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# Cyclone “Amphan” evacuation dilemmas of coastal households amidst COVID-19 pandemic: A study of South-Western region of Bangladesh

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## Abstract

Cyclone 'Amphan' battered the coastal communities in the south-western part of Bangladesh in 2020 during the Covid-19 pandemic. The coastal communities experienced the situation for the first time and were in dilemma whether to stay at home to embrace the cyclone alone or risking the Covid-19 contagion in the cyclone shelters by evacuating themselves. This article intended to explore cyclone Amphan evacuation dynamics among the coastal households amidst COVID-19 pandemic. The study investigated evacuation behaviors among households and explored the impacts of COVID-19 on the evacuation processes. We adopted household survey for collecting primary information and determined 378 samples for interviews at a precision level of 0.05 in fourteen villages. Results demonstrated that despite the utmost effort from the government, 96.6% people in the coastal area received an evacuation order before the landfall, and only 42% people respected the evacuation order. Majority households choose to stay at home because of fear due to Covid-19 in the crowded shelters. Although half of the evacuees were housed in the cyclone shelter, visible COVID-19 protecting facilities were unavailable. Thus, this study would assist future government policies and enhance disaster evacuation plans by incorporating the pandemic to reduce disaster risks in the global south.

## 1. Introduction

Understanding the complexity of human behavior before and during disasters is of paramount importance for countermeasures, preparedness, and recovery efforts by providing suitable sites for the evacuees, appropriate shelters, and emergency supplies (Yabe et al. 2019). Human decision drastically changes as the emergencies progress and influence significantly by multiple stimulating factors, ranging from risk perception to the source of early warning information (Morss et al. 2016, Hasan et al. 2011). Evacuation scenarios vary with the type of disasters such as: cyclone, tsunami, earthquake, and etc. Despite the importance of evacuation dynamics of disasters, fewer efforts are employed in analyzing and predicting evacuation of individuals' choice (Yabe et al. 2019; Lee et al 2018). As a result, it is critical to know the individual's thought and perception regarding available disaster evacuation options in the time of an ongoing pandemic (i.e., Covid-19). Although the scholarship of managing disasters amid the pandemic situation is limited, some approaches have been found in literature that urge for further investigations:

- It needs to prioritize to protect human life at the evacuation centers including disaster management staffs who are engaged in evacuating people during disaster. Disaster management stakeholders may face trade-off between saving people's life from disasters and curbing the spread of COVID-19. The evacuation decision can be taken by comparing the risks of flooding with the risk of spreading COVID-19 (Ishiwatari et al. 2020).
- There needs to engage local communities through sharing risk information. As the knowledge regarding COVID 19 is limited, dissemination of risk information is crucial to avoid spreading rumors and misinformation (Ishiwatari et al. 2020, Ahasan et al. 2020).
- Local communities or community-based organizations might play an effective role in managing disasters amid the pandemic situation. In New Orleans, Evacuteer- a nonprofit organization normally focused on helping residents to evacuate during a disaster, but it shifted operations in managing the hurricane amid the COVID-19 pandemic situation to stockpiling foods and supplies, recognizing the fact of exhausted local food and medical supplies. Other example showed that the Mississippi River Cities and Towns Initiative, a coalition of mayors and leaders, had procured personal protective equipments before flooding so that they could distribute them to the citizens whenever severe flood occurred during the pandemic (Abkowitz 2020).
- Vacant hotel rooms and college dormitories could be used as the evacuation shelter. They were used as the shelter options when tornadoes hit the Southeast of USA in April amid the pandemic. The Redcross had revised playbook for sheltering people while considering social distancing. Instead of opening new shelters during pandemic, the Redcross worked with hotels to accommodate hundreds of storm victims. Through this decision, volunteers' safety had been ensured as emergency response were coordinated from home (Abkowitz 2020).

Bangladesh is exclusively vulnerable to cyclone disasters due to its geographical setting, funnel-shaped exposure to the Bay of Bengal, high population density, and limited infrastructural supports to protect the coastal regions (Alam and Chakraborty 2021). According to Parvin et al. (2019), and Haque et al. (2012); approximately 6–10% of the global tropical cyclones and 40% of the global storm surge occurs at the Bay of Bengal, which is responsible for 42% of tropical cyclone-associated deaths in Bangladesh in last two centuries. Though Bangladesh has successfully reduced the number of deaths caused by cyclone and storm surges recently, the situation demands changes during the pandemic. Therefore, it is essential to analyze the evacuation scenario in any disaster during this pandemic to understand changes of evacuation patterns. Note that on March 8, 2020, Bangladesh has reported its first three cases of COVID-19 and imposed a nationwide lockdown from March 26 (Kariul et al. 2020). With the dispersion of COVID-19 at an exponential rate and a sudden stagnation of all economic activities due to subsequent lockdown, Bangladesh has already been struggling, and the resilience becomes fragile. During this pandemic, Amphan (i.e., Category-5 hurricane) has made landfall in the evening hours of May 20, 2020, through the Sundarbans between Bangladesh and West Bengal with a wind speed of about 190km/h, along with storm surges of up to 5 meters (i.e., 17 ft) (Ellis-Petersen and Ratcliffe 2020; Mishra and Vanganuru 2020). The Meteorological Department of Bangladesh (BMD) has issued the highest possible warning in the low-lying coastal districts to evacuate around two million people in two days (Reliefweb 2020). During the pandemic, the evacuation advisories provided by the government have had immense impact on personal decision of community members to evacuate immediately. Under usual circumstances, volunteers are visible in place to assist residents to evacuate quickly. However, the pandemic has made it difficult for people to decide whether to evacuate or stay at home. Therefore, it is critical to study the evacuation behavior of people when there has been 21,145 active COVID cases and the super cyclone of the century raging at the door.

Paul (2009); Ahsan et al.(2016); Roy et al.(2015); Saha and James (2017); and Parvin et al. (2009) endeavored to understand the dynamics of evacuation systems during tropical cyclone events in coastal areas of Bangladesh. These studies evaluated evacuation scenarios in coastal Bangladesh from cyclone Bhola (1970) to cyclone Roanu (2016) and identified an improved evacuation scenario over time. Cyclone Bhola (1970) was the deadliest tropical cyclone in the world, which caused nearly half a million casualties and first spotted the huge evacuation problems of coastal communities. Frank and Hossain (1971) reported less than 1 percent of coastal people took refuge in the safe shelter and identified the experience of the failure of warning and misunderstanding the danger as the major cause of non-evacuation in Cyclone Bhola. Later, Paul et al.(2010) studied the evacuation behavior during cyclone Gorky (1991) and reported a higher rate of evacuation while comparing the previous events. He found around 26.7% of coastal people evacuated during cyclone Gorky. These

studies identified flaws in early warnings and cyclone shelter-related issues, such as inadequate and crowded shelters, and long-distance of the cyclone shelters from home as major reasons behind non-evacuation. Studies on Cyclone Sidr in 2007 demonstrated an improved warning system in place that successfully evacuated almost 60% people before the landfall as indicated by Paul (2010, 2012), and Uddin (2010). However, these studies reported a lower percentage of evacuation during Sidr (33.2% by Paul (2010) and 45% by Uddin (2010). Along with cyclone shelter and early warning related issues, these studies identified non-evacuee's perception as fear of burglary, religious orthodoxy, false sense of safety at home, etc. for non-evacuation during cyclone Sidr. After cyclone Aila hit coastal Bangladesh in 2009, some studies, including Ahsan et al. (2016) and Parvin et al. (2019), also examined the factors that discouraged people from complying with the evacuation orders by employing focus group discussion and questionnaire survey. These studies reported similar results explained in the previous events. Though all these above-mentioned studies effectively illustrated the evacuation scenarios of previous cyclones in Bangladesh, in case of the super cyclone Amphan was considered as unique amidst the COVID-19 pandemic (Vinoj and Swain 2020, Mishra & Vanganuru 2020). Few studies focused on the individual's decision on evacuation and influencing factors during the pandemic. Thus, a study on the evacuation scenario during super cyclone Amphan would be of paramount importance to portray the impact of the pandemic on evacuation decisions and destinations. Therefore, this paper aimed to investigate the influential factors of evacuation decisions before the cyclone Amphan amidst the pandemic. Consequently, this study suggested few planning implications based on empirical analysis and findings, which would be expected to assist stakeholders and policymakers to devise judicious emergency preparedness and mitigation measures for future.

## 2. Concept And Context

## 2.1 Human Risk Perception Dimension and Cyclone Hazard

Human risk perception is a crucial predictor of disaster preparedness, evacuation, and mitigation strategies, which is shaped by social, cultural, religious belief, and familiarity with hazards (Peacock et al. 2005). Risk perception varies widely depending on geographical and cross-cultural settings (Lee et al.2015). Considering the disaster proneness of Bangladesh, several studies highlight the dimensions of human risk perception of cyclone hazards. Sattar and Cheung (2019) consider a cyclone risk perception index using 10 indicators from the familiarity/experience dimension of hazard. Ayeb-Karlsson (2020) focuses on the gender dimension of risk perception in coastal Bangladesh whereas, in another study, Ayeb-Karlsson et al. (2019) identifies variation of social and cultural perceptions. Studies of Paul et al. (2010); Paul (2012), Ahsan et al. (2016), Parvin et al. (2019), and Uddin (2010) explain the human perception that influence evacuation decision of individuals. After the outbreak of COVID-19, Alam and Chakraborty (2021) have investigated Covid-19 risk perception and its relation to evacuation decisions in coastal Bangladesh. Considering the importance of risk perception on cyclone hazard, we have reviewed relevant literature and identified the risk perception factors available in previous cyclone events. We summarize that the factors in the questionnaires as possible options of non-evacuation to make the research as inclusive as possible.

## 2.2 COVID-19 Scenario and Preparedness Measures During Cyclone Amphan

Though COVID-19 was first detected in December 2019 in China, Bangladesh detected its first three cases on March 8, 2020 and since then, the country was facing an unprecedented crisis of exponential infections and deaths rate. To avoid the transmission of COVID-19 in the country, the government first declared a country-wide lockdown and travel restriction from March 26, 2020. The Government also prepared National Preparedness and Response Plan (NPRP) to limit the transmission of COVID-19 and to lessen its impact on the health, wellbeing, and economy. The Government set up the COVID-19 Emergency Operation Center to coordinate nationwide preparedness and response activities jointly with the Diseases Control Unit of the Directorate General of Health Services (DGHS) and the Institute of Epidemiology Disease Control and Research (IEDCR). These joint ventures started testing the samples and provided daily updates of COVID-19 infection in the country. Till the end of April 2020, 17 testing laboratories and 18 hospitals were equipped to test samples and offered treatment to the infected patients, which was insufficient for 160 million people (Rahman et al. 2020). Moreover, the healthcare services available in these existing hospitals were inadequate with the insufficient number of doctors and nurses against the patients. As a result, when super cyclone Amphan originated in the Bay of Bengal, the country was already in the community transmission phase with around 21,145 active total cases until 16 May 2020 (Fig. 1) (WHO, 25 May, 2020). The daily infection and death tolls of COVID-19 before and after cyclone Amphan is depicted in Fig. 1. The Government had to take the challenging decision of evacuating 5 million coastal people to accommodate in approximately 12000 cyclone shelters considering the social distancing rules of COVID-19 infection (Kelman and Ahmed 2020). The Cyclone Preparedness Programme (CPP) volunteers and evacuees were requested to follow appropriate protective measures while evacuating in the cyclone shelters.

## 3. Study Area

We considered one of the coastal districts of Bangladesh, named Satkhira as our study area. On the evening hour of May 20, 2020, the 'super cyclone' Amphan made landfall in West Bengal, India, and entered Bangladesh during nighttime through Satkhira district with 60–90 Km/h wind speed and high tidal inundation (NAWG 2020). The cyclone created massive destruction of 50 embankments that inundated more than 100 villages in Satkhira (ibid.). According to BMD, Satkhira district anticipated the route of cyclone Amphan (Jahan and Sal 2020). As a result, the highest early warning and massive evacuation procedures were conducted in Satkhira before the landfall. Additionally, the district was battered with many other socio-economic issues, including severe poverty, high population density, illiteracy, and inaccessibility to basic amenities because of its remoteness (Alam et al. 2019).

The total administrative area of Satkhira district is reported approximately 3817.29 Square km (of which 1632.00 sq.km. is under forest.) with 7 Upazila, 2 Paurashava, 79 unions, and 1436 villages (BBS 2014). The district is composed with flat landscape and surrounded by the world's largest mangrove forest – the Sundarbans (a UNESCO heritage site). Furthermore, the West Bengal state of India is located on the west side, and the Bay of Bengal is on the southern side, respectively (Fig. 2 for details). The latest population census has depicted that the total population of Satkhira district is around 754097, with a male-female ratio of 1.01, a population density of 198 per square kilometer, and 52.07% literacy rate (BBS 2014). As the devastation of the cyclone has been

tangible, it is important to investigate the evacuation scenarios during the pandemic. For this, we have opted to randomly choose two villages in each Upazila (total 14 villages in 7 Upazila) to conduct the study (Fig. 2).

## 4. Methods

To accomplish this study, we employed a method comprised with: (i) literature review; (ii) structured interview survey to residents; and (iii) geospatial analysis. Details of these procedures are noted here.

*Literature review*

We conducted an in-depth literature search to establish the relationships among cyclone evacuation procedures, early warning systems, people's perception in understanding the threats of super cyclones, governance procedures, volunteer's involvements, and the impacts of ongoing Covid-19 pandemic. Additionally, we collected local and regional newspapers (both English, and Bengali), census information from the Bangladesh Bureau of Statistics (BBS), published and unpublished research reports, scientific articles, and government documents highlighting the evacuation need and adopted methods during the pandemic.

*Structured interview survey*

Structured interviews and unstructured consultation with the Amphan-hit communities were the major primary sources of information in this study to summarize results. The interviews included few specific questions regarding the socio-economic information of the respondents, Covid-19 risk perception, understanding the early warning systems, familiarity of evacuation procedures, choices of evacuation routes and shelters in the nearest proximities, and reasons of either evacuating or not. In collecting the primary information, we adopted a systematic sampling method. The sampling procedures performed in two stages, such as: (i) selection of the number of villages; and (ii) determining the appropriate number of interviewees. We finalized the questionnaire through a sequential process such as literature review, discussion with community members, and piloting to check the consistency and uniformity. Table 1demonstrates the details.

Table 1
Distribution of number of samples considered in the study area.

| Upazila | Village | Total households | Sample households |
|---|---|---|---|
| Kalaroa | Boddipur | 487 | 27 |
| | Sonabaria | 1515 | 27 |
| Satkhira Sadar | Narayonjol | 397 | 27 |
| | Fingri | 1381 | 27 |
| Tala | Nagarghata | 2997 | 27 |
| | Jiala Nalta | 732 | 27 |
| Kaliganj | Hogla | 216 | 27 |
| | Mautala | 2096 | 27 |
| Debhata | Kulia | 2182 | 27 |
| | Parulia | 800 | 27 |
| Assasuni | Budhata | 1462 | 27 |
| | Pratap Nagar | 1736 | 27 |
| Shaymnagar | Gabura | 1460 | 27 |
| | Burigoalini | 1444 | 27 |
| Total | | 18905 | 378 |
| Source: BBS 2014 | | | |

We conducted the survey in fourteen villages during June 2020, and an individual respondent was considered the primary sampling unit. We conducted interviews of twenty-seven households from each village using KoBoToolbox based primary survey to ensure the data quality. The nationwide lockdown and restriction on mobility were few challenges we encountered for collecting data, and therefore, a 'random walk' practice, suggested by World Health Organization (WHO 2011), was applied to select the household for the survey. Note that, to assess the validity of the questionnaire, a scale-level content validity index method (S-CVI/Ave) was used in this study. In developing the S-CVI/Ave, a panel of 10 professionals[1] were asked to evaluate the relevance of each question on a 4-point Likert scale where 1 referred to irrelevant, and 4 indicated very relevant. Using the Microsoft Excel platform, the opinion of ten experts were evaluated to measure the validity of selected 26 questionnaire items. The result of the content validity index (S-CVI/Ave) was 0.83, which substantiated a good validity (Fig. 3 for details).

*Calculation of Trustworthy Index*

To measure the trustworthiness of different sources of evacuation order, respondents were asked to provide a score to each component in a Likert Scale where 5 referred to high trust, and 1 meant no trust. Therefore, using the Garrett (1924) ranking method, the ranking of each source was done based on their trustworthiness score. The equation applied for relative importance index analysis of respondents' trustworthiness towards sources of the evacuation order (see Eq. i). The survey result demonstrated level of trust in sources of evacuation order (see Table 3) that might have a relation with the respondents' evacuation behaviour.

Relative Importance Index (R)= $\frac{\sum\left\{\left(r_1 \times f_1\right)+\cdots+\left(r_n \times f_n\right)\right\}}{A \times N}$ ……Eq. (i).

[*Here r = Individual rank given by the respondent; f = frequency; n = No. of components identified; N = Number of total respondents; and A = highest weight (i.e., 5)*]

*Geospatial analysis*

To demonstrate the distance of nearest cyclone centers, available access roads, and nearest waterbodies for possible inundation, we collected a set of geographic information system (GIS) datasets. This information was collected from reliable government sources, Khulna University's research cell at Urban and Rural Planning Discipline, and from local municipalities. Note that, we obtained the GIS shape files with a Universal Traverse Mercator (UTM) projection system.

[1] A panel of ten disaster risk management (DRM) professionals from Asian Disaster Preparedness Center (ADPC), Bangladesh was selected to validate the results. They were asked to evaluate the relevance of each question on a 4-point Likert scale where 1 referred to irrelevant, and 4 indicated very relevant.

## 5. Results

Socio-economic Characteristics and Evacuation Behavior

An individual's evacuation choice during a disaster is associated with socio-economic characteristics, as social interaction plays a crucial role in determining whether to evacuate or not (Ersing et al. 2020; Burnside et al. 2007). Therefore, nineteen socio-economic variables are listed in Table 2 regarding the evacuation status of the respondents. A chi-square test for independence with α = .05 is used here to analyze whether the evacuation behavior of the respondent is related to the socio-economic variable or not. The chi-square test is statistically significant for 12 out of 19 variables (shown in Table 2). According to the chi-square test result, gender, religion, number of family member, marital status, vehicle ownership, child below six years of age, and income are statistically insignificant. The significant variables are listed as: age, education, occupation, household type and ownership, COVID-19 awareness, land and cattle ownership, elderly population, previous cyclone and storm surge experience, and year of living.

Furthermore, to assume the effect of each variable on the evacuation decision of the respondents, the Phi coefficient and Cramer's V analysis have been applied. Phi coefficient is a measure for the strength of an association between two categorical variables in a 2×2 contingency table (Prematunga 2012). In contrast, Cramer's V is an alternative to phi in tables bigger than 2×2 tabulation (Grimm 1993). Akoglu (2018) classifies the Phi coefficient and Cramer's V value; where the obtained values more than 0.25, 0.15 to 0.25, 0.1 to 0.15, and 0.5 to 0.1 indicate very strong, strong, moderate, and weak association respectively. According to the Phi/Cramer's V value shown in Table 2, previous storm surges, household type, and education strongly associated with the evacuation decision on the respondent during cyclone Amphan. Moreover, year of living, respondent's age, land ownership, cattle ownership, and occupation have strong relationship with the decision of the respondent to either evacuate or stay. It is also evident from the Phi co-efficient value that respondent's awareness about COVID-19 spread plays a moderate role in the evacuation behavior during cyclone Amphan.

Table 2
The contrast between respondent evacuation status and socio-demographic profile

| Indicator | | Evacuee | Non-evacuee | Chi-square | Effect size (Cramer's V/Phi) |
|---|---|---|---|---|---|
| Age | Less than 30 yrs. | 21(36.8%) | 36(63.2%) | χ2 = 16.991, df = 3, sig = 0.001** | V = 0.212 |
| | 30 yrs. To 45 yrs. | 66(34%) | 128(66%) | | |
| | 45 yrs. To 60 yrs. | 60(57.1%) | 45(42.9%) | | |
| | Greater than 60 yrs. | 12(54.5%) | 10(45.5%) | | |
| Gender | Male | 107(40.4%) | 158(59.6%) | $\chi^2$ = 1.034, df = 1, sig = 0.309 | φ = − .052 |
| | Female | 52(46.0%) | 61(54.0%) | | |
| Religion | Muslim | 148(41.3%) | 210(58.7%) | $\chi^2$ = 4.209, df = 2, sig = 0.122 | V = 0.106 |
| | Hindu | 11(61.1%) | 7(38.9%) | | |
| | Christian | 0(0%) | 2(100%) | | |
| Education | Illiterate | 67(53.2%) | 59(46.8%) | χ2 = 24.683, df = 6, sig = 0.001** | V = 0.256 |
| | Class I-V | 41(45.1%) | 50(54.9%) | | |
| | Class VI-X | 30(40%) | 45(60%) | | |
| | SSC or Equivalent | 10(24.4%) | 31(75.6%) | | |
| | HSC or Equivalent | 5(15.2%) | 28(84.8%) | | |
| | Honors or Equivalent | 6(60%) | 4(40%) | | |
| | Masters or Equivalent | 0(0%) | 2(100%) | | |
| Number of Family Member | 3 Member | 16(50%) | 16(50%) | χ2 = 1.087, df = 3, sig = 0.780 | V = 0.054 |
| | 4 Member | 61(42.7%) | 82(57.3%) | | |
| | 5 Member | 54(40.6%) | 79(59.4%) | | |
| | > 5 Member | 28(40%) | 42(60%) | | |
| Marital Status | Married | 153(41.6%) | 215(58.4%) | χ2 = 5.054, df = 2, sig = 0.08 | V = 0.116 |
| | Unmarried | 0(0%) | 2(100%) | | |
| | Widow/Divorced | 6(75%) | 2(25%) | | |
| Occupation | Agriculture/ Farming | 49(53.8%) | 42(46.2%) | χ2 = 13.960, df = 3, sig = 0.003** | V = 0.192 |
| | Business | 61(45.9%) | 72(54.1%) | | |
| | Service | 34(35.4%) | 62(64.6%) | | |
| | Others | 15(25.9%) | 43(74.1%) | | |
| Household Ownership | Yes | 158(43.10%) | 209(56.90%) | χ2 = 5.054, df = 1, sig = 0.025** | φ = 0.116 |
| | No | 1(9.10%) | 10(90.90%) | | |
| Household Type | Pucca | 3(6.3%) | 45(93.8%) | χ2 = 100.651, df = 3, sig = 0.001** | V = 0.516 |
| | Semi-Pucca | 30(21.4%) | 110(78.6%) | | |
| | Katcha | 102(63%) | 60(37%) | | |
| | Wooden House | 24(85.7%) | 4(14.3%) | | |
| Vehicle Ownership | Yes | 39(34.8%) | 73(65.2%) | χ2 = 3.425, df = 1, sig = 0.064 | φ =-0.095 |
| | No | 120(45.1) | 146(54.9%) | | |
| COVID Awareness | Yes | 123(45.2%) | 149(54.8%) | χ2 = 3.967, df = 1, sig = 0.04** | φ = 0.102 |
| | No | 36(34%) | 70(66.0%) | | |
| Cattle Ownership | Yes | 124(48.1%) | 134(51.9%) | χ2 = 11.999, df = 1, sig = 0.001** | φ = 0.178 |
| | No | 35(29.2%) | 85(70.8%) | | |

*Note: Results of some indicators such as age, gender, education, religion, and income are also presented in Alam and Chakraborty (2021).

| Indicator | | Evacuee | Non-evacuee | Chi-square | Effect size (Cramer's V/Phi) |
|---|---|---|---|---|---|
| Land Ownership | Yes | 152(45.8%) | 180(54.2%) | χ2 = 15.489, df = 1, sig = 0.001** | φ = 0.202 |
| | No | 7(15.2%) | 39(84.8%) | | |
| Child Below 6 years | Yes | 51(40.5%) | 75(59.5%) | χ2 = 0.195, df = 1, sig = 0.658 | φ =-0.23 |
| | No | 108(42.9%) | 144(57.1%) | | |
| Old (60+) | Yes | 65(31.7%) | 140(68.3%) | χ2 = 19.712, df = 1, sig = 0.001** | φ = -0.228 |
| | No | 94(54.3% | 79(45.7%) | | |
| Previous Cyclone Experience | Yes | 158(43.2%) | 208(56.8%) | χ2 = 5.786, df = 1, sig = 0.016** | φ = 0124 |
| | No | 1(8.3%) | 11(91.7%) | | |
| Previous Strom Surge Experience | Yes | 150(80.6%) | 36(19.4%) | χ2 = 223.670, df = 1, sig = 0.001** | φ = 0.769 |
| | No | 9(4.7%) | 183(95.4%) | | |
| Year of living | Less than 5 Year | 0(0%) | 4(100%) | χ2 = 22.860, df = 4, sig = 0.001** | V = 0.246 |
| | 5 Year to 10 Year | 1(33.3%) | 2(66.7%) | | |
| | 10 year to 15 year | 0(0%) | 7(100%) | | |
| | 15 Year to 20 Year | 1(4.5%) | 21(95.5%) | | |
| | More than 20 year | 157(45.9%) | 185(54.1%) | | |
| Income | < 5000 BDT | 0(0%) | 3(100%) | χ2 = 7.467, df = 3, sig = 0.058 | V = 0.141 |
| | 5000–10000 BDT | 54(42.9%) | 72(57.1%) | | |
| | 10000 to 20000 BDT | 105(43.4%) | 137(56.6%) | | |
| | 20000 to 30000 BDT | 0(0%) | 7(100%) | | |
| Note: N = 378, Significant variables are marked with (**) | | | | | |
| *Note: Results of some indicators such as age, gender, education, religion, and income are also presented in Alam and Chakraborty (2021). | | | | | |

Real and Expected Evacuation Order Scenario

The evacuation order is the final stage of early warning granted by the BMD at least 10 hours prior to the cyclone landfalls (Parvin et al. 2019). In this study, respondents have been asked to explain the evacuation procedures from the order to take shelter in the centers. Analysis (Fig. 4 for details) depicts that 96.6% of the respondent in Satkhira district has received evacuation order, which supports the previous findings of Ahsan et al. (2016). Figure 4 shows that 56.6% of respondents has received evacuation order in 3 to 6 hours, and 27.5% of respondents received the order 3 hours before landfalls.

Furthermore, it is evident from the findings that more than half of the respondents (63.8%) prefer to get the evacuation order within 6 to 12 hours before the cyclone landfalls (Fig. 4). Also, 31.5% of the respondents prefer receiving the evacuation order within 3 to 6 hours before the landfall.

Sources of Evacuation Order

Cyclone warning and evacuation orders from the government usually reached to the people through multiple sources including: government officials, media, and community volunteers (Walch 2018). We found that friends, relatives, and neighbors (61.9%) were the leading source of receiving evacuation orders during cyclone Amphan followed by mosques (55.37%), social media (46.05%), and television (37.85%) (Fig. 5 for details). Interestingly, some respondents reported that electricity outage and mobile network issues hindered receiving information through television, mobile phone, and internet. Thus, they relied on evacuation orders obtained from mosques and social connections.

Trustworthiness of the Evacuation Order Source

Based on Henry Garrett method (Eq. 1), this study ranks the trustworthiness of the evacuation order sources (Table 3), received from: mosques, television, newspaper, CPP volunteers and friends, relative, and neighbors than other sources. Consequently, we have included the reasons behind the mistrust in the source of evacuation order through open-ended questions and categorized the responses based on the content (Fig. 6 for details). From the response, it is evident that failure of warning system in the previous cyclone is the leading cause behind the mistrust. Inaccurate, exaggerated, risk unspecific, and misleading warning in the previous cyclone is the major reason that works as the 'Crying Wolf Syndrome' among the coastal communities. Due to the inefficiency of experts and authorities (41.3%) and enormous corruption (39.4%), people have lost their confidence in respecting evacuation orders. Some respondents (32.3%) have complained about the political polarization of the community organizations, institutions, and media, which reduced the social

acceptance of those organizations. Moreover, yellow journalism in electronic/print media (29.1%) and spreading rumor through unmonitored social media (27.8%) have worked as a catalyst in reducing public trusts.

Table 3
Ranking the trustworthiness of evacuation order and receiving sources.

| Sources | High Trust (5) | Moderate Trust (4) | Neutral (3) | Low Trust (2) | No Trust (1) | Total | A*N | Score | Rank |
|---|---|---|---|---|---|---|---|---|---|
| Radio | 465 | 540 | 435 | 10 | 0 | 1450 | 1890 | 0.77 | 6 |
| TV | 835 | 532 | 234 | 0 | 0 | 1601 | 1890 | 0.85 | 2 |
| Newspaper | 790 | 532 | 261 | 0 | 0 | 1583 | 1890 | 0.84 | 3 |
| Mosque | 850 | 684 | 111 | 0 | 0 | 1645 | 1890 | 0.87 | 1 |
| Social Media | 450 | 524 | 447 | 16 | 0 | 1437 | 1890 | 0.76 | 7 |
| Siren & Miking | 330 | 404 | 513 | 58 | 11 | 1316 | 1890 | 0.70 | 9 |
| Friends/Relative | 310 | 920 | 258 | 0 | 0 | 1488 | 1890 | 0.79 | 5 |
| NGO/CBO | 280 | 552 | 477 | 28 | 11 | 1348 | 1890 | 0.71 | 8 |
| CPP Volunteers | 165 | 1316 | 48 | 0 | 0 | 1529 | 1890 | 0.81 | 4 |

Preparation Time for Evacuation

Though evacuation order was provided at least 10 hours before the landfall, we observed that people received it about 3 to 6 hours before cyclone Amphan struck. Therefore, people received less time to evacuate. People started to leave their houses at the last moment when the weather condition turned to the worst. Interestingly, we found that all the respondents who complied with the evacuation order had left home around 0–2 hours before the landfall. Few of them left home when the storm was in place and precipitation already started that triggered flash flood. Moreover, the average preparation time of men was 108 minutes (SD = 32), whereas women required 143 min (SD = 43) to evacuate on an average. Interestingly, we found that women required more evacuation time as they were responsible for the safety of the family members such as children and elderly, household chores, assets, and belongings, including cattle and other livestock. In few cases, women prepared food and collected necessary stuffs to bring along to the evacuation centers. Additionally, it was evident that 77.4% of respondents of total evacuee were aware of the COVID-19 risks, and therefore, they brought the COVID-19 safety kits such as face mask, hand sanitizer, and hand soap in the cyclone shelter for their safety. Note that, collecting the COVID-19 safety kits took few extra minutes to delay evacuation procedures.

Evacuation Destinations

Based on the investigation, we identified that 42.06% of respondents were evacuated to a safe place during cyclone Amphan. According to Table 5, 50.9% of total evacuees chose cyclone shelter as their evacuation destination (Table 4). Approximately 40% of the evacuee women took shelter in their neighbor's or relative's house during cyclone Amphan. We found that Shaymnagar and Asasuni Upazila (i.e., closest to the Bay of Bengal), had the highest evacuation rate, whereas no one left their houses in Kalaroa Upazila.

Table 4
, Evacuation destinations of local people during cyclone Amphan.

| | Cyclone Shelter | | Neighbors/Relative House | | School Building | | NGO Office | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| Male | 55 | 51.40% | 14 | 13.10% | 19 | 17.80% | 19 | 17.80% |
| Female | 26 | 50.00% | 21 | 40.40% | 5 | 9.60% | 0 | 0.00% |
| Total | 81 | 50.9% | 35 | 22% | 24 | 15.1% | 19 | 11.9% |

Table 5
, Evacuation scenarios of different Upazilas during cyclone Amphan

| Upazila Name | Evacuation (%) | Cyclone Shelter | Relative/Neighbors House | School Building | NGO Office |
|---|---|---|---|---|---|
| Kalaroa | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Tala | 9.26% | 20.00% | 60.00% | 0.00% | 20.00% |
| Shaymnagar | 91.74% | 63.22% | 14.29% | 12.29% | 10.20% |
| Kaliganj | 48.15% | 38.46% | 26.92% | 19.23% | 15.38% |
| Asasuni | 90.74% | 61.22% | 14.29% | 14.29% | 10.20% |
| Debhata | 48.15% | 38.46% | 26.92% | 19.23% | 15.38% |
| Satkhira Sadar | 7.41% | 0.00% | 100.00% | 0.00% | 0.00% |

Modal Choice during Evacuation

Figure 7 shows that most of the evacuees have reached to the shelter on foot (40.3%) and leg-pulling van (37%). On the contrary, most of the evacuee returned home by walking (62.9%) and by boat (16.4%) after the cyclone. Note that, the flash flood inundated several areas and evacuees used boats to return home.

Availability of COVID-19 Facilities for Evacuees

This study explored whether there were availability of COVID-19 protection facilities in the shelters. About 92.6% of the respondent mentioned that there were no facilities for Covid-19 kits, and only 7.14% reported partial availability. Interestingly, Covid-19 facilities included with the availability of hand washing soaps and sinks. We found that men and women took shelter in different rooms; however, social distancing, facial masks, and hand sanitizers were absent. Furthermore. evacuees took shelters in the neighbors, friends or relative's house had better COVID-19 protection facilities.

Table 6
, Availability of COVID-19 protection facilities in the cyclone shelters.

| | COVID-19 Facility Availability | | | | | |
|---|---|---|---|---|---|---|
| | Yes | | No | | Partially Available | |
| | N | % | N | % | N | % |
| Cyclone Shelter | 0 | 0.00% | 75 | 92.59% | 6 | 7.41% |
| Neighbors/Relative House | 5 | 14.29% | 26 | 74.29% | 4 | 11.43% |
| School Building | 0 | 0.00% | 12 | 50.00% | 12 | 50.00% |
| NGO Office | 0 | 0.00% | 19 | 100.00% | 0 | 0.00% |

Reasons for Non-Evacuating during Cyclone Amphan

Approximately 96.6% respondents received evacuation orders but many of them failed to evacuate themselves. Haque (1995) reported only 22.8% evacuation in cyclone Gorky, Paul (2014) identified 41.4% evacuation in cyclone Sidr, and Parvin et al. (2019) found 84% evacuation during cyclone Aila in coastal areas of Bangladesh. It signified an improvement in evacuation rate over the time. However, during cyclone Amphan, this study found that only 42.06% people were evacuated to a safer place.

- Cyclone shelter related problems.

Overcrowding in cyclone shelters was one of the prominent causes of not evacuating. Due to COVID-19 risk, where social distancing was highly encouraged, some respondents viewed the crowded cyclone shelter as riskier, and thus, they decided to stay at home, and few returned from the shelters after noticing the crowd. Unavailability of cyclone shelter in the locality, and longer distances to travel were also responsible for non-compliance to the evacuation order for 21.92% and 23.74% respectively. According to the Cyclone Shelter Construction, Maintenance and Management Policy-2011 of Bangladesh, cyclone shelters should be located within 1.5 km distance to allow quick evacuation during a hazard (Hossain and Rahman 2018; Hossain et al. 2014). A cyclone shelters buffer zone of 1.5 km reported that most of the areas in Kalaroa (0%) and Tala Upazila (4.22%) were unserved. Additionally, more than three-fourth area of other Upazilas, including Assasuni, Debhata, Kaligaj, Satkhira Sadar, and Shaymnagar had limited access to cyclone shelters (see Fig. 8 for details). Moreover, capacity of the existing cyclone shelters was not adequate to serve the population. According to the analysis, except for Shyamnagar Upazila, cyclone shelters did not have the capacity to accommodate at least 5 percent of the total population of the respective areas.

Table 7
, Cyclone shelters' capacity and service area in Satkhira district. Data obtained from multiple sources including district gazette book, and census.

| Upazila Name | Total Area | Total Population | Number of Cyclone Shelter | Capacity of Cyclone Shelters | Served Area (1.5 km buffer) | Area Served (%) | % of Population Served |
|---|---|---|---|---|---|---|---|
| Assasuni | 378.05 | 268754 | 8 | 4750 | 52.39 | 13.86 | 1.77 |
| Debhata | 175.34 | 125358 | 6 | 6125 | 41.62 | 23.74 | 4.89 |
| Kalaroa | 232.82 | 237992 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| Kaliganj | 326.10 | 274889 | 11 | 9390 | 77.64 | 23.81 | 3.42 |
| Satkhira | 397.75 | 460892 | 14 | 14271 | 98.53 | 24.77 | 3.10 |
| Shyamnagar | 1543.43 | 318254 | 39 | 31875 | 265.77 | 17.22 | 10.02 |
| Tala | 334.87 | 299820 | 2 | 1300 | 14.12 | 4.22 | 0.43 |

- Cyclone warning related reasons.

Experience on the failure of warning (35.16%) and disbelief in warning system (27.85%) were the leading reasons of influencing the evacuation decision of respondents. Some respondents mentioned that the failure of warning during Sidr (2007) and Aila (2009) encouraged them not to evacuate. The other

warning-related non-evacuation reasons were lack of understanding of cyclone warnings (27.4%), sudden change of warning signals (16.89%), and delay in receiving warning (14.61%). During cyclone Amphan, 9.13% of the non-evacuee respondent reported that they did not hear any evacuation warning at all.

- Transportation and communication-related reason

In this study, 37.90% of the non-evacuee respondents reported poor/muddy road conditions as the reason for non-evacuation during cyclone Amphan. Additionally, nation-wide lockdown had an impact for not having access to vehicles to evacuate during the event. Moreover, this study reported that heavy rainfall just before the landfall shattered the electricity network. Thus, people had to struggle to receive updated information from the evacuation orders. Therefore, unlike previous cyclones, some of the respondents could not evacuate due to electricity blackouts (18.72%) and mobile network problems (10.96%) during Amphan. About 48 percent of all non-evacuee did not comply with the evacuation order as they could not abandon their cattle. Approximately 24.2% cases, people could not leave for shelter due to the difficulties of carrying the elderly and children to and from the cyclone shelters.

- Social and cultural reasons

We identified from the analysis that the respondents who had no storm surge experience previously, were less likely to evacuate during a cyclone. Respondents who lived in at least structured or semi-structured houses in a low storm-surge risk areas mostly chose to stay at home during Amphan. Therefore, 68% of all non-evacuee didn't comply with the order as they felt safe at their own house (Table 8 for details). Also, few women did not evacuate as the household head (i.e., usually men) were not at home during the event. Note that, many household heads in Kaliganj Upazila had moved to big cities in search of livelihoods. In Boddipur village in Kalaroa Upazila, many people left for foreign countries, mostly in Malaysia, India, or Middle Eastern countries. Due to the absence of the household heads at home, women did not want to evacuate in cyclone shelters during Amphan for social and cultural reasons.

Approximately 34.25% of all non-evacuees reported that they were aware of the warning but could not envisage the danger of the impending event, and therefore, they assumed it would not affect their area. About 41.55% of all non-evacuee respondents indicated that they did not leave their homes because they feared that their homes/business, place/fish cultivation pond might be looted. Nearly 14.61% non-evacuee did not go to shelter thinking of challenges of returning after cyclone such as road blockade, waterlogging, transport unavailability, etc. About 11.67%respondents perceived that cyclone was 'God's will' and therefore did not evacuate during Amphan. These people believed their fate is prefixed by God, and thus, it was irrelevant if anyone stayed at home or evacuated to a shelter since their survival depended on God's will.

- Other reasons

Considering the risk of COVID-19 infection from the crowded cyclone shelter, 26% of all non-evacuee dared to stay home during Amphan. As soon as the storm became stronger and the flood protection embankments became fragile, some community volunteers attempted to protect the embankments during the cyclone. This study identified about 5.5% of all non-evacuee could not go to cyclone shelters due to their voluntary involvements in embankment protection.

Table 8
, Reasons for non-evacuee during cyclone Amphan

| Reasons(n = 219) | % | N |
|---|---|---|
| **Cyclone Shelter Related Problems** | | |
| Overcrowded cyclone shelter | 26.94% | 59 |
| Long distance from cyclone shelter | 23.74% | 52 |
| Unavailability cyclone shelter | 21.92% | 48 |
| **Cyclone Warning Related Issue** | | |
| Past experience of failure of warning | 35.16% | 77 |
| Disbelief in waring system | 27.85% | 61 |
| Lack of understanding cyclone warning | 27.40% | 60 |
| Sudden change warning signal | 16.89% | 37 |
| The warning was too late | 14.61% | 32 |
| Didn't get any warning | 9.13% | 20 |
| **Transportation and Communication Problem** | | |
| Poor/muddy road network | 37.90% | 83 |
| No transport availability | 23.30% | 51 |
| Electricity blackout | 18.72% | 41 |
| Couldn't communicate due to mobile network down | 10.96% | 24 |
| Couldn't Bring the Child/ Elder member | 24.20% | 53 |
| Could not Leave the Cattle | 48.40% | 106 |
| **Social, Cultural and Perception Related Reason** | | |
| Felt safe at home | 68.04% | 149 |
| No previous storm surge experience | 49.32% | 108 |
| Fear of burglary | 41.55% | 91 |
| Cyclone in this season would not severe | 34.25% | 75 |
| Male member outside home | 21.00% | 46 |
| Cyclone occurred at night | 15.07% | 33 |
| The shelter filled with male person | 17.81% | 39 |
| Returning issue after cyclone | 14.61% | 32 |
| Gods will | 11.87% | 26 |
| **Other Reason** | | |
| COVID Outbreak | 26.03% | 57 |
| Involved in Embankment Protection Work | 5.48% | 12 |

## 6. Discussion

The rising curve of COVID-19 expansion and raging super-cyclone Amphan appeared to be created a double disaster scenario in the coastal areas of Bangladesh. Consequently, it was difficult to take the decision to evacuate under this unique situation was complex. The need and novelty of this research could be easily portrayed using pre- and post-Amphan google trend data of Khulna division, which would be shown in Fig. 9. This study extracted the google trend data of Khulna division for two search term- 'Amphan' and 'Coronavirus,' for five days before and after Amphan to understand people's concern. Results illustrated an important finding that the coastal people of Bangladesh were equally concerned about COVID-19 (locally known as coronavirus) and the super cyclone Amphan one day before and after the landfall. It indicated that coastal communities of Bangladesh had to confront the cyclone by staying at home or risking COVID-19 contagion in a shelter. We compared our findings with previous studies to identify unique findings regarding the evacuation behavior amidst the pandemic.

- We found 12 out of 19 socio-economic variables were statistically significant with the evacuation decision from respondents. This study explored that the age of the respondent was statistically significant in evacuation behavior during a cyclone, which was consistent with similar studies. The result shows that the people with 45 + age are more likely to evacuate during cyclone than others. There was a threat of damaging coastal embankments in many

villages of Satkhira during Amphan. Considering this fact, the young people did not evacuate and engaged in community-based efforts to protect the embankments. These types of efforts are not mentioned in the studies of the previous cyclone. This finding might encourage disaster management organizations to design community-based evacuation planning framework upon involving more young people.

- Though gender and marital status were found significant in the study of Uddin (2010), it differed in this study. The analysis identified that women-headed households had a higher percentage of evacuation (46%) than male-headed households. During the normal time, NGOs usually raised awareness and built capacity among the beneficiaries. During the cyclone, NGOs monitored the evacuation behavior for people's safety, especially for women. Furthermore, Bateman & Edwards (2020) interpreted that widowed and divorced women were more likely to evacuate than married women as this group might have less home boundness and high-risk perception. Gender specific evacuation programs such as married, widow or divorced, adolescent girls, and elderly should be culturally competent. Home-based shelter development might be another option for improving the evacuation behavior of the women. In coastal areas, wealthy people often built houses where the upper part of their houses were used as emergency shelters for themselves and their neighbors during cyclones (Paul 2014). Therefore, disaster managers should consider constructing such homes within vulnerable communities as part of disaster preparedness and evacuation planning. The innovative planning of house construction and credit facility might encourage people to build house-based shelters.
- On the contrary, Ahsan et al. (2016) mentioned that cattle and land ownership had a significant association with evacuation behavior, which was discordant with the result of Paul (2014). Throughout the overall evacuation scenario analysis, two factors were remarkably significant as: (i) People who had experience of storm surges were more likely to evacuate; and (ii) the COVID-19 infection risk, which affected almost all steps of evacuation, including preparation time, mode choice, evacuation decision, and destination. COVID-19 awareness was the second strongest predictor of evacuation decision. Most of the people (54.8%) who were aware of Covid-19 risk, did not evacuate to cyclone shelter. Non-evacuation behavior due to the risk of Covid infection became obvious for vulnerable people. Therefore, during the pandemic, warning dissemination was not enough to motivate people to evacuate from their vulnerable places. Therefore, the local government should compare risks of the cyclone with the infection potentials of COVID 19 to prepare evacuation plan accordingly.
- This study identified 96.6% people received cyclone evacuation orders before the landfall, which signified the improvement of early warning and evacuation order. Interestingly, Chowdhury et al. (1993) reported only 26% got evacuation order during cyclone Gorky (1991), Paul (2014) stated 75% of the respondents got evacuation order before the cyclone Sidr (2007), and Ahsan et al. (2016) informed that evacuation order reached to 97% respondents during cyclone Aila (2009). However, these studies did not consider the existing pandemic that might give scientists more thought to follow evacuation procedures in the future.
- Role of evacuation order and successful evacuation during a disaster were well accredited in evacuation research during Hurricanes Katrina in 2005 and Ivan in 2004 (Kim and Oh 2014, Mesa-Arango et al. 2013) as well as cyclone research in Bangladesh (Mallick, Rahaman, & Vogt, 2011). In this study, attempts were taken to incorporate the coastal community's preference on receiving evacuation order, ranked the trustworthiness of order sources, which would be helpful for the policymakers to devise a comprehensive warning system. This study found that social connection (e.g., friends, relatives, or neighbors) and the mosques were the major source of receiving evacuation orders during Amphan, which supported the findings of Parvin et al. (2019). However, the rise of social media such as Facebook, Twitter, WhatsApp, etc., were evident from the findings of this study. None of the respondents received evacuation order through social media during cyclone Aila (Parvin et al., 2019) as social media was not available at that time, whereas 46% respondent was informed through social media during Amphan. In terms of reliability, people identified social media was less reliable as it was unmonitored and known for spreading rumors. Moreover, unlike the previous cyclones, the role of CPP volunteers in disseminating evacuation orders were found insignificant during Amphan because of COVID-19 dispersion risk and lockdown issues.
- This study identified the mistrusts of channels of information, and the causes included inefficiency of authorities, corruption, yellow journalism, spreading false news, etc. For instance, on September 12, 2007, just before two months of cyclone Sidr, the authorities provided a false tsunami alert considering a massive earthquake event in Sumatra. People believed and evacuated to a safe place after hearing this alert from officials and other media, but nothing happened. Then later, when a tropical Cyclone Sidr approached southern Bangladesh, many communities ignored early warnings, which cost the lives of coastal people (Samarajiva and Gunawardene 2016). Additionally, during cyclone Sidr, the Storm Warning Centre (SWC) of BMD published seven weather bulletins (13–19) for the coastal people. From Bulletin 13–17, both Chattagram and Mongla port were alerted with signal 4, but when the 18th bulletin was published, the danger level suddenly changed from 4 to 10 for Mongla port and 4 to 9 for Chattagram port. Such sudden change in two consecutive warnings created huge confusion and put millions of lives in danger (Paul and Routary 2013; Roy et al. 2015). During cyclone Fani (2019), BMD predicted the cyclone would made landfall on the south-western coast of Bangladesh and alerted those areas with danger level 7. Eventually, the cyclone moved its path and did not hit the south-western part of the country (Ahsan et al. 2020). These events raised questions about the efficiency of the authorities and eroded people's confidence in the cyclone warning system. Moreover, just a few months before Amphan, several online news and social media spreaded false news about COVID-19, and thousands of people got deceived by the news (Al-Zaman 2021). Thus, many people mistrusted any news provided by those platforms, including the news of cyclone Amphan. Since knowledge of COVID 19 among the rural communities were limited, information sharing with communities would be crucial to avoid rumors and misinformation. Information shared with communities must be supported by the scientific evidence and disseminated through legitimate sources. Once trust with communities were lost, it would be difficult to engage communities in evacuation system (Ishiwatari et al. 2020).
- This study identified unavailability, long-distance, and overcrowded capacity of the cyclone shelters as the reason for not evacuating during cyclone Amphan. These findings were aligned with the insight of Paul's (2012) study on cyclone Sidr and Ahsan et al. (2016) study on cyclone Aila where they identified the mean distance to cyclone shelter was 3 km and 3.14 km, respectively. This study identified early warning-related issues such as disbelief, experience of failure, sudden changes, etc., as non-compliance reason with the evacuation order. Due to lockdown, the transport movements were reduced significantly, and therefore, transport unavailability became a strong catalyst for evacuation decision. Considering transport unavailability, carrying the elder, children, and livestock to a safe place became difficult, and thus, many people decided to stay at home. The local government should think about emergency vehicles' provision to evacuate vulnerable populations during cyclone amid COVID 19 pandemic.

## 7. Concluding Remarks

Concurrence and interaction of natural disasters with the coronavirus disease (COVID-19) challenges the resilience of societies and systems. Though cyclone is not a new phenomenon for Bangladesh, the COVID-19 pandemic brings havoc to the traditional disaster management knowledge (i.e., social cohesion, food security, livelihood, mobility, etc.), and institutional resilience (i.e., healthcare system, emergency response, etc.). This study provides a comprehensive analysis of the evacuation scenarios of the coastal people of Bangladesh during super cyclone Amphan, which has occurred in the middle of the pandemic. The study has attempted to collect primary data immediately after the cyclone. However, challenges have been in place while collecting the information in the time of lock-down with no access to public transportation, less accessibility to remote villages due to waterlogging and inconvenient road network, and access to safe food and drinking water in the rural areas. Despite all the challenges, this study investigates the issues related to evacuation systems during the pandemic in the coastal communities in Bangladesh during Amphan. We have reported through this study that the percentages of evacuees dropped down while comparing the similar earlier events in the same study area. This usually has happened due to the existence of the Covid-19 pandemic, and the fear in people's mind about this very unknown situation. Consequently, the priority of the local emergency management authorities has somewhat shifted to respond to the pandemic in the first place. However, we have found that local authorities may trigger a better evacuation system depending on trusts and efficient communication network. Though some physical challenges are identified as a cause of non-evacuation, public perception-related issues are marked as the leading reason for non-evacuation.

Researchers working in emergency planning during disasters have common interests in understanding the factors influencing people's evacuation decisions. This article explains how people decide to evacuate the face of double whammy risks like cyclone and COVID-19 pandemic. Although this article demonstrates a new fear of COVID 19 and lockdown situation that significantly affects the whole evacuation dynamics during cyclone, eventually it marks as a significant non-evacuation decision. Moreover, people have emotional considerations to evacuate during a critical situation like pandemic and disaster. In the double whammy situation, all the stakeholders should work together for an efficient action to protect people's life in the first place. Furthermore, considering the intensity and spatial extent of cyclones or tsunamis, government may relax social distancing and lockdowns to encourage people to evacuate. Consequently, to manage emergency under the pandemic situation, dissemination of risk information among the local communities is crucial to encourage people to take appropriate shelter. Since knowledge of COVID 19 is limited, dissemination of appropriate information regarding COVID 19 is important to avoid rumors that have negative impacts on evacuation behavior of the local people. Furthermore, we have conducted this study in remote rural villages, and thus, similar methods of data collection and results may not be providing identical experience for other researchers in different socio-economic conditions.

## Declarations

### Conflict of interests

The authors declare no conflict of interests in conducting this research.

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### Availability of data and material

The data used in this research is primary survey data and can be found from the corresponding author by request.

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## Figures

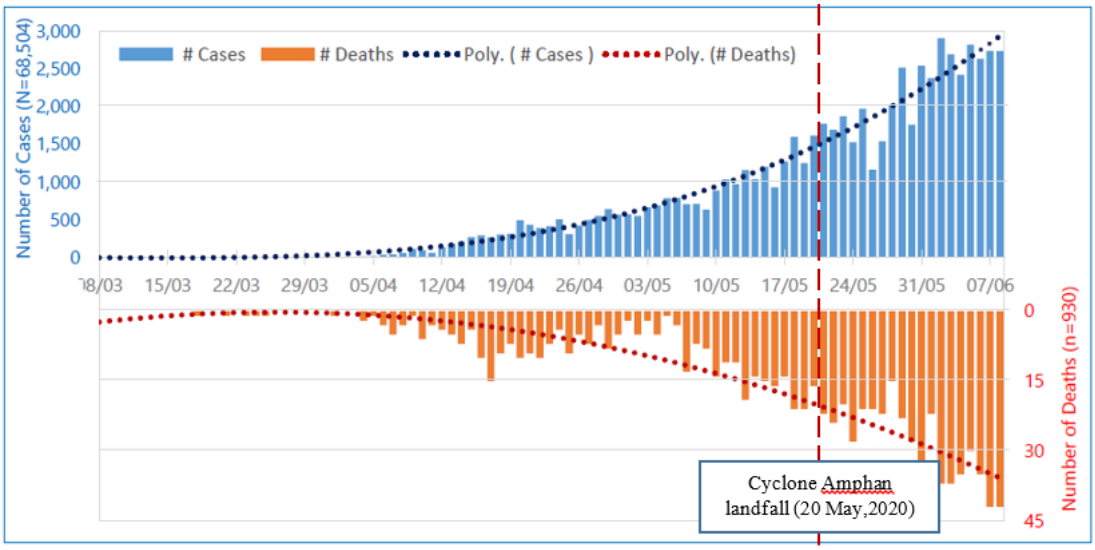


**Figure 1**

Infection and death rate before and after cyclone Amphan (Source: WHO, 8 June 2020)

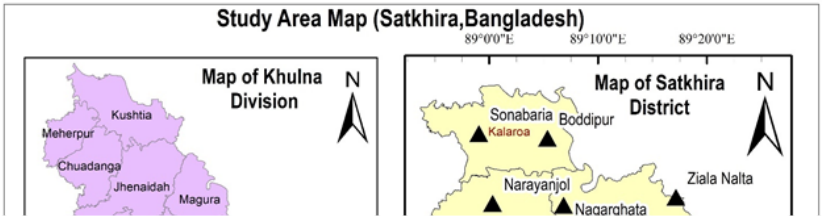


Figure 2

Location of the study area. Note that, the cyclone path can be seen on the left panel. Additionally, the sampled villages under investigation are seen on the right panel.

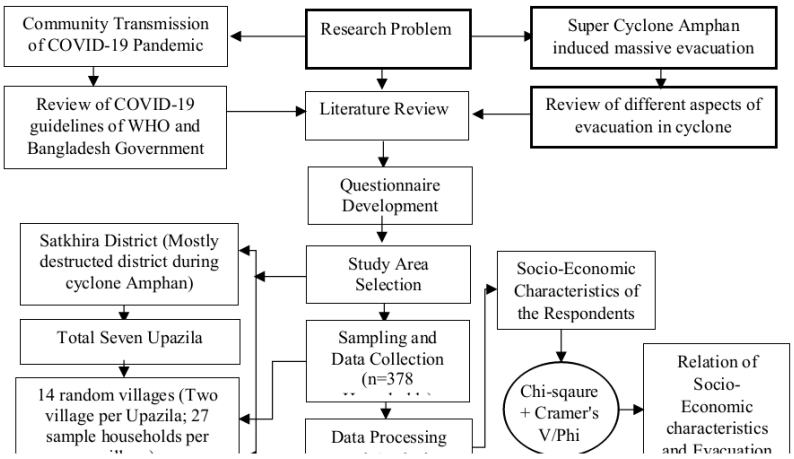


**Figure 3**

Schematic diagram of the methods employed in this study.

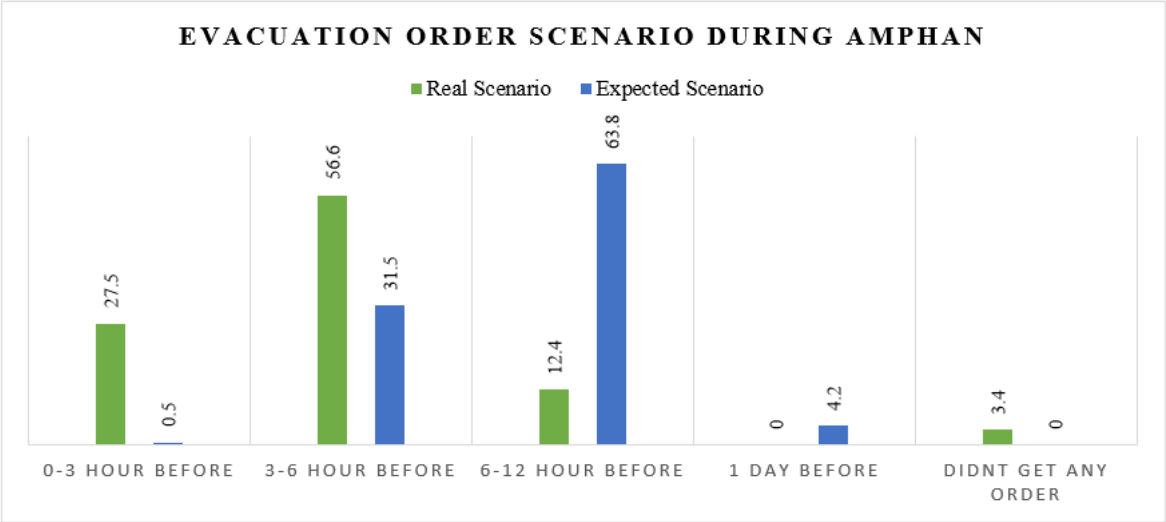


**Figure 4**

Reality and People's preference for receiving the evacuation order during Amphan. Data is summarized from the field investigation.

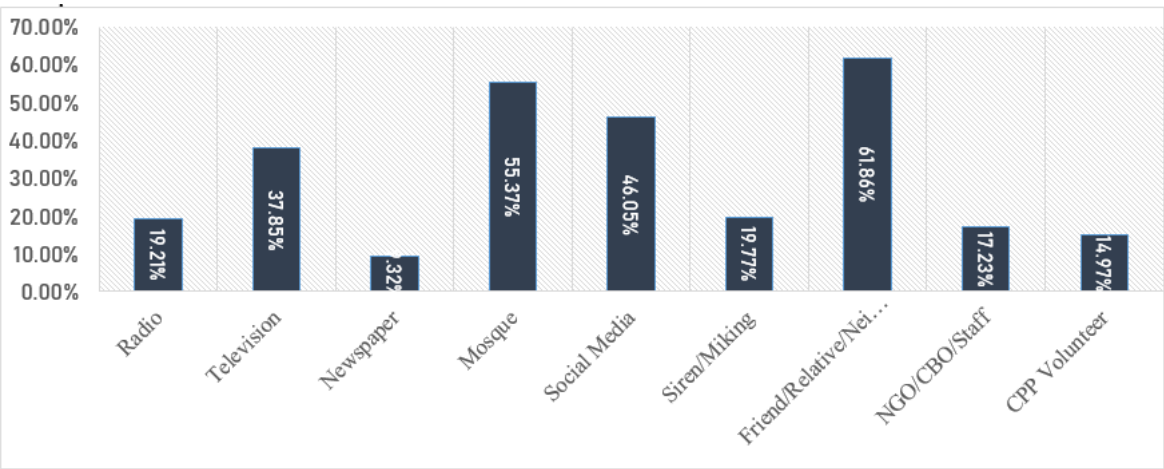


**Figure 5**

Sources of receiving evacuation order during Cyclone Amphan.

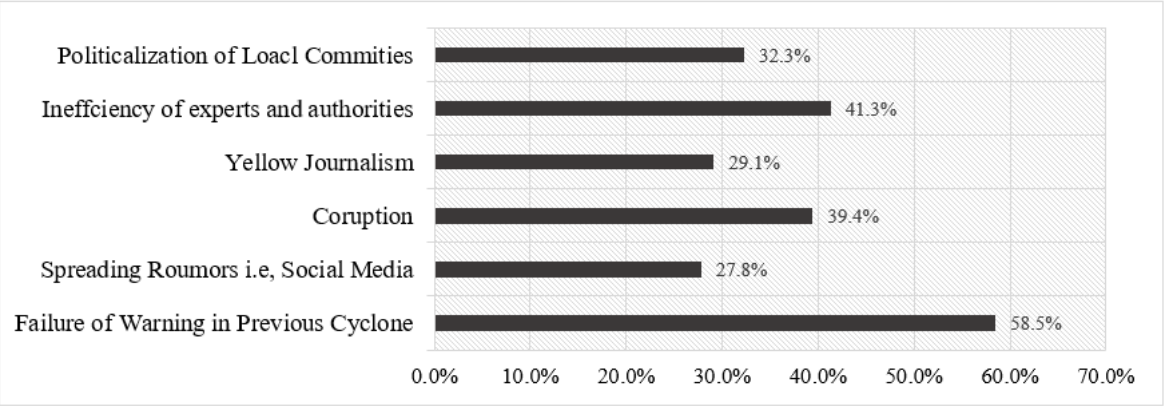


**Figure 6**

Reasons of mistrust in evacuation order received from media.

**Figure 7**

Mode used by evacuees to reach to the cyclone shelters.

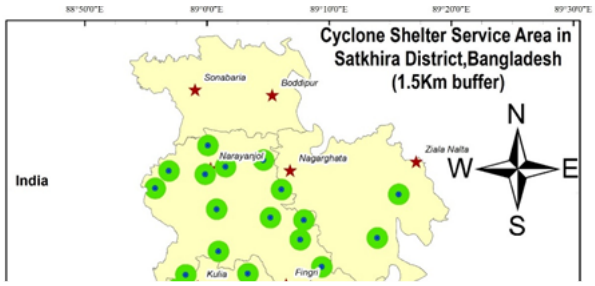


**Figure 8**

Accessibility of cyclone shelters in the study area with 1.5 km buffer.

**Figure 9**

Public concern analysis using google trend data during Amphan.