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An Assessment of a Tsunami Warning in South-East Bangladesh

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ABSTRACT

This research aims to look at household responses to a tsunami warning that took place in south-east coastal areas of Bangladesh on 12 September 2007. The study was conducted in both the mainland and islands of Cox's Bazar district. We examined the impact of the warning by measuring the effectiveness of the warning, reasons behind evacuation or failure to do so, experience of evacuating and staying in shelters, and loss in assets. We also examined whether evacuees will trust future warnings. The findings also reveal the extent to which people in the tsunami prone coastal areas have enough time to respond to a warning in the future. The findings in this study provide important information to help improve the effectiveness of tsunami warning in the future.

INTRODUCTION

Bangladesh is vulnerable to many natural disasters. One of these disasters includes tidal wave surges as a result of both local tsunamis and those that take place elsewhere, such as in Indonesia. In order to minimize damage and evacuate, experts at the Earthquake and Tsunami Preparedness Project states that people would only have 20 minutes to evacuate should a local tsunami strike (Roy 2007). To prevent loss of lives, the ministry of relief and disaster management (MRDM) of the government of Bangladesh sends announcements through local agencies to alert people to evacuate. One such incidence took place on 12 September 2007, which was also the first warning of its kind in Bangladesh. A news paper article stated that this warning was issued because a tsunami took place in western Indonesia killing 10 people and injuring 100 (The Daily Star 2007). Coincidently, water levels on the shores of Cox's Bazaar rose by 2.5 feet and tremors were felt on Kuakata beach. Many people were evacuated to designated shelters although no tidal wave due to tsunami washed out the coastal belt of Bangladesh.

To understand what happens during a potentially life-saving tsunami warnings, BRAC RED conducted a research in southeast Bangladesh where the tsunami warnings were announced. We examined the impact of an 'inaccurate' warning by measuring the effectiveness of the warning, reasons behind evacuation or the failure to do so, experience of evacuating and staying in shelters, loss in assets and whether the evacuees would trust in future warning. The study will also help reveal the extent to which people in the tsunami-prone coastal areas have enough time to respond to the warning in the future.

METHODS

This research was conducted using a quantitative approach. Structured questionnaires were used to design the survey. Data were collected through 23 trained enumerators. Local interpreters were also used to help translate questions in local dialects.

The study was conducted in November 2008 in Cox's Bazaar district in southeast Bangladesh where a tsunami warning was announced on 12 September. Areas were identified initially from a newspaper report in the Daily Star published on 13 September 2007. These areas included mainland areas of Pekua, Ukhia, Teknaf, Ramu, and Cox's Bazaar *upazilas.* It also included islands, such as St. Martin, Kutubdia, and Maheshkhali *upazilas*. Therefore, an attempt was made to assess the impact of an inaccurate tsunami warning as well as whether the impact made any difference on the mainland as opposed to islands assuming that those living on islands are more vulnerable because of their geographical location. Thirty villages or clusters from the coastal areas of the mainland and 30 from the islands were chosen for the study. Within each cluster of village, 30 households were randomly selected for interviews, which resulted in a sample size of 1,800 households. The respondents were representatives of households and they consisted of adult men and women aged above 18 years.

A fieldwork condition was difficult in areas where transportation was hard to find. No difficulties were faced in terms of accessing respondents. Cyclone Sidr of 15 November 2007 did not affect data collection since cyclone Sidr did not hit Cox's Bazaar. STATA was used to analyze the data. Due to the lack of time, there were a few limitations to this study. We did not apply any qualitative methods that could help answer many 'why'-related questions to clarify various aspects of trust and willingness to evacuate when a warning is announced. Information could not be collected regarding the type of assistance the evacuees might expect to receive from ministry of relief and disaster management (MRMD), what some people bought on the way to shelters, and whether evacuees needed medical treatment once they reached shelters.

FINDINGS

RESPONDENTS' BACKGROUND

Demography and education

Majority of the respondents were men (54%). Women comprised of 44% in main land and 48% in island. On average the respondents were 39 years old. More than half of the male respondents (around 56%) were found to be illiterate (Table 1). Around 67% of the women reported to be illiterate. The proportions of male and female respondents that received primary level of education were nearly 24% and 20% respectively. Around 12% of male and 9% of female respondents had secondary level of education. A small number of respondents were SSC passed or had a degree higher than SSC.

