



The nexus between extreme weather events, sexual violence, and early marriage: a study of vulnerable populations in Bangladesh

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Abstract

This study aims to explore whether a relationship exists between extreme weather events, sexual violence, and early marriage. We selected two districts in Bangladesh that are vulnerable to extreme weather events: Sunamganj, which experiences flash flooding, and Brahmanbaria, which experiences cyclones and related floods. Survey data was collected from 120 randomly selected household heads from two villages in these districts, and in-depth interviews were conducted with 40 household heads who indicated early marriage was a coping strategy for managing effects of weather events. The mixed-methods study finds that early marriage of daughters is a coping strategy for managing two negative consequences of extreme weather events. First, by minimizing household expenses, householders can pay for damage-related expenses. Second, unmarried daughters may be subject to sexual violence during a crisis, especially in temporary shelters, which would harm both the family's and daughter's reputation and prevent future marriage.

Keywords Bangladesh · Early marriage · Extreme weather events · Poverty · Sexual violence · Vulnerable areas

Introduction

Bangladesh is among the six most flood-prone countries in the world (UNDP 2004) and is also regularly exposed to other extreme weather events such as cyclones. This situation makes the population vulnerable to many undesirable outcomes, including two that are rarely studied: early marriage and sexual violence. Floods and extreme weather events exacerbate already high levels of poverty in the country as they affect a large number of people and cause damage to property. Women are disproportionately

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more vulnerable than men to these effects from extreme weather events (Kümbetoğlu and User 2010; Nasreen 1998). Indeed, in Bangladesh, as in other developing countries, the majority of the population is vulnerable to extreme weather events (Brouwer et al. 2007; Peduzzi et al. 2009). Flooding affects peoples' homes and livelihoods, especially those based on environmental resources (Philip and Rayhan 2004). Consequently, vulnerable households adopt a range of coping strategies, such as seeking for relief or food aid, relying on social networks, selling assets and properties, and seeking alternative source of income (Van der Geest and Warner 2015). Though rarely considered, early female marriage is also a coping strategy (for exceptions see Alston et al. 2014; Azad et al. 2013; Nasreen 2008).

This paper is focused on the influence of extreme weather events, particularly floods and cyclones, on the practice of early marriage in Bangladesh. Floods and cyclones exacerbate poverty and increase the risk of sexual violence toward unmarried girls. Therefore, parents may decide to marry their daughters at younger ages in order to reduce the household's consumption and reduce their daughters' risk of becoming unmarriageable as a result of sexual violence. The paper is structured as follows. It begins by defining early marriage and sexual violence in the Bangladesh context and identifies a conceptual framework for this research. The third section describes the mixed-methods research approach adopted for this study, as well as the process used for selecting the two areas of study, one which is affected by flooding and the other by cyclones and flooding. Results are then presented, followed by discussion and conclusions.

Conceptual framework

Early female marriage in Bangladesh

Early marriage is defined by law as any formal or informal union involving a groom under 21 years old or a bride under 18 (Haque et al. 2014). Early marriage is also sometimes called child marriage (e.g., Alston et al. 2014); we prefer the term "early marriage" as the age group implied by "child" is vague. For our study, we define early marriage as the marriage of girls before the age of 18. In Bangladesh, estimates of early marriage for girls range from 66 to 80%, although they have been declining (Godha et al. 2013; Kamal et al. 2014; UNICEF 2011). Among women 20 to 49 years old, 71% had married by age 18 and 85% by age 20 (NIPORT et al. 2016). There is some evidence of an increase in age at first marriage: between 2011 and 2014, the percentage of women aged 20 to 24 who had married declined slightly from 65 to 59%.

There is only modest pressure to raise the age at first marriage in Bangladesh. The majority of women do not perceive their own age at marriage as too young, although those who married before the age of 18 are more likely to feel this way. More than 50% of women aged 15 to 49 years thought their marriage took place at an appropriate age, while 39% thought that they should have married later. Among women who married before age 18, 49% thought this was too early. By contrast, the vast majority (87%) of women who married when they were 18 to 20 years old, or more than 21, thought they got married at the right time (NIPORT et al. 2016).

Early marriage in Bangladesh is associated with poverty, low levels of education, women's employment status, religion, dowry practice, and rural residence (Alston et al.

