a cyclone warning system by means of which inhabitants are alerted of impending storms via loud speaker.

Methods

From June 6-16, 1985, five two-man teams from the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B), while providing emergency medical relief to cyclone victims, conducted a survey to study selected epidemiologic characteristics of the disaster. Surviving members of households (communal kitchen units) were identified as primary sources of information. Due to the disaster situation, random sampling techniques were not applied, nor was the survey instrument pre-tested. Individuals were selected for interview as they were encountered, and only from areas in which the ICDDR,B relief team was working (*figure 1*). No information was gathered regarding households of which all members had perished, nor was a determination of total deaths attempted.

Information is reported from 93 families with survivors. Pre-cyclone family size, the number of deaths, knowledge of the impending cyclone and its source, previous cyclone experience, and selected possessions were recorded. In addition, the location of the nearest cyclone shelter was noted by the teams. Interviews were conducted on Sandwip island, in each of eight disaster relief centers, and on Urir Char, a less permanent and smaller island, where survivors were identified through the Navy relief allocation registration list. No cyclone shelter existed on Urir Char.

Results

Both Sandwip and Urir Char households had been severely affected by the cyclone. All of the Urir Char and 90.6% of the Sandwip interviewees had lost their homes, and 97.2% and 73.6% of the livestock respectively.

In spite of this evidence that the cyclone had a devastating impact on both islands, the death rate in the Urir Char households of which survivors were interviewed was significantly higher than that determined from the Sandwip survivors (*table 1*). Ninety-one percent (90.1%) of the 11 deaths in Sandwip and 99.1% of the 110 deaths in Urir Char (*table 2*) were individuals who did not seek shelter ($P < 0.001$).

An analysis of the determinants of this difference in behaviour is revealing. Al-

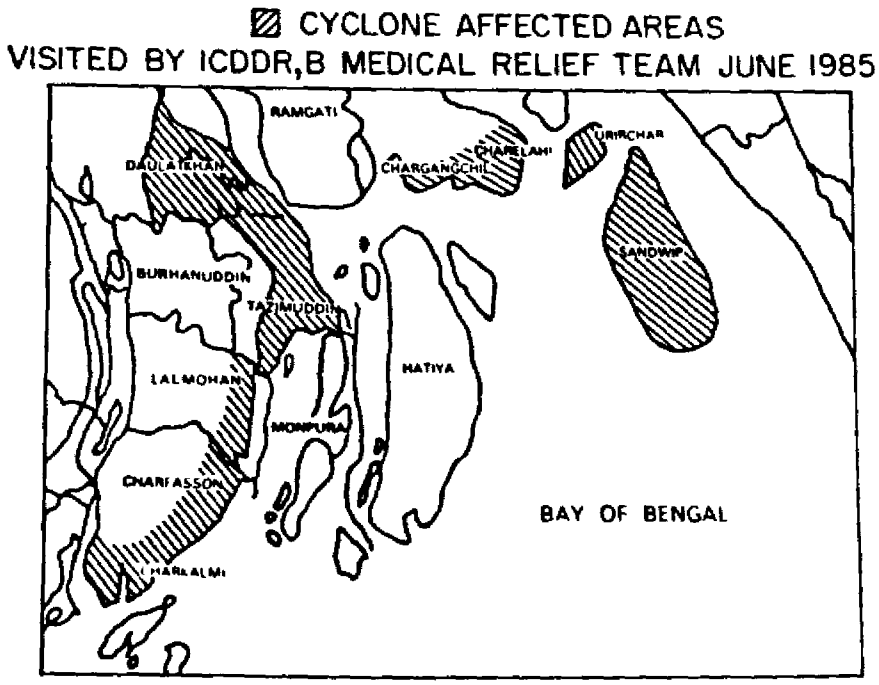

Figure 1. Cyclone affected areas visited by ICDDR,B medical relief team June 1985

Table 1. Families interviewed by area, size of the family and deaths due to cyclone Bay of Bengal, May 1985

Island	*Number of families interviewed*	*Total pre-cyclone family members*	*Mean family size (SD)*	*Number of deaths*	*Death rate/1000 family members*
Sandwip	53	321	6.00 (2.4)	11	34.3
Urir Char	40	272	6.80 (2.3)	110	404.4

Table 2. Death by location at the time of cyclone Sandwip and Urir Char, May 1985

Location	*Sandwip (n=11)* %	*Urir Char (n=110)*
Home	90.9	99.1
Shelter	9.1	0.9

$P < 0.001$

though there were no statistically significant differences in possession of a radio (22.5% on Urir Char and 40.0% on Sandwip), and advance knowledge of the advancing cyclone (70.1% and 100%, respectively), access to shelters was much greater on Sandwip than on Urir Char; 75.5% of the Sandwip interviewees could reach a cyclone shelter in less than two hours compared to 2-4 hours for 69.2% of the interviewees from Urir Char (*table 3*) ($P < 0.001$). Furthermore, 38/53 (71.7%) of interviewed household members from Sandwip, as compared with only 11/40 (27.5%) from Urir Char (*table 4*) had had prior experience with cyclones ($P < 0.001$). Inhabitants of Sandwip also

Table 3. Nearest cyclone shelter distance, measured in time presented as a percentage: Sandwip and Urir Char, May 1985

Distance in hours	*Sandwip (n=53)*	*Urir Char (n=39)**
Less than two hours	75.5	30.8
2-4 hours	24.5	69.2

$P < 0.001$
*One non-respondent

Table 4 Comparison of past cyclone experience, presented as a percentage: Sandwip, Urir Char, May 1985

	Past cyclone experience	
	Positive	*Negative*
Sandwip (n=53)	71.7	28.3
Urir Char (n=40)	27.5	72.5

$P < 0.001$

Table 5. Advance notice of impending cyclone in hours, presented as a percentage. Sandwip and Urir Char. May 1985

Hours	*Sandwip (n=53)*	*Urir Char (n=28)**
10-12	91.3	16 2
3- 6	8.7	83.8

$P < 0.001$:
*12 interviewees had no notice at all

Table 6. Distribution of reasons, expressed by interviewees for not moving to shelter presented as a percentage- Urir Char and Sandwip, May 1985

Reasons	*Urir Char (n=51)*	*Sandwip (n=30)*
Short notice	3.9	3.3
No transport	2.0	0 00
Shelter too far	29.4	3.3
Advised not to move	3.9	10 00
Difference of opinion in the family	3 9	20 00
Did not anticipate severity	31 4	60.00
No knowledge of cyclone	17 6	0 00
Nightfall	7.8	0.00
Financial difficulty	0 0	3.3
	100.0	100.0

appeared to have had earlier warning (*table 5*); 91.3% had at least ten hours to prepare, while 83.8% of Urir Char residents had less than six hours advance notice ($P < 0.001$)

Each of the interviewees from Urir Char and Sandwip expressed their personal reasons for not seeking shelter, several gave more than one reason. This is shown in percent distribution (*table 6*).

Discussion

The findings of this study suggest that the group who decided to stay at home were at the highest risk of death from the cyclone. This was the key factor associated with the observed deaths. The reasons for this behaviour contributing to the excess deaths were examined and a number of factors with positive association were detected. These are: no information or late information regarding the impending cyclone, relative distance of the shelter from home, and lack of cyclone experience.

A temporal relationship between these factors could not be established in clear mathematical terms, nor their individual contribution as determinants of excess deaths in Urir Char. Nevertheless, detection of association indicated points at which the chain of events leading to excess deaths could have been interrupted. To solve this quandary, a heuristic approach was adopted (*figure 2*), which is an accepted mode of explaining complex problems where conventional analytic methods fail.

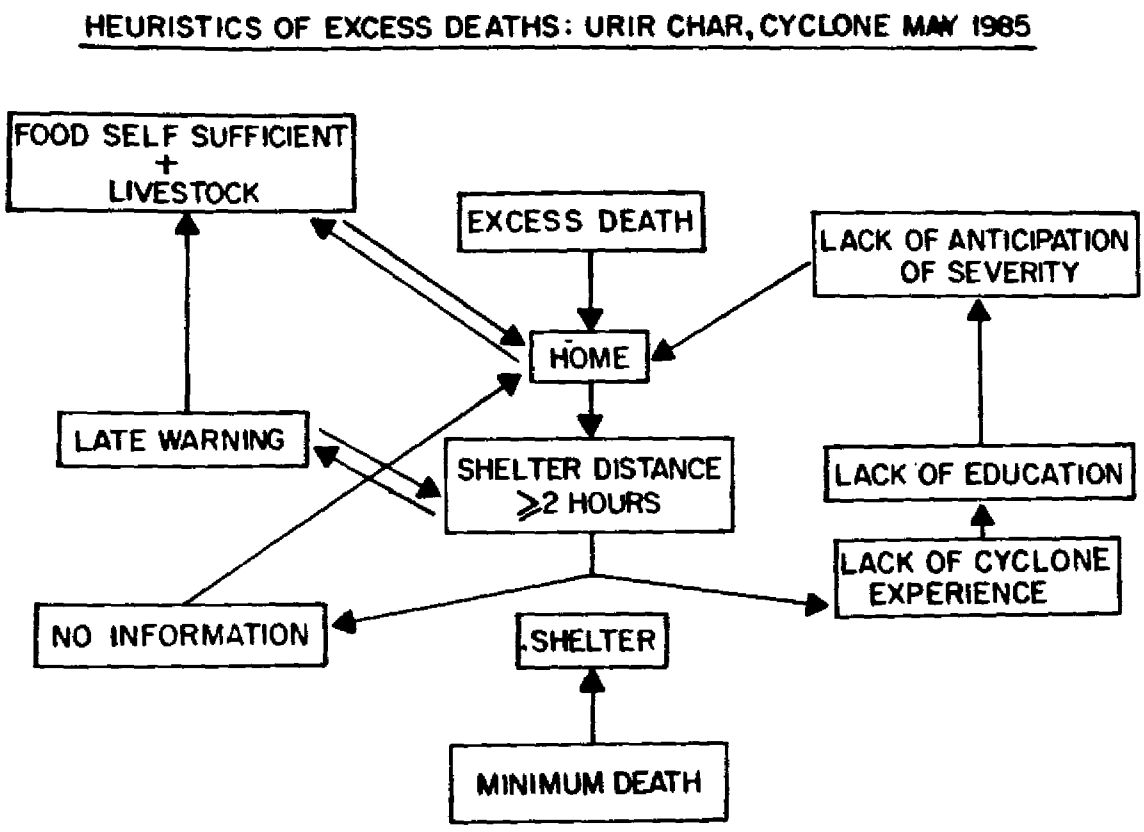

Figure 2 Heuristics of excess deaths Urir Char, cyclone May 1985.

The heuristic approach based on these factors has identified the barriers, which possibly prevented the group from seeking safety. These were physical as well as behavioural.

Lack of prior cyclone experience combined with the deficiency in education resulted in impaired anticipation of the severity of the cyclone. This possibly contributed to the decision to stay at home. Relative ignorance of the impending cyclone also played a significant role. Families who had no warning of the cyclone, obviously remained at home.

The majority of Urir Char residents received a relatively late warning. Neighbours were the main source of information in Urir Char, and this contributed to the delay in communication. Seventy percent of the Urir Char families would have been compelled to make a journey of 2-4 hours to reach the nearest cyclone shelters which was on Sandwip across the channel. To travel this distance under normal conditions might not have been a problem, but at night with prevailing rain and high winds, it posed a formidable hazard. The late notice, the distance of the shelter and the stormy weather condition might have positively influenced the decision to stay at home.

The study revealed that 90% of the families in Urir Char were farmers, who were self sufficient in food. Their livestock possessions were considerable in number. Similar observations were made after the 1970 cyclone, the nutritional status of the affected population was found to be higher in contrast to the control area. This was attributed to the richness of the 'char' areas [4]. To Urir Char farmers, self sufficiency in food,

home, and livestock were a source of pride. The likelihood and the idea of abandoning these in the face of danger and face economic ruin was inconceivable.

No previous epidemiological study has reported the associated factors of cyclone deaths in coastal areas of Bangladesh. Sommer and Mosley [5] conducted an extensive survey after the disastrous 1970 cyclone. Their study, however, was mainly concerned with the assessment of relief needs.

In spite of the limitations of this study undertaken during the disaster situation, it does support the following conclusions: a) cyclone shelters are effective in averting deaths; b) easy access to a cyclone shelter is important for its effectiveness; c) both the timing and the method of cyclone warning are important in reducing the risk; d) education regarding the hazard of cyclones can be beneficial for cyclone preparedness in a community.

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