Table 1. Educational background of the respondents (%)

		All	Main land	Island
Education-male	Illiterate	56	58	50
	Primary level	24	24	27
	Secondary Level	12	11	13
	S.S.C pass or above	8	7	10
	n	965	499	466
Education-female	Illiterate	67	70	65
	Primary level	20	19	20
	Secondary Level	9	8	11
	S.S.C pass or above	3	3	4
	n	835	401	434

Occupation

The average household size was found to be around 6 in all areas. Table 2 indicates that most men were fishermen (21%). Other occupations consist of non-agriculture self employment (19%), day labourers (17%), agriculture self-employment (15%), and salt production (6%). Majority of the female respondents (83%) were involved in household work. Some women were found to be self-employed (non-agriculture), monthly income earners, and fisherwomen. No significant difference was found in terms of proportion of people involved in different types of occupation between mainland and island.

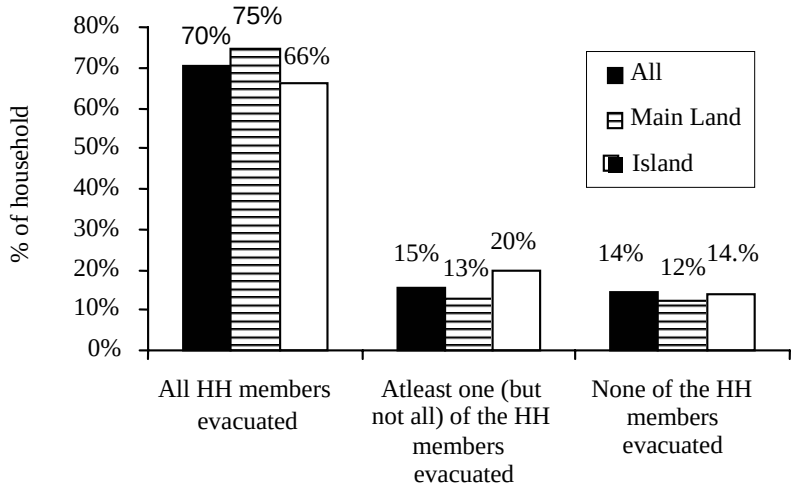
Table 2. Occupation of the respondents (%)

		All	Main land	Island
Occupation male	Fisherman	21	21	21
	Self employed(non agriculture)	19	19	19
	Day labour	17	21	14
	Self employment(agriculture)	15	16	14
	Salt production	6	6	7
	Service	5	5	6
	Physically weak	6	6	6
	student	2	2	3
	others	8	6	10
	n	965	499	466
Occupation female	Household work	83	85	81
	Self employed, (non agriculture)	3	2	3
	Service	3	2	3
	fisherman	2	2	2
	Physically weak	2	3	2
	student	1	1	2
	others	6	5	6
	n	835	401	434

Rates of evacuation

Only 2% of the respondents on the mainland and 11% of the respondents on the islands reported that they or their household members were counseled about the importance of evacuation prior to the false tsunami warning. Additionally, majority of the respondents (about 93%) reported that neither they nor their household members were consulted whether evacuation was necessary. Even though most people were not notified about the reasons to evacuate or were not consulted by the tsunami warning authorities, most people evacuated. All the members of 75% of the mainland households and 66% of the island households were evacuated while none was evacuated from 12% households on the mainland and 14% households on the islands (Fig.1).

Figure 1. Evacuation rates



The proportion of male members who did not evacuate was found to be significantly higher (61%) for islands compared to mainland (56%). The average age of the members who did not evacuate was 26 years and 25 years for mainland and islands respectively. The major reason that why many people did not evacuate was because they did not want to leave behind household assets. A significant amount of people preferred to stay home with other family members. The proportion of people preferred to stay at home was almost double on the mainland (20%) compared to the islands (10%) (Table 3). Around 9% of the people who did not evacuate mentioned that they took it as a false alarm. Around 11 % of people on the islands who did not evacuate the islands compared to 1% on the mainland reported that they found their own homes more reliable rather than other types of shelter. Some also stated that other shelters were too far or they were unable to get there since they were handicap or were out to sea.