2014; Hossain et al. 2016; Islam et al. 2016a, b; Kamal et al. 2014; Streatfield et al. 2015). The practice of early marriage of girls is strengthened by the presence of poverty, and early marriage is more common among the poorest families (Hoq 2013; Hossain and Islam 2013; ICRW 2006; Otoo-Oyortey and Pobi 2003; Parsons et al. 2015). In Bangladesh, poverty is related to the gender and educational status of a household head, total family size, monthly household income, income sources, land ownership, and indebtedness (Kamal 2011; Philip and Rayhan 2004).

Marriage and wifhood are normative social practices in Bangladesh (Amin 1998; Chowdhury 2009). They ensure the women socioeconomic and personal security as well as their social status (Bates et al. 2004; Kabeer 2011; Zaman 1999). The families of both the bride and the groom arrange the marriage, which is a common cultural practice in Bangladesh. Conventionally, the process of marriage initiates with the proposal from the groom's family to the bride's family either directly by the groom's family, or one of his relatives or friends, or by a *ghatak* (marriage broker). A *ghatak* gets benefits either through money or other ways. As a response to the proposal, the bride's family invites the groom's family to see the bride and the family. When both families find the proposal is suitable regarding the law, customs, and traditions, they go forward to discuss demands if they have from both sides and to fix a date of marriage (Ahmed 1986). The girls generally have no influence in deciding whether to be married or not, and with whom and therefore, they do not participate in the negotiation (Bhuiya et al. 2005; Schuler et al. 2006).

The demands from the groom and his family are referred to as dowry and are either financial or non-financial such as large sums of money, jewelry, furniture, and other goods. The practice of dowry was supposedly to secure the happiness of the daughter (Chowdhury 2010) and to counteract the risk of divorce (Geirbo and Imam 2006). However, the present practice is that many brides' parents willingly provide necessary things such as jewelry, furniture, and kitchen utensils to the groom for the sake of their daughter's happiness, even if the groom does not demand it (Chowdhury 2010). Moreover, the bride's family arrange the marriage ceremony in their house or in a community center and bear the costs of marriage ceremony for the best hospitality for the groom's family, friends, and relatives. After 1 or 2 days of this ceremony, the groom's family arranges a ceremony as a bridal reception: the groom is the host and the bride's family and relatives are invited. This is how a traditional marriage takes place in Bangladesh though it may slightly vary according to religion and to the rural or urban character of the area.

Extreme weather events and sexual violence

In this study, the term sexual violence refers to rape, sexual abuse, unwanted touching, and being coerced, threatened, or otherwise forced to watch private sexual acts (Krug et al. 2002: 149). During and after extreme weather events, women, especially young women, often experience sexual violence in South Asia. For instance, evidence of sexual violence and assault was noted in the immediate aftermath of the 2005 earthquake in Kashmir (Mehta 2007) and the Asian tsunami (Oxfam 2005). During extreme weather events in Bangladesh such as floods and cyclones, especially along the coastal belt where the impact is greatest, people take shelter in public buildings such as schools, hospitals, and local offices, for short (e.g., 15 days) or long periods (e.g.,

3 months or more). Girls are frequently threatened with sexual violence in these shelters (Plan International 2011). The situation is similar in refugee camps where long distances to toilets or showers and deficient closing mechanisms on tents pose a threat to women's safety and security (Dasgupta et al. 2010). Consequently, because of the unsafe conditions created by extreme weather events, people experience additional threats.

If a girl is raped, assaulted, or otherwise sexually abused, the status of the girl's family is affected at the time of her marriage and the girl can even become unmarriageable. Furthermore, the problem also affects the chances of marriage for the other unmarried sisters of the family (Caldwell et al. 1998). Moreover, there is an associated risk of paying a higher dowry if the marriage of a victimized girl is delayed (Alston et al. 2014). Indeed, any sexual violence is quickly spread to the community and raises question regarding the reputation of both the girl and her family: the responsibility mainly weighs on the girl's family as it is understood that the girl is not closely watched and protected (Caldwell et al. 1998). Thus, ensuring the good reputation of a girl is valued by the family. However, as patriarchy is deeply rooted in society, women victims are sometimes accused of causing themselves sexual violence (Farouk 2005). As summarized by Alston et al. (2014, p. 140): "Because of eve-teasing and the threat of violence and dishonor, there is increasing pressure on families to marry their daughters to protect them and to maintain the standing of the family in the community." Thus, maintaining the family's reputation and protecting the daughters from the risk of being victims of sexual violence may be critically compromised in the areas with severe impacts of climate change and natural disasters (Rashid and Michaud 2000), and early marriage of girls might be considered as a solution.

