

BMJ Open Women's health-related vulnerabilities in natural disaster-affected areas of Bangladesh: a mixed-methods study protocol

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ABSTRACT

Introduction Global climate change has produced growing natural disasters across the world especially in Global South. Different countries experience varied vulnerabilities depending on their geographical location, economic status and ability of management. In a highly disaster susceptible developing country like Bangladesh, many individuals experience a greater rate of natural disasters with devastating health effects. Compare with men, women have a higher incidence of mortality and health effects following natural disasters. The study aims to explore women's experience of physical and psychological health vulnerabilities with primary causes in natural disaster-affected areas of Bangladesh.

Methods and analysis This is an exploratory mixed-method study comprising survey and in-depth interviews with equal priority to identify physical and psychological health vulnerabilities of women living in natural disaster-affected areas of Bangladesh. Quantitative data will be collected using self-administered sociodemographic and perceived severity instrument, 12-item Short-Form, Impact of Event Scale-Revised and Brief Coping Scale, while specific open-ended guidelines will be used for the qualitative part. The instruments will be translated into Bangla following the Brislin (1970) model of translation. The survey will be administered in paper copies, with at least 384 respondents, whereas 30 participants will be in-depth interviewed using an audio recorder. Survey data will be analysed using SPSS V.25 following descriptive and inferential statistics as required. The recorded open-ended responses will be transcribed and analysed using thematic analysis. Finally, both data sets will be integrated and synthesised according to the sequential mixed-method approach.

Ethics and dissemination The study has been reviewed and approved by the Human Research Ethics Committee of the University of New England. The results will be actively disseminated through peer-reviewed journals, conference presentations, social media, the internet and various community engagement activities.

INTRODUCTION

Global climate change is a major concern in today's society. Climate change has been purported to cause many weather-related events such as drought, floods, storms, cyclones, riverbank erosions and so on across

Strengths and limitations of this study

- The study will be the pioneer to the best of our knowledge in identifying women's both physical and psychological health vulnerabilities in natural disaster-affected areas of Bangladesh.
- The use of a mixed-method approach will give a more comprehensive research outcome as little is known about the phenomena.
- The use of 12-item Short-Form and Impact of Event Scale-Revised instruments which were already used in the context of natural disasters will value/recognise the research findings.
- Limiting the study into two disaster-affected areas of Bangladesh rather than the majority of the affected areas is a limitation.

the world, especially in the Global South, which has an adverse impact on human health.^{1 2} Developing countries, including Bangladesh, are more vulnerable to the impact of these events and many individuals experience a greater rate of natural disasters related to these weather events because of their location, lack of resources, limited access to medical facilities and poor infrastructure for mitigation.³ According to the World Risk Report (2014), Bangladesh is the fifth most natural disaster-prone country of the 173 countries in the world.⁴ Bangladesh is highly susceptible to many natural disasters such as floods, cyclones, droughts, riverbank erosion and earthquakes almost every year because of the flat geography, low-lying and climatic features including rainfall, typical flooding, air temperature, humidity and distinct seasons.^{3 5-9} On average, the country experiences severe tropical cyclones every 3 years of which 70% of the population is exposed, and approximately 25%–60% of the landmass is swamped with floodwaters every year affecting more than 80% of the population.⁵ Therefore, floods and cyclones are the

most significant natural disasters that have a damaging impact on Bangladesh.⁵

Some areas of Bangladesh, especially the coastal areas, are more prone to natural disasters related to weather events including severe cyclones (Sidr, 2007; Aila, 2009; Roanu, 2016) resulting in an enormous loss. Bangladesh is the world's most vulnerable country to tropical cyclones as indicated by the United Nations Development Programme.¹⁰ From 1877 to 2016, Bangladesh has met 171 cyclones, including 45 severe cyclonic storms.⁹ Research indicates in 1970 and 1991, about 500 000 and 140 000 people were killed in Bangladesh as a result of cyclones.¹¹ Recently, on 20 May 2020, Bangladesh experienced Cyclone Amphan, which recorded nine deaths, swamped many low-lying areas, resulting in collapsed embankments, uprooted trees and 500 000 homeless families.¹² In addition, cyclones are responsible for salinity intrusion, freshwater crisis, changed livelihood patterns, health problems, sanitation and malnutrition, all of which lead to other problems such as migration.⁹ Although many studies have been conducted on vulnerabilities and the impact of cyclones in coastal Bangladesh,^{3,9} there remains a dearth of literature on the specific health vulnerabilities of women from these disasters.

Along with catastrophic cyclones, some other disasters such as floods and waterlogging are common across other areas of Bangladesh. Recently, Bangladesh experienced the worst flood in the last four decades, which caused intense flooding across more than one-third of the country other than the coastal areas.¹³ This widespread flooding resulted in 145 deaths (mostly women and children), affected 8 million people across 32 districts, destroyed 103 855 houses and damaged 4636 educational infrastructures.¹³ Hence, the lives of men, women and children are at great risk during natural disasters in affected areas of Bangladesh. In the future, these flood events are likely to occur more frequently, and their adverse impacts are likely to be more severe due to the impacts of climate change.²

In addition to the loss of life, damage to houses and loss of domestic animals and crops make natural disaster-affected people more vulnerable to the impact of disasters. Women are specifically vulnerable to disaster-related health outcomes compared with men⁷ especially in low-income and middle-income countries.¹⁴ Health impacts regarding gender disparities are mediated through socioeconomic, cultural and physiological factors.¹⁴ Because women are not expected to be athletic in some cultures, they become vulnerable to injury and at risk of death during disasters. Consequently, during disaster women recorded higher mortality rates^{14,15} and experience decreased life expectancy after disasters due to unequal access to basic social goods. Research also indicates that women are at a higher risk for abuse; mood disorders such as depression and anxiety; childbirth-related complications such as bleeding and low-birthweight infants; and poor economic and mental health recovery after disasters.¹⁴ Patriarchal societal norms and values in developing countries cause women and woman-headed families to be more vulnerable to disaster-induced health threats due to unequal access to

opportunities.^{7,10} For example, disasters increase women's work burden compared with men due to women's home-bound roles such as cooking, taking care of the children and elderly, feeding animals and carrying water from long distances which compel them to compromise their own safety.^{2,8,14} Women are also known to take less food or sacrifice their food for other family members during and in the aftermath of a disaster period.⁷ Moreover, women face other issues, due to the lack of separate toilets, bathing facilities and living rooms, when they are required to reside in shelter homes during and after natural disasters. Women also experience safety concerns associated with the risk of sexual harassment that can occur in shelter accommodation.⁷

Given these factors and considering the paucity in the literature, it is essential that an exploration of the experiences of women after natural disasters be undertaken. Therefore, the proposed study aims to explore women's health-related vulnerabilities in the most disaster-prone areas (ie, coastal areas) and recent disaster-affected areas of Bangladesh. The investigation of women's health-related vulnerabilities in the disaster-affected areas is essential to determine why and how their health is impacted and affected by natural disasters specifically in Bangladesh. In brief, this research will contribute to existing knowledge by identifying the causes and consequences of different types of health vulnerabilities of women in the disaster-affected areas of Bangladesh.

AIM

The aim of this study is to explore women's experiences of physical (acute disease, chronic disease, waterborne disease and infectious disease) and psychological health vulnerabilities (emotional trauma, such as shock, anxiety, sleeping disorder, and post-traumatic stress disorder (PTSD)) in natural disaster-affected areas of Bangladesh.

Specific objectives are:

1. To examine the causes and consequences of health vulnerabilities of women in natural disaster-affected areas of Bangladesh.
2. To understand the rates of physical health vulnerabilities of women involved in natural disasters.
3. To determine the psychological health status/emotional well-being of women involved in natural disasters.
4. To explore the coping strategies of survivors in relation to health risks resulting from natural disasters.
5. To assess women's access to healthcare facilities in natural disaster-affected areas.

Study hypotheses

1. Older women will have a higher association with physical health vulnerability.
2. Women with lower educational status will have a higher association with physical and psychological health vulnerabilities.
3. Women with lower socioeconomic status will have a higher association with physical and psychological health vulnerabilities.

4. Participants with frequent experience of natural disasters will have a higher association with PTSD symptoms.

METHODS

Study design

This explorative study will use mixed methods¹⁶ to explore the health vulnerabilities of natural disaster-affected women in Bangladesh. In phase 1, a quantitative approach will be used to address the causes and consequences of health vulnerabilities, determine the health status of women after disasters, and measure the level of coping and access to healthcare facilities. In phase 2, a qualitative approach will obtain in-depth information to help explain quantitative findings. A mixed-method design is considered as the most appropriate for this study as little is known about women's health vulnerabilities after natural disasters in Bangladesh. The use of a mixed-methods approach will lead to more evidence to address the broad study question and objectives.¹⁷

The advantage of using mixed-methods research is that both approaches lead to a more comprehensive understanding of the issue through the integration of the data from both approaches.¹⁸ As a result, through the process of methodological and data integration, a more comprehensive research outcome is created, as opposed to an outcome from using just one approach. Data will be analysed and interpreted sequentially at each stage of the study, and then all data will be integrated and synthesised at the end of the study as is required in a mixed-methods study.¹⁸ An overview of the study design is presented in [table 1](#).

Study areas/setting

The study will be conducted in the cyclone Sidr-affected Sarankhola Upazila of Bagerhat District and flood-affected Sagata Upazila of Gaibhandha District in Bangladesh. The administration of Bangladesh is divided into several hierarchical units following Division (highest hierarchical unit), District, Upazila and Union. Sarankhola Upazila is a coastal natural disaster-prone area, and Sagata Upazila is a riverside area; both areas are the worst disaster-affected areas in Bangladesh among the 19 disaster-prone districts. The selection of these two affected areas has been based on information obtained from the Ministry of Disaster Management and Relief,¹³ local government offices and non-government organisations (NGOs).

Sample size and sampling method

The sample size of 384 is estimated for the survey from a total female population of approximately 158 435 (Sarankhola: 76399, Sagata: 82036). The sample size was determined using Raosoft¹⁹ (software that is widely used to determine the sample size). The target proportion of respondents, 185 from Sarankhola Upazila and 199 from Sagata Upazila, has been determined based on the total female population (aged 18 years and above) of these two Upazila. Due to the sensitivity of this research topic, 15 participants at each site, a total of 30 participants altogether, are argued to be an

Table 1 Overview of the study design

Study design	Stage	Procedure
<i>Phase 1</i>		
	Scoping	Adaptation
Instrument development, modification and transcription.	Translation and back translation	Testing for validity and reliability
Pilot study (n=30)		
<i>Phase 2</i>		
	Quantitative data collection (n=384)	Survey distribution/ data collection
Preparation, collection and analysis of— quantitative data— disaster affected women	Quantitative data analysis	Analysis using SPSS V.25
<i>Phase 3</i>		
	Qualitative interview development	Development of interview questions based on previous results and gap
Preparation, collection and analysis of— qualitative data— disaster affected women and community health workers	Qualitative data collection with disaster-affected women (n=30), qualitative data analysis	Individual unstructured/open-ended in-depth interviews
	Integration of quantitative and qualitative results	Coding and thematic analysis
		Interpretation and explanation of all results

adequate sample size for in-depth interviewing in the qualitative phase of the study.

Participants and sampling procedure

Considering the aim of the research, systematic random sampling will be used to recruit the survey respondents while purposive sampling will be used in recruiting the participants for the in-depth interviews. The researcher will randomly select a Union (the lowest administrative unit of Bangladesh) from each aforementioned Upazila, and then two villages will be selected from each Union in a similar manner. A list of the total number of households from the villages will be collected to select respondents using a systematic random sampling procedure. The unit of analysis will be all female members of the households in the study area, aged over 18 years. In the case of availability of multiple respondents, the female member (aged 18 and above) of the selected households, who are more interested in participation, will be recruited. However, if the sample respondent is absent at the time of the interview, at least two revisits will be made to interview the sample respondents. In the case of non-response from the respondents or

unavailability from the selected households and following the inclusion/exclusion criteria, the researcher will select an alternative households/respondents from the immediate next household in order to achieve the required number of respondents. Thus, the researcher will try to keep the non-response rate at 0.

For the qualitative part of this study, the researcher predicts that 30 disaster-affected women (15 in each site) will be sufficient to reach data saturation.

The proposed sample size 30 (ie, 15 at each site) of this study can be justified by the following: (a) in-depth interviewing is a time-consuming/intensive research and (b) the nature of qualitative research does not require large samples.²⁰ Participants will be reached through the connections established by the researcher while conducting the survey.

Inclusion criteria

1. Women aged 18 years and above.
2. Permanent residents of the study areas.
3. Have experienced a natural disaster.
4. Willing to consent and participate in the study.
5. Able to communicate their experiences to the researcher.

Exclusion criteria

1. Male residents in natural disaster-affected areas.
2. Women aged under 18 years.
3. Women who have never experienced a disaster.
4. Women with difficulty in hearing or speaking.
5. Evidence of a severe mental illness/disturbance.

Data collection

Measures

A sociodemographic section and specific questions will be included in the survey based on the review of the relevant literature, and information from previous studies. This section will identify the causes of women's health vulnerabilities, determine their post disaster health status and their level of access to healthcare facilities in the context of Bangladesh. A Likert-scale, ordinal, interval and dichotomous category (yes/no) will be adopted for these additional questions. The survey will also have a component where the respondent's consent will be taken for the survey and where their willingness to be interviewed for the qualitative phase is documented.

The 12-item Short-Form (*SF-12*) *Health Survey and Impact of Event Scale-Revised (IES-R)* will form the basis of the survey, which will determine women's health status after disasters. The 1SF-12 Health Survey was developed by Wee and colleagues²¹ for the Medical Outcomes Study (MOS). *The SF-12 Health Survey* is able to produce the two summary scales originally developed from the SF-36 with considerable accuracy and yet with far less respondent burden.²² To get short generic summary information on physical and mental health status, the SF-12 is an instrument of choice. The tool has previously been used in many studies in the context of natural disasters.^{23 24}

The IES-R was designed as a measure of PTSD symptoms and contains 22 questions. It is considered the most appropriate tool for assessing the impact of recent and specific traumatic events and has been previously used in natural disaster research.^{25 26} The original scale, developed by Horowitz, Wilner, and Alvarez (1979),²⁷ was revised by Weiss and Marmar (1996)²⁸ in order to better correspond directly with the Diagnostic and Statistical Manual for Mental Disorders-IV (DSM-IV) symptoms of PTSD. Although DSM-V is now used rather than DSM-IV, in most respects, there are no extensive changes from DSM-IV.²⁹

Disaster survivors' coping strategies will be explored using the Brief Coping Scale (28 items)³⁰ developed by the department of psychology in the University of Miami. Self-developed perceived severity-related questions and some coping strategies have been developed based on a pilot study.

No studies were found in Bangladesh where the tools have been translated and validated into Bangla (the mother language of Bangladeshi people). Therefore, in this research, the SF-12, IES-R and Brief Coping Scale will be initially translated following the Brislin³¹ model of translation, prior to testing and dissemination.

Procedure

The research will be divided into three phases over 2 years.

Phase 1

In phase 1, an initial scoping phase will be undertaken to ensure the relevance of the SF-12 and the IES-R for use in the context of Bangladesh with residents of the disaster-affected areas. An initial scoping exercise will assist the researcher to understand the need for amendment of the tool, where necessary modification will be undertaken to confirm the appropriateness for use in Bangladesh. After any necessary modifications, the tools will be translated into Bangla following a widely used translation model outlined by Brislin and used by other cross-cultural researchers.^{32 33} As a requirement of Brislin's model, the transcribed measurement tools will also be pilot tested (sample n=15), and followed by a test-retest determination (sample n=15) to assure the validity and reliability of the tool after translation.³⁴ The final instruments for the survey will be developed following these steps.

Phase 2

The second phase is the conduct of the quantitative survey research using a face-to-face survey interview technique. A total of 384 disaster-affected women will be recruited from the Sarankhola Upazila of Bagerhat and Sagata Upazila of Gaibhandha using systematic random sampling procedures. The unit of analysis will be all female members (aged 18 years and above) of the households. The proportion of the respondents is estimated based on the total female population of these two Upazilas (185 of the respondents would be included from the Sarankhola Upazila of Bagerhat District and the rest of the 199 respondents would be considered

from the Sagata Upazila of Gaibhandha District) for the quantitative part of this research.

Data collection will be performed by the researcher (SRF) with the assistance of a local data collector to achieve the required sample size. Completion of each survey interview is expected to take approximately 40–50 min. Paper copies will be used to collect quantitative data and substantial additional information will be noted for the next phase.

Phase 3

A descriptive exploratory qualitative study will be undertaken for this phase of the research. The qualitative phase will aim to explore and explain the particular characteristics and experiences of different types of physical and psychological health vulnerabilities. For example, this phase will attempt to unravel the sensitive issues the women experienced during and following the disaster. The qualitative participants will be chosen purposively within the second phase of the study, where women will identify if they are willing to be interviewed. Specific guidelines and open-ended questions will be used for conducting in-depth interviews. Further, the information collected in the previous phase of the study will be used to develop the questions to be explored in the qualitative phase. Interviews will be conducted at a time and place of the participants' choosing. A setting that is favourable to an interview and where privacy can be assured is recommended.²⁶ All interviews will be recorded and transcribed for understanding and analysis of developing themes. Privacy and confidentiality will be maintained at all times and responses will be de-identified. In addition, notes will be made immediately after interviewing to note any characteristics of the interview relevant to the study objectives that cannot be noted through recording, such as body language. The one-off in-depth interviews are expected to take approximately 60 min. In the case of participants' unwillingness to be interviewed, participants will be allowed to leave the interview at any time. It is expected that data collection will occur over a 6-month period, from March to July 2020.

Patient and public involvement

Natural disaster-affected women will be the respondents of this study, no patient will be involved. A detailed participant information sheet will preface each survey and in-depth interview with written consent to participate. Verbal permission will be obtained to record in-depth interviews. No personally identifiable information will be collected in order to maintain the privacy of the respondents.

Data analysis

The quantitative data from the survey will be analysed using the Statistical Package for the Social Sciences (SPSS) V.25.³⁵ Analysis of the survey data will be conducted following descriptive statistics and inferential statistics as required. Descriptive statistics will be used to gain information about respondents' demographic characteristics (age, marital status, level of education and economic status), and SF-12 and IES-R responses. Categorical variables will be described

using frequencies and percentages while mean, SD and median values will be used to describe continuous variables. Finally, bivariate statistics and multiple regression analysis will be performed to examine the correlation, significance or variance between outcome variables and independent variables and sociodemographic factors. In addition, as the tools have not been previously used in Bangladesh, psychometric testing (ie, using Cronbach's alpha coefficient) of the tools will be conducted to assess the internal consistency of the scales following the recommended approach.^{26 36}

Conversely, for the qualitative analysis, data will be transcribed from Bangla to English, checked for accuracy and analysed for themes with the assistance of a qualitative data analysis programme such as NVivo.¹⁸ This method of analysis is recommended for qualitative data, as data can more easily be coded for emerging patterns and themes and relationships between such themes.¹⁸ Thematic analysis will be conducted on the transcribed data, discovering key components of the data (which can be words, sentences, phrases, paragraphs or even entire documents) in relation to the study's aim and objectives.

Finally, the synthesis of the combined dataset will be completed at the end of the study following the recommended approach for sequential explanatory mixed-method approaches³⁷ to unravel the complexities of the phenomenon under study. The integration of both datasets is one of the essential conditions of the final analytic phase of a mixed-method study.³⁷

ETHICS AND DISSEMINATION

Ethical approval was obtained from the Human Research Ethics Committee University of New England (HE19-122).

The findings of the research will be disseminated through a comprehensive strategy including peer-reviewed journals, national and international conference presentations, social media, the internet and various community engagement activities.

DISCUSSION

This project has the potential to explore different types of physical and psychological health problems experienced by women following natural disasters that have to date not been addressed in Bangladesh. For a disaster-affected country like Bangladesh, it provides an understanding of the key factors for women's health vulnerabilities and consequences, highlights their healthcare requirements and how women survived in a disaster and postdisaster situation.

The findings of the study can be used to identify health requirements, improve the safety, security and coping strategies for women in a similar situation in the world's most natural disaster-exposed Asian countries such as China, Vietnam, Philippines, Nepal, India, Pakistan and Japan.³⁸ In addition, drawing attention to women's physical and psychological health outcomes following natural disasters may assist policy-makers, NGO workers and international donor (ie, World Bank, UN) communities to work side by side with locals to develop healthcare risk mitigation plans for

women in the natural disaster-affected areas across the globe, including Bangladesh.

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