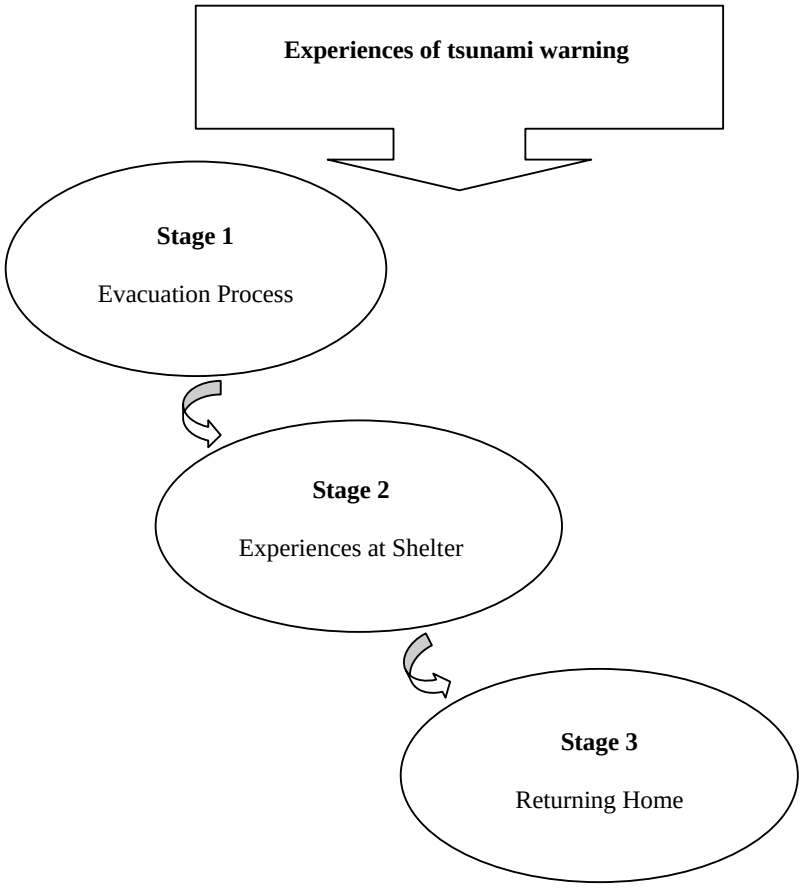
Table 3. Reasons for not evacuating their own house as mentioned by the respondents (%) who did not evacuate

	All	Main land	Island
Did not want to leave behind household assets	45	51	40
Stayed with other family members	15	20	10
Took it as a false alarm	9	9	10
Was in out of the area	7	5	8
found home more reliable	7	1	11
Had no assistance or physically unable	2	1	2
Shelter place was near	4	2	4
Shelter places were over crowded.	3	3	2
Was in deep sea	4	3	5
Others	2	1	4
Did not mention	2	1	2
n	2037	901	1136

Three stages of tsunami warning experience

Tsunami warning experience can be described in three stages (Fig.2). Stage 1 will focus on the evacuation process which will basically include dissemination of tsunami warning, types of shelter the evacuees moved to, types of assistance received while evacuating, assets carried to the shelters, travel cost incurred, total time required to evacuate and finally important factors affecting the response time. Stage 2 will discuss the experience of evacuees at different shelters. Stage 3 will illustrate the experiences of returning home- how and when the evacuees felt safe to return home and incidence of asset loss.

Figure 2. Three stages of experiences of tsunami warning



STAGE 1: EVACUATION PROCESS

Dissemination of the tsunami warning

Among those who evacuated, most people heard the warning announced through loud speakers or 'miking'. Around 74% of the inhabitants on the mainland and 75% on the islands reported that the tsunami alert and evacuation message reached to them through miking (Table 4). The telephone was least used on both the mainland and the islands. Other media included radio or television and neighbours (Table 4).

Table 4. Dissemination of tsunami warning as mentioned by the evacuees (%)

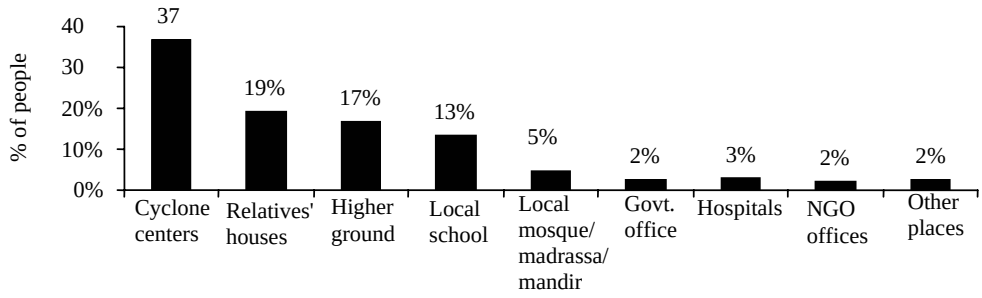
	All	Main land	Island
Miking	75	74	75
Radio/TV	13	16	9
Neighbours	8	5	11
Telephone	3	3	3
Others	1	0.55	2
n	1549	786	763

This table includes multiple responses

Evacuation shelters

Among those who evacuated, many ran for shelter to the closest safest places. Figure 3 shows that majority of people (around 37%) both on the mainland and islands rushed to cyclone centers. People were also found to take shelter in their relatives' house, which they thought to be safer since many were located at higher grounds. People in both types of areas were also found to take shelter in a local educational institute, religious institute, hospitals, government offices, and NGO offices. A small fraction was also found to stay within cemeteries, on roads, bridges, shops or on boats.

Figure 3. Types of shelter



When disaggregated by mainland and islands, several differences can be found as shown in Figures 4 and 5 with regard to various types of shelter people tried to find.

Figure 4. Shelters on the mainland

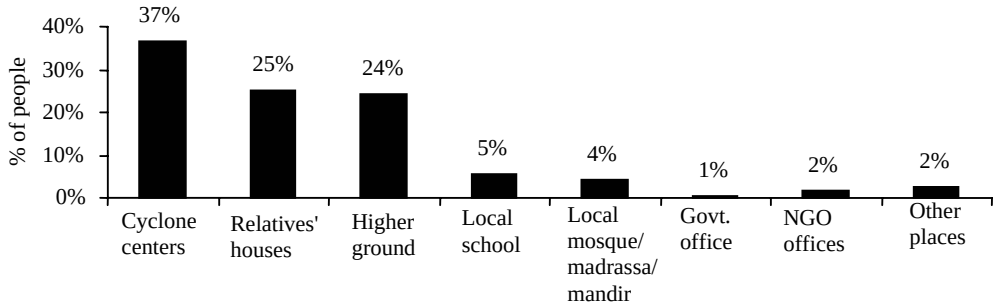
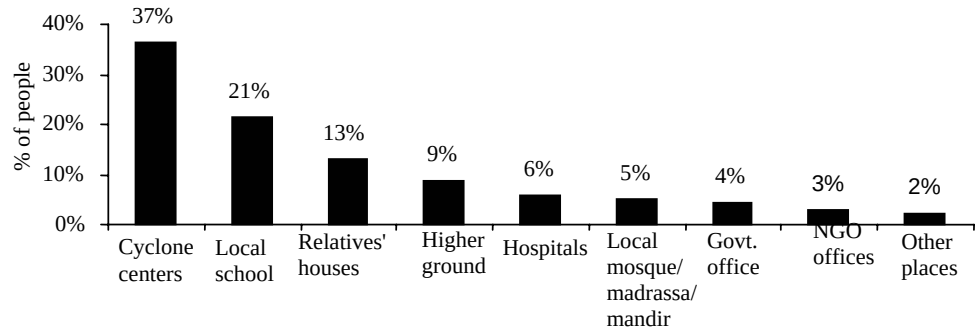


Figure 5. Shelters on the islands



Around 25% of the mainland households and 13% of the island households reported that they went to relative's house for shelter (Figures 4 and 5). However, a significant proportion of

households (24%) on the mainland were found to take shelter on the higher ground under the open sky, while it was about 9% for island evacuees.

We found that most of the coastal inhabitants rushed to places for shelter, which were closer to their homes. The average distance between their houses and the shelter was found to be 1.6 km for mainland and 1.05 km for island areas. Though the shelters were not very far, it took mainland inhabitants on average 31 minutes and island inhabitants 24 minutes to reach there with their valuables.

Assistance during evacuation

It is important to know whether evacuees received assistance in the process of evacuation because it also reflects upon the services the concerned ministry offers when a natural disaster is about to take place. We found that the people did not have enough assistance while evacuating. Only 10% of the mainland and 14% of the island inhabitants who were evacuated reported to receive assistance at the time of evacuating. Although the cyclone preparation programme (CPP) requires government officials, NGOs, and volunteers to assist people to evacuate, their contribution was found to be insignificant both on the mainland and islands. Instead, 96% of the mainland and 91% of the island inhabitants who received assistance reported that their neighbours and relatives helped them to evacuate and reach to the safer places.

Assets carried to the shelter

A large proportion of households in the mainland (about 58%) that evacuated were found to carry materials to cyclone shelter compared to those on islands (around 48%) (Table 5). Majority of them were found to carry clothes and money in both the localities. Proportion of households that carried food and ornaments were significantly higher in the islands compared to those on mainland. However, the proportion of households that carried electronic goods was found to be higher on the mainland compared to those on the islands. Additionally, households in both the areas were also found to carry poultry and livestock, utensils, and important documents. The value of the goods carried by the households in both the areas on average was around Tk. 16,500. However, around 41% of the mainland and 51% of the island households that were evacuated left home without carrying any valuables, even though out of the 41%, 87% evacuated with all the household members. In the case of the islands, out of the 51%, 78% evacuated with all the household members.

Table 5. Types of assets carried to the shelters as mentioned by the evacuees (%)

	All	Mainland	Island	t- value (mean difference)
Clothes	65	64	67	-0.73
Cash money	62	60	65	-1.31
Ornaments	41	34	50	-4.68***
Electronics goods	26	35	15	4.6***
Poultry and livestock	16	17	16	0.44
Utensils	13	14	11	1.15
Food	9	6	14	-3.73***
Others	3	2	5	-
n	1945	1067	872	

* This table includes multiple responses

Table 6 shows that in both the areas, both male and female household members jointly decided what assets to be taken to the shelter in most cases (around 70% in the mainland and

63% on islands). Proportion of households where decision was taken by only female members were found to be significantly higher for island compared to that of mainland. However, no significant difference in terms of decision-making was found based on gender in both areas.

Table 6. Decision making on types of assets carried to the shelters as mentioned by evacuees (%)

	Mainland	Island	
Decision of male members only	13.88	15.03	Pearson chi2(2)=5.4031 Pr=0.067
Decision of female members only	16.27	22.13	
Decision of both male and female members	69.85	62.84	
n	461	366	

Travel and other costs

Although it is not clear the extent to which assets carried affected the costs of travel, it has been found that around 90% of the respondents or 87% of total evacuees reported that they did not incur any travel costs to reach the shelters with their physical assets. There were also no travel costs involved while going back home from the shelters. The shelters were not far from their homes. However, the average travel cost for the 10% who evacuated was Tk. 256 (Tk. 255 for mainland and Tk. 297 for islands). The average total cost (travel cost plus other costs that households incurred while staying in shelters) for 10% of the respondents was Tk. 56 and Tk. 47 for mainland and island households respectively. The households did not sell anything while evacuating, and therefore, there were no losses from selling goods at lower prices at the night of disaster.

Time required to evacuate and factors affecting response to warning

Total time required to evacuate is a matter of concern because it determines effective evacuation process to move households to shelters as soon as they receive the tsunami warning. It was found that on average, households took 1 hour 15 minutes to evacuate. The average time the respondents on the mainland took to evacuate was 1 hour 11 minutes, while it was 1 hour 18 minutes for island inhabitants to evacuate. This is of significant concern since people need to be able to evacuate within 20 minutes of hearing a warning of a local tsunami according to experts at the Earthquake and Tsunami Preparedness project as mentioned in the beginning of the report. Based on an ordinary least square method, Table 7 helps to determine the important factors affecting the response time to tsunami warning.

Table 7 suggests that people on islands took significantly more time to evacuate compared to that of mainland. The number and demographic aspects of a household was found to be associated with the time required to evacuate. Even though it was expected that the higher number of old members and children in the household would increase the total time of evacuation, the study found no such impact. Unexpectedly, it was found that those who received assistance while evacuating took more time to evacuate compared to those who did not. This might reflect the fact that the households that received assistance from their relatives or others, waited for others to help them to evacuate. Receiving assistance from neighbours may also be related to the amount of physical assets taken to shelters. It was found that total time required for evacuation was significantly higher for the households those took physical assets to the shelter compared to those who did not. We, however, did not find any significant linkage between per capita income of the households, occupations, and time required to evacuate. Even the types of the media through which the households were informed of the warning and distance to places of shelter were found to be insignificant. Although the evacuees that took shelter in their relatives' houses were found to be more likely to delay evacuation compared to those who took shelter elsewhere, no such significant association was observed for those moved to cyclone center. However, level of trust in tsunami/cyclone warning was found

to significantly affect households' response to the warning. Households with high level of trust in tsunami warning were found to evacuate quickly compared to those who did not have full trust in this type of evacuation message.

Table 7. Factors affecting response to warning

Dependent variable: time required for evacuating		
Factors	Coefficient	t- value
Type of area(1=mainland, 0=island)	-8.7	-2.9**
Total number of family members	1.2	1.7
Number of old members(60+ years) in the household	3.1	0.9
Number of children(60+ years) in the household	2.5	1.4
Per capita income	0.003	1.05
Assistance from others while evacuating(1=yes, 0 otherwise)	13.7	2.5
Carrying stuffs to the shelter (1=yes, 0 otherwise)	16.2	5.5
Distance to shelter place	0.54	0.8
Received warning through miking (1=yes, 0 otherwise)	8.7	1.3
Received warning through radio/television(1=yes, 0 otherwise)	7.03	0.9
Received warning from neighbors (1=yes, 0 otherwise)	3.1	0.3
Level of trust in tsunami warning(0=strongly believe, 1 otherwise)	12.2	2.9**
If the household head is fisherman(1=yes, 0= otherwise)	-2.9	-0.83
If the household head was in business(1=yes, 0= otherwise)	2.6	0.6
If the household took shelter in the cyclone center (1=yes, 0= otherwise)	3.7	1.1
If the household took shelter in the relatives' houses (1=yes, 0= otherwise)	11.8	2.6**
R square	0.05	
n	1533	

STAGE 2: EXPERIENCES AT SHELTERS

Facilities in places of shelter

Most of the people (around 90%) who took shelter in MRDM centers and local schools reported that there were toilets for common use for both men and women (Table 8). However, few people informed that there were separate toilets for men and women in such shelters. Medical aid was unavailable for most people regardless of type of shelter. Local schools had better drinking water facility than the cyclone centers. This percentage was found to be quite high (around 64%) for schools on the islands. However, these shelters had almost no facility of preparing and distributing food. Most of the people (around 97%) reported that they did not have any sleeping facilities. However, physical assets that people brought with them to the shelters were secured for one-third of the respondents in both the cyclone centers and local schools.

Table 8. Facilities available at shelters as mentioned by the evacuees (%)

	Cyclone centers			Local schools			Relatives' houses		
Facilities	All	M.land	Island	All	M.land	Island	All	M.land	Island
Common toilet	90	93	88	91	93	90	95	95	94
Toilet (separate for men or women)	24	17	31	34	9	41	26	17	48
Medical Aid	1	1	0	1	2	1	2	0	5
Clean drinking water	39	41	37	57	35	64	74	69	88
Food	0.8	1	0.7	3	2	3	58	54	67
Sleeping facilities	3	1	5	4	0	6	57	52	71
Security of Assets	30	30	30	30	12	36	69	64	79
n	572	294	278	178	43	135	255	182	73

The major problem that most of the respondents faced in the cyclone center was no arrangement for sleeping (Table 9). More than half of the people complained about this on the main land and a quarter of the respondents complained on the islands. There was also no arrangement for food. This problem was higher on the islands. Lack of treatment was the next major issue of complaint. This problem was more significant on the mainland. Overcrowding was anther point of complaint that many respondents raised. Complaints about scarcity of drinking water were reported more on the mainland than on the islands. Lack of security for women was more severe on the islands. Other major problems were no arrangement for lighting and mosquito coils, and lack of security for valuables. Only a few people on the islands said that they did not face any problem.

Table 9. Problems faced by the evacuees at the cyclone centers (%)

	All	Main land	Island
No arrangement for sleeping	41	55	26
No arrangement for food	34	30	39
No arrangement for treatment	26	31	21
Too crowded and scarcity of essential place	25	19	17
Scarcity of drinking water	21	26	15
No proper arrangement for women/lack of security for women	15	10	20
No toilet	7	5	10
No electricity/no arrangement for light	7	3	10
Mosquito problem	6	12	0
Lack of security of property and possessions	3	3	3
Others	4	4	4
No problem at all	3	0	5
Didn't mention	6	2	9
n	1113	582	531

* This table includes multiple responses

Like cyclone centers, problems also exist at the higher ground where no arrangements were made for food and sleeping, and there was scarcity of drinking water on both the mainland and islands (Table 10). The lack of toilets was more of an issue on the islands than the mainland. People at the higher ground on mainland faced fear of animals, such as leech and snakes. A large portion of people complained that there was lack of security for women at higher ground on the islands. The intensity of this problem was relatively less on the mainland. Other problems at the higher ground include lack of medical treatment facilities, lighting, space, and security (Table 10).

Table 10. Problems faced by the evacuees at the open higher grounds (%)

	All	Main land	Island
No arrangement for sleeping	43	47	29
Fear of leeches/snakes/animals	26	34.9	1.52
No arrangement for food	16	17	15
No arrangement for treatment	8	7	11
Too crowded and scarcity of essential place	11	11	9
Scarcity of drinking water	30	30	29
No proper arrangement for women/lack of security for women	8	4	23
No toilet	24	19	39
No electricity/no arrangement for light	7	0.5	27
Mosquito problem	10	11	6
Lack of security of property and possessions	3	3	4
others	4	4	2
Didn't mention	2	2	1
n	515	383	132

* This table includes multiple responses

No arrangement for food was the major problem faced by the people who took shelter in the local schools (Table 11). People on the mainland were more vocal about this problem. The next major problem faced was that there was no arrangement for sleeping, and again this problem was more sever on the mainland. The scarcity of space was equally severe both on the mainland and the islands. A large number of people both on the mainland and islands mentioned of lack of medical treatment facilities in this type of shelter. Fourteen percent on mainland and 17% on islands informed that the lack of proper arrangement and security for women also was a major problem. The other problems faced included lack of light, scarcity of drinking water, lack of security for possessions, dirty environment, and mosquitoes. Few people on the islands did not have any complain about shelter in the local schools.

Table 11. Problems faced by the evacuees at local schools (%)

	All	Main land	Island
No arrangement for food	40	49	37
No arrangement for sleeping	34	51	29
Too crowded and scarcity of essential place	27	25	27
No arrangement for treatment	26	33	24
No proper arrangement for women/lack of security for women	16	14	17
No electricity/no arrangement for light	9	2	11
Scarcity of drinking water	8	12	7
No problem at all	7		9
No toilet	7	5	7
Lack of security of property and possessions	3	5	3
Dirty Environment	3		4
Mosquito problem	2	5	1
Others	2	0	3
Did not mention	13	0	17
n	178	43	135

* This table includes multiple responses

The respondents who stayed in relatives' house faced similar problems (Table 12). Although comparatively a high proportion of people both on the mainland and the islands stated that they faced no problem at all in their relatives' houses, the major problem was that there was no arrangement for medical treatment. Space restriction was also a problem. These issues were more significant on the mainland. The problems of no arrangement for sleeping and eating were equally faced on the mainland and the islands in relatives' houses. The lack of security for women was more critical in the mainland. Other major issues included scarcity of drinking water, lighting, toilet facilities, and security for possessions, which were particularly similar to the situation at open higher grounds.

Table 12. Problem faced by the evacuees at the relatives' house (%)

	All	Mainland	Island
No arrangement for treatment	52	50	59
Too crowded and scarcity of essential place	25	27	19
No arrangement for sleeping	23	22	25
No arrangement for food	19	18	22
No proper arrangement for women/lack of security for women	18	20	15
Scarcity of drinking water	7	9	4
No electricity/no arrangement for light	5	5	4
No toilet	3	4	3
Lack of security of property and possessions	2	1	4
Others	2	2	4
Did not mention	22	21	25
No problem at all	17	17	15
n	257	184	73

* This table includes multiple responses

STAGE 3: THE RETURNING PROCESS

Leaving for Home

The evacuees stayed 7 hours on average in the shelters regardless of its types. They returned home on the night of tsunami alert. Table 13 shows that most people who took shelter in various safe places returned home based on their own decision. Their proportion is significantly higher in the mainland compared to the islands. Similarly, more than half of the people who took shelter in relatives' houses went back home on their own decisions.

Table 13. Announcement for returning home as mentioned by evacuees (%)

	Cyclone center			Local school			Relatives' houses			High ground		
	All	Main land	Island	All	Main land	Island	All	Main land	Island	All	Main land	Island
Self-decision	38	48	33	39	63	31	53	54	51	48	50	41
Other people of shelter/	35	28	43	36	14	43	11	7	22	36	32	47
Miking	13	21	6	7	23	1	15	21	3	7	7	7
TV/Radio	9	6	12	13	-	18	13	11	18	7	8	4
Telephone	2	1	3	2	-	3	6	6	7	1	2	0
Others	3	1	4	3	-	4						
n	572	294	278	178	43	135	257	184	73	258	192	66

The next important source that helped evacuees make decisions to return home was following other evacuees in the shelters. This percentage is far higher in the islands than in the mainland. However, this percentage is comparatively low for those people who took shelter in relatives' houses in the mainland and very high for those who shifted to higher grounds on islands. Miking by MRMD authorities also helped a number of people make decisions about returning home. A considerable number of people who stayed especially in the cyclone centers, local schools and relatives' houses in the mainland decided about returning home based on miking. However, miking was found to be one of the least effective information source for people on the islands. Radio and television also played a important role for those who took shelter at cyclone centers, local schools and relatives' houses especially on the islands. Some people also received phone calls that helped them decide to leave.

(a) Assets lost

After returning home from various shelters, some respondents found that their physical assets were missing. Approximately, 3.8% of mainland and 4.4% of island households reported that they found some of their assets missing. The average value of the lost assets was reported to be Tk. 5,487 on the mainland and Tk. 5,295 on the islands. This loss is almost equivalent to average monthly income of a household, which is Tk. 5,117 and Tk. 5,248 for mainland households and island respectively. The average ratio of the value of the lost asset to household income was found to be 1.6 and 0.7 for mainland households and island respectively. This indicates that the value of the missing asset was higher than their monthly household income in most cases in mainland.

TRUST IN WARNINGS AND FUTURE RESPONSES

Even though the tsunami alert on 12 September turned out to be inaccurate, it was found that the majority of the respondents (76% on the mainland and 74% on the islands) would follow this type of evacuation message in future. However, this percentage becomes even larger (85% on the mainland and 81% on the islands) if we consider the responses of those who evacuated. This high level of trust is reinforced by the fact that people still evacuated even though most did not receive information on the benefits of evacuation or were not consulted about evacuating. In contrast, around 43% and 53% of the mainland and island respondents who did not evacuate reported that they would pursue the evacuation message faithfully in future. This reflects that those who evacuated are more risk averse compared to those who did not. Around 22% of the respondents on the mainland and 24% on the islands reported that they would take more time to observe the situation before moving to a shelter. Around 2% of the respondents reported that they would stay at home rather than evacuating. This percentage becomes larger (around 7%) if only the respondents who evacuated are considered. Around 76% of the male and 73% of the female respondents reported that they would follow the evacuation message in future. Around 22% of the male and 24% of the female respondents reported that they would take time to observe before evacuating. Only 1.6% of the male and 2.16% of the female reported that they would stay at home.

There is no direct correlation between education and levels of trust (Pearson Chi (6) =7.71, Pr=0.26) in terms of response to future tsunami alert (Table 14).

Table 14. Trust in tsunami warning by education level (%)

	Illiterate	Primary level	Secondary Level	S.S.C pass or above
Follow the evacuation message verbatim	76	76	76	68
Will take more time to observe the situation before moving to a shelter	22	23	25	28
Will stay at home	2	1	3	4
n	1074	412	192	104

CONCLUSION

There are several conclusions that can be drawn from this study on the effect of tsunami warnings on the southeast coast of Bangladesh. Current evacuation time should be minimized in order to ensure an effective evacuation process in case of local tsunami. Overall, most people in the area were evacuated after hearing the tsunami warning over miking. This suggests that miking is perhaps the most efficient way to reach people. It also suggests that most people are risk averse, and therefore, would pay heed to the warning. Inhabitants in the tsunami prone areas need assistance to respond to warnings, particularly those on islands and large families. Unfortunately, evacuees did not receive any help from cyclone preparatory programme (CPP) but relied on neighbours for assistance. CPP should play a greater role since they are more likely to be efficient in providing help. Basic amenities were not provided at cyclone shelters. For instance, in MRDM-maintained cyclone shelters, there were no facilities for sleeping, eating, or medical care. Additionally, management was unorganized with regard to announcing when it would be safe to go back home since most people decided to go home through word of mouth and not an official announcement. The number of cyclone centres need to be increased while facilities need to be improved. Additionally, information about the tsunami status and when it is safe to return home needs to be transparent. Although most people were evacuated, considerable number of people found it difficult to do so because they did not want to leave valuable assets behind. These deficiencies in the evacuation process underscore the need for greater efforts to be made in building awareness about tsunami evacuation and preparing for a quicker response to warnings. As we found that, households with high level of trusts are more likely to evacuate quickly, greater levels of trust in tsunami warnings need to be increased, particularly among those with low levels of trust, through awareness building via various communication mediums. Besides warnings should be more accurate in order to prevent indirect and direct costs associated with evacuating process.

REFERENCES

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