Extreme weather events, poverty, sexual violence, and early marriage

The Protective Action Decision Model (PADM) describes the decision-making process that accompanies threat appraisal and the assessment of potential coping behaviors (Lindell and Perry 2004). According to this model, the process of protective action decision-making starts from three cues which are the predecessors of a decision-making process: environmental, social, and warnings. The environmental cues refer to sights, smells, or sounds that signal the prospective threat; the social cues are derived from the observation of others' behavior or responses; and the warnings are the messages transferred to a receiver according to his/her characteristics. These cues then initiate a pre-decisional process with the receivers which, in turn, influence the perceptions of threat, of protective action, and of the social stakeholders (e.g., households) of the community. Afterwards, these resulted perception is the ground for protective action decision making. Finally, the perceptions result in behavioral responses such as seeking information, coping mechanism to solve the problem, and emotion-based coping. In the Protective Action Decision Model, environmental cues thus accelerate the decision-making process, whereas under normal conditions, environmental cues indicate that the situation is safe (Lindell and Perry 2004). Extreme weather events and flooding areas are environmental cues that trigger a threat appraisal and the possible invocation of coping behaviors (Blaikie et al. 1994; De Haen and Hemrich 2007; Fordham 1998; Greiving et al. 2006).

One coping strategy is for parents to marry off a young daughter as a means of reducing total household consumption (CARE 2016; ICRW 2006; Parsons et al. 2015). By marrying a daughter at an early age, the costs of her maintenance and education are

transferred to another household (Hossain and Islam 2013; ICRW 2006; Malhotra 2010; Otoo-Oyortey and Pobi 2003; Parsons et al. 2015; UNICEF 2001). This strategy is especially likely in contexts where early marriage is perceived as the optimal course of action for young girls (Bajracharya and Amin 2012). For example, in rural Nepal, parents consider marrying their child daughters aged less than 18 to a rich man to relieve themselves of the financial burden their daughters' pose (Malhotra 2010; World Vision UK 2013), and in arid Ethiopia, people believe that having more girls in the family places them at risk of poverty (Ezra 2001). Poor families also prefer early marriage for their daughters to minimize the financial burden of paying dowry for their girls (Parsons et al. 2015), because the amount of dowry they are expected to pay is lower for a girl than for an adult woman. In contrast, for the families of young men, dowry is a mechanism for the accumulation of capital. Girls are thus seen as burdensome, a situation which encourages gender inequality (Alston et al. 2014). Since households in disaster-prone areas are often impoverished, it is likely that householders living in these areas consider early marriage for their daughters as a coping strategy against further impoverishment and food shortages due to a disaster (Ferdousi 2014; Urama et al. 2017).

Early marriage is also a coping strategy in contexts in which sexual violence is common and the reputations of daughters and families must be protected (Alston et al. 2014; Azad et al. 2013; Nasreen 2008; World Vision UK 2013). In Bangladesh, India, and Nepal, girls from poorer households are more likely to experience sexual violence than those from richer households, and therefore early marriage is more likely to be contemplated in poorer households as a solution to this societal problem (Verma et al. 2013). The problem becomes more acute during environmental crises. For example, one study found that increased early marriage was a consequence of increased sexual violence following cyclone Sidr in Bangladesh (APIT 2009). Following the 2004 Asian tsunami, there was an increase in the rate of both early marriage and different forms of sexual violence in Indonesia (Felten-Bierman 2006). Poor families who live in shelters/refugee camps view early marriage as the only protection for their daughters against sexual violence in Philippines (Ballesteros 2010). To avoid this happening to their female children, families may consider marrying them soon after a disaster event.

Methodology

Sampling strategy

For our survey, we employed a multistage non-random sampling design selecting geographic units (villages) that were highly vulnerable to flooding and cyclones in order to maximize the likelihood of identifying householders who would use early marriage as a coping mechanism after a disaster. In the first stage, a literature review on recent extreme weather events in Bangladesh indicated two districts, Sunamganj and Brahmanbaria, which are respectively vulnerable to flooding (Kamruzzaman and Shaw 2018) and cyclones (Hayashi and Yamane 2010; Yamane et al. 2010). Sunamganj District is in the Sylhet Division and Brahmanbaria District is in the Chittagong Division (Fig. 1). These districts are in divisions with poverty and early marriage rates similar to or lower than those in other divisions of Bangladesh (Table 1). In Sylhet and Chittagong respectively, 62.2 and 72.8% of ever-married women aged 15 to 49 years were married before the age of 18

(Islam et al. 2016a). Poverty is also widespread with 26.1% of households in Chittagong and 25.1% of households in Sylhet meeting the criteria for poverty (Ahmed et al. 2010).¹

In the second stage, we selected two Upazilas of these districts based on the literature on recent floods and cyclones. Upazilas are sub-units of districts and the second lowest tier of regional administration. The Jamalganj Upazila in Sunamganj District and the Brahmanbaria Sadar Upazila in Brahmanbaria District were selected since they are found highly vulnerable respectively to flash floods (Anik and Khan 2012; Haq and Ahmed 2017; Haq 2018) and cyclones (Siddiqui and Hossain 2013). In the third stage, we selected two villages, Alipur village in Jamalganj and Chandi village in Brahmanbaria Sadar, due to their vulnerability to annual floods and cyclones, respectively. Chandi village was the worst affected village during the 2013 cyclone (Siddiqui and Hossain 2013). These villages were recommended as the most affected villages in their districts by the two Upazila Nirbahi Officers, the two chief executives of the Upazilas, for the two Upazilas (The Upazila Nirbahi Officer is the Chairperson of the Upazila Disaster Management Committee who coordinates the disaster management activities at the Upazila level).

At the very start of fieldwork, we went to the local administrative office to discuss the purpose of our study with the Secretary of the Chairman of each village and to request the latest electoral roll. To validate the electoral roll and to identify the household heads from the voter lists, we conducted a meeting in each village with 10 local knowledgeable people and elites who are over 50 years old and who have good knowledge about the villagers and the families. We asked the participants in the meeting to identify household heads irrespective of gender and age. We use this validated list of household heads as our sampling frame to produce population representative samples for the two villages selected because of their vulnerability to flooding and cyclones.

We focus on household heads because they are the persons who are primarily responsible for household decision-making about financial resources and children. In our two lists of household heads obtained from the voter lists, there were 340 household heads (220 from Chandi and 120 from Alipur) found to be aged 34 to 67 years. We then assigned a number against each name. Then, using a sampling size formula (see Islam 2014:163), we selected 120 household heads as the total sample; a proportional allocation technique produces a sample of 78 household heads for Chandi and 42 for Alipur.

Having selected our samples, we visited households and asked to speak with the household head, relying on local residents who know the exact location of all households and are well known to the villagers to introduce us. We returned to the selected households until an interview was obtained. No substitution of households was made. Therefore, the response rate is 100%.

We surveyed household heads, whether they are male or female, as they are responsible for making marriage decisions for the girls in the household. Girls themselves have no say in the decision to be married or not. We also focus on household heads since girls who were married off early often live in another region and seldom visit their parental home, so they are not available for interviews. Similarly, we exclude girls who were married into the village from another area since their regions of origin may not have experienced extreme weather events that occurred in the study area.

¹ Based on Ahmed et al. (2010), households' poverty incidence is defined here by sociodemographic and economic indicators such as gender and educational status of a household head, family size, monthly income, income sources, land ownership, and indebtedness.

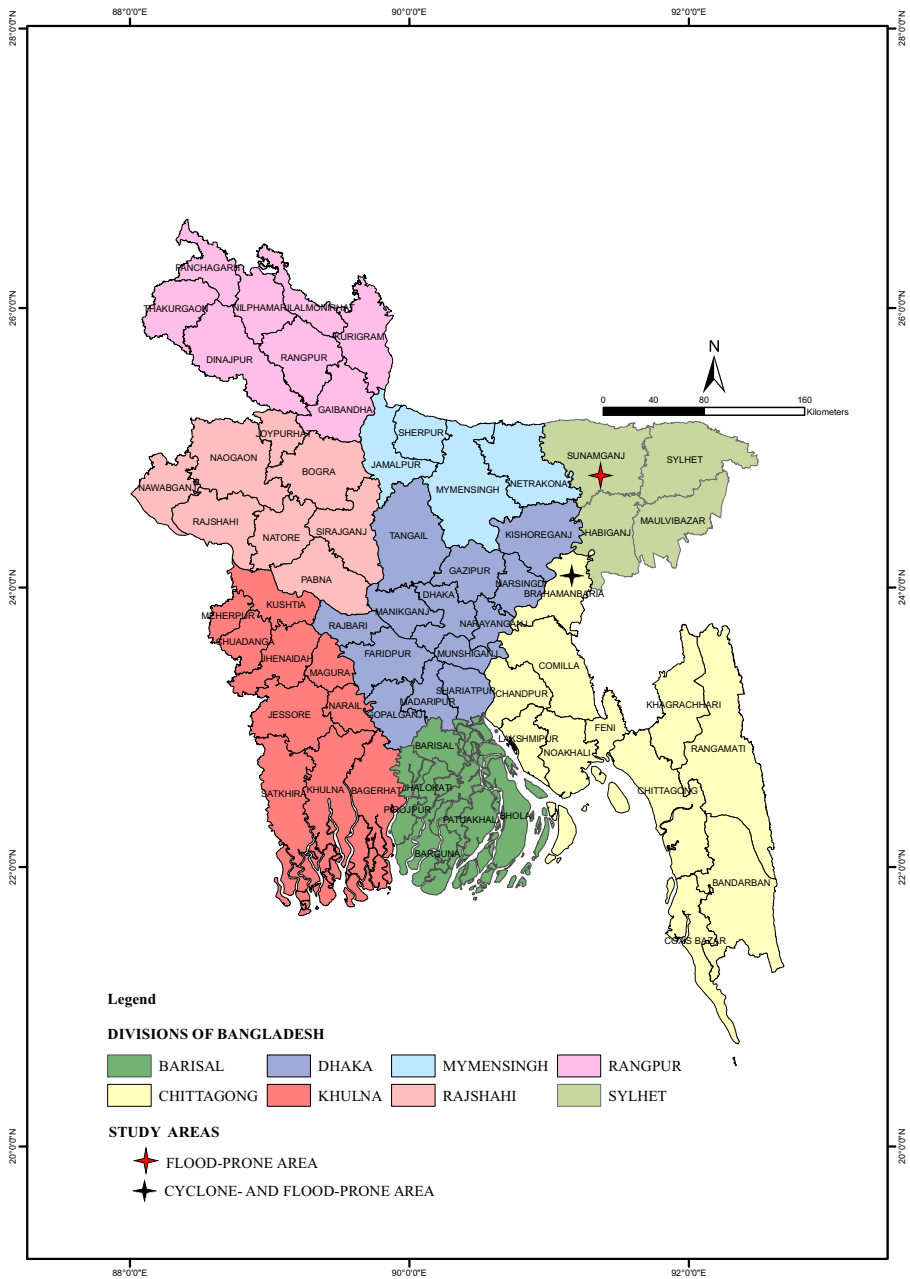


Fig. 1 Map of Bangladesh with the study areas

Data collection

In this mixed-methods research (Teddle and Tashakkori 2009), two types of interview data through a questionnaire and an in-depth interview guide, both written and used in

Table 1 Poverty and early marriage in selected administrative divisions of Bangladesh

Division	Total population ^a	Percentage of poor households ^a	Percentage of women aged 15 to 49 who are ever-married by age 18 ^c
Rajshahi	18,252,001	27.4	81.7
Rangpur	15,482,473	42.0	85.4
Dhaka	45,762,841	30.5	76.9
Khulna	15,445,562	31.9	82.3
Barisal	8,223,589	38.3	81
Chittagong ^b	27,904,587	26.1	72.8
Sylhet ^b	9,784,451	25.1	62.2
Bangladesh	14,08,55,504	30.7	77.7

^a Source: Ahmed et al. (2010)

^b Chandi Village is in Chittagong Division, and Alipur Village is in Sylhet Division

^c Source: Islam et al. (2016a)

Bengali. All data were collected by the lead author, Khandaker Jafor Ahmed, in June to September of 2015. The translated versions of both instruments are presented in [Appendix](#).

First, a short questionnaire was administered to household heads with closed-ended questions about their sociodemographic profile, marriage-related issues, incidences of sexual violence against daughters, and information related to extreme weather events ([Appendix](#)). Heads were informed about the purpose of the research, assured confidentiality of their personal information and responses, and asked permission to record the interview. Though some respondents at first felt wary of the recording, they became eager to speak when we introduced them to the purpose of the study and emphasized that the research had a purely academic aim. Respondents were allowed to decline their participation if they wanted so but all of them did participate to the survey. Each questionnaire took around 20 to 30 min to complete. When a male or female household head was not sure about particular information, such as the household's monthly income or a daughter's age, then the most well-informed person in the household (e.g., brother-/sister-in-law, mother-/father-in-law, son/daughter) was asked to provide that information.

Next, surveyed household heads were identified for an in-depth interview if they met at least one of the following criteria: they had an experience of sexual violence against one of their daughter, they fear sexual violence against their girls, and/or they had at least one daughter unmarried and one married off before 18. In each village, ten male heads and ten female heads were selected purposively for an in-depth interview, thus a total of 40 in-depth interviews. The informed consent procedures were repeated before the interview. Heads were asked to provide details about any sexual violence their daughters may have experienced and their perception of the risk of sexual violence to their daughters. In-depth interviews lasted between 40 and 60 min. Since this is an exploratory study, our data analysis focuses on the interview transcripts. The interview recordings in Bengali were transcribed by local language experts able to translate into English. Translations were then crosschecked and the relevant information summarized by the first two authors (Khandaker Jafor Ahmed and Shah Md. Atiqul Haq).

During the in-depth interviews, some female heads appeared shy when told about the intention to audio-record of the interview but became comfortable with participating after the aims and significance of the study were reiterated. Male heads were difficult to reach as most were working outside village during the fieldwork period. In the course of the in-depth interviews, it was noted that female respondents were very spontaneous and provided more valuable insights about the early marriage of their girls in comparison with male respondents. Their statements were thus found to be very relevant, meaningful, and significant, which explains why in this paper interview excerpts featured in the “Results” sections are mostly from female heads. That women usually give more detailed information than men is often observed in various cultural areas (for example in France, see Kaufmann 1998). In this research, data were collected by the lead author (a male interviewer) with male and female interviewees. We did not analyze the effects of gender (of both interviewer and interviewees) on the quality of data produced, but gender may influence the data quality during the collection process (Broom et al. 2009). During the data analysis though, we tried to situate the data within a gendered approach. In future research on population dynamics and climate change, more attention should be given on gender issues to ensure better data quality and more relevant analysis.

Results

Survey results for the two selected areas

Summary statistics of the sociodemographic characteristics of the household heads and their households are presented in Table 2 for each of the two villages. Households in Alipur, the village prone to flash flooding, are more disadvantaged than those in Chandi, the flood- and cyclone-prone area. This is evident from the higher rate of female headship in Alipur, lower levels of education by heads, and lower monthly incomes. Furthermore, most of the households’ income in Alipur comes from fishing and labor, while in Chandi, households are more likely to earn income from agriculture, labor, or business. In addition, Chandi households are much more likely to own their land than those in Alipur and they are less likely to have taken out a loan. In sum, households in Alipur are more disadvantaged, which may be related to environmental conditions and the risk of extreme weather and flooding. Both villages are vulnerable to extreme weather, although their risks are distinct. Alipur is vulnerable to extreme flash flooding each year during the rainy monsoon (between June and September) and post-monsoon autumn (October and November). During this flooding period, the area surrounding the village turns into a vast inland sea, turning the village into an island and limiting communications and livelihoods because most people are unable to move around without a boat. Similarly, monsoon flooding occurs in Chandi but not to the extent that livelihoods and communications are disrupted. In fact, a destructive cyclone in 2013 killed 36 people, injured thousands, and destroyed many homes in Brahmanbaria, the district including Chandi.

Our expectation that early marriage is a coping mechanism for managing the effects of extreme weather events is consistent with the finding that age at first marriage is younger in Alipur than in Chandi. Table 2 shows that among all married daughters from the surveyed households, more were married before the age of 18 in Alipur (86%, i.e.,

Table 2 Summary statistics from the villages surveyed

Sociodemographic characteristics	Alipur <i>N</i> = 42	Chandi <i>N</i> = 78
Household head		
Male	61.9	83.3
Female	38.1	16.7
Educational level		
Cannot read and write	71.4	35.9
Can read and write	23.8	21.8
Primary	4.8	21.8
Secondary	—	17.9
Higher secondary	—	2.6
Family size (average)	5.81	5.59
Monthly income (in BDT) ^a		
Less than 4000	40.5	11.5
4001 to 6000	31.0	25.7
6001 to 8000	23.7	25.6
More than 8000	4.8	37.2
Income sources		
Agriculture	2.4	38.5
Business	16.7	21.8
Fishing	38.1	10.3
Working others' land	7.1	5.1
Labor	35.7	24.3
Land ownership		
Yes	14.3	51.3
No	85.7	48.7
Took out a loan		
Yes	52.4	26.9
No	47.6	73.1
Age at marriage of brides ^b		
Before 18	86	62
18 and more	14	38
Average age	15.41	16.86
Did any daughter of the household face sexual violence		
Yes	38	15
No	62	85
Does the household head fear sexual violence against daughters?		
Yes	48	28
No	52	72

Source: Field survey, 2015

^a 1 Euro = 102.56 BDT; 1 USD = 83.33 BDT^b Age at marriage of all daughters reported by the surveyed household heads in the studied villages

46 out of 53) than in Chandi (62%, i.e., 58 out of 93). Moreover, 38% household heads from Alipur against 15% in Chandi mentioned that a daughter had faced sexual violence. Similarly, 48% of household heads from Alipur and 28% from Chandi feared sexual violence that their daughter(s) may face.

The next section of the analysis uses the in-depth interviews to explore how household heads make marriage decisions for their daughters to cope with the adverse effects of extreme weather.

Early marriage: a strategy for reducing household expenses

Information obtained from the in-depth interviews indicates that many household heads view having a large family as a burden, especially during extreme weather events, and consider early marriage for their daughters to reduce that burden. The following examples from both villages underscore this point.

In Alipur, a poor male household head reckons that money will be saved after the other daughters are married off. He cannot read or write, lives from day labor that he has to find each day, and his income per month is less than BDT 4000 (below Euro 39/USD 48)); he lives with three married daughters, two of whom married before age 18, and three unmarried daughters aged of 15, 13, and 10 years.

“The more members there are in a family, the greater the expenses are for the household head. Most of the families from our area, regularly affected by floods, suffer during extreme crises due to the lack of work opportunities and to losses and damages caused by the floods. I have to think of our three unmarried daughters. I cannot manage to pay for the expenses that my household requires as I am poor and helpless. If I marry off my daughters, I will be able to save some money and I may be able to buy good food.” (Male, 50, Alipur)

Similarly, a widowed female household head from Alipur suffers from food insecurity due to the effects of extreme flooding. She cannot read or write, lives from day labor, and her income per month is less than BDT 4000—below Euro 39/USD 48. This woman has two daughters aged of 14 and 10 years and she also believes that early marriage can reduce the burden of a large family.

“Oh, my son [*‘bap-re’; to the interviewer, with a long breath*], my family is a large family, and we struggle to manage our daily expenses. We also face extreme floods that destroy our rice production, and our piece of land is small. We suffer from food scarcity as a result of extreme flooding; so, we have to go hungry or reduce our food consumption. If this land and our home are badly affected by floods, we have to go to shelters or to relatives’ homes. Floods make us poor. When these situations worsen, we consider early marriage for our daughters against poverty. With Alipur flooding each year, we suffer if we have more children. If we marry off our daughters, it means we need to feed and clothe less people.” (Female, 50, Alipur)

Another widowed female household head from Alipur said that flooding reduces income from the farm and local employment and therefore leads her household to poverty. In Alipur, fields are flooded from June to November each year and crops (especially rice) are cultivated once a year from November to May under irrigation. If there is flooding earlier than usual, households that solely rely on agriculture lose their crops in the field and thus cannot secure their food and income. This household lost the crops in the field due to an early flood occurred in April 2014 and could not secure

money for the rest of the year by selling any surplus production. Moreover, because the land was flooded, this widowed could not work on the field during that time. Therefore, she sees early marriage of girls as a solution to this situation:

“We cannot work the land due to flooding, and there is a scarcity of employment in our locality. That’s why our income is low. It is difficult for me to manage a family of ten members, including four unmarried daughters. I intend to arrange the marriage of my daughters as early as possible to reduce my burden in maintaining this family.” (Female, 44, Alipur)

Another female household head from Alipur also emphasized early marriage as a mechanism to cope with crisis resulting from extreme weather events. In her household of seven members, one of the three daughters married before age 18 and the two other daughters (ages 14 and 12) are still unmarried. By her day labor and with no formal schooling, this head earns less than BDT 4000 (below Euro 39/USD 48). This female household head says that the girls stop going to school during the flood and stay home with nothing to do, and during this time, marriage proposals arrive frequently. Parents may eventually accept a proposal when it comes during a flood.

“When there is flooding [*April to August*] water surrounds us. People sit around without doing any work. The poor get poorer during this period. Children are also idle at home as many of them, especially girls, stop going to school. To some extent boys and girls help their mother with household chores. However, as the girls are inactive, they receive many marriage proposals. Though we tried to ignore the proposals, as the crisis stretched on, we choose to marry our girls at an early age.” (Female, 41, Alipur)

Parents, especially in vulnerable areas, hope to have more sons than daughters, thinking that sons will support the family during crises brought on by extreme weather events. Parents also wish to marry off their daughters to rich husbands so that the daughters may lead a happy life in the homes of in-laws. Parents also hope to receive support from their son-in-law during hard times following extreme weather events. One female head had four daughters, with two of them married off before 18, and no sons. She preferred that her daughters be married off to a rich family in an area that does not flood, and she emphasizes the potential support, especially during floods, she herself may receive from a well-off son-in-law free from flooding.

“The miseries of the poor just never end. I have no son, just four daughters. Three daughters are married, two of them early. I got my elder married when she was 19. There was no severe flood for a few years, and I could afford to support my family. My youngest daughter is only 14, but I will accept a marriage offer for her from a groom who is able to look after his family well. I cannot provide food, clothing, cosmetics, and education for her. So I prefer for my daughters to be in a rich family in a flood-free area where they will face no crisis. They will lead a happy life if they secure rich husbands. I feel happy when I give my daughters in marriage to a rich family in an area with no floods, as I know they will be in safe place and can lead a happy life after the marriage. Besides, they might help us during our crises.” (Female, 48, Alipur)

The logic of early marriage found in Alipur is also evident in Chandi, a village prone to cyclone-related flooding and damage. Here, for example, a household head said that a large family can bring unhappiness for the head of the family because it is a burden during and after a cyclone. This male household head from Chandi has five daughters, four of whom married before 18 and the last one 15 and unmarried. His monthly income to support the nine people in the household is 5500 BDT (USD 66/Euro 54). When the household head was asked why he married off his girls while they were still under 18, he said:

“I have married off four daughters out of five, with one left to be married. The 2013 cyclone destroyed most of my belongings (house, cattle, furniture, and money) and I have no hope and don’t know what to do. I am dependent on relief provided by the government and NGOs and on financial support from my kith and kin. How many days will I have to depend on them? I am scared about what to do with my youngest unmarried daughter since I cannot provide for her basic needs. If I can marry off all my daughters, then I can reduce my financial burden, and it will reduce my family size as well.” (Male, 55, Chandi)

Another male household head adds that a marriage during or after an extreme weather event costs less because all households suffer from the crisis. This senior male household head from Chandi (monthly income BDT 5000/USD 60/Euro 49, family size of seven, with two unmarried girls and two married before 18) shared his experience:

“We face crises brought about by floods and cyclones, and we lose our crops, sources of income, and work opportunities. We understand that poverty becomes severe during extreme weather events. Having more daughters is burdensome, and we find it more worrisome than having sons. So, we try to find a groom and marry off our daughters at an early age because this is the only way we can transfer our burden. We think that by marrying off our daughters we can save some money to prepare for crises, especially from floods and cyclones. For example, a marriage during a flood or after a cyclone requires less money to be spent because the crisis is generalized in the area. During this crisis, arranging a marriage at a low cost is a means to keep pressure of having a low number of unmarried daughters.” (Male, 65, Chandi)

Summing up, the interviewees emphasize that poverty is exacerbated by extreme weather events that cause severe damage, loss of livelihoods and assets, and reduced job opportunities. Households headed by women, all of whom are widows, and those with more daughters than sons are especially vulnerable. Early marriage for daughters is thus seen as an opportunity to transfer costs to the groom’s family, and if arranged during or after an extreme weather event, the marriage is less expensive because the guests’ expectations for the ceremony are lower since all households are impoverished, suffer, and depend on relief. In addition, some parents living in areas affected by cyclones or flooding expect help from the groom’s family when a crisis occurs.

Early marriage: a safeguard against the daughter's loss of marriageability, especially during extreme weather events

Household heads also reported that their daughters experienced actual or threatened sexual violence in shelters and elsewhere during and after an extreme weather event, prompting them to arrange marriages quickly. They explained that during extreme weather events, especially floods, they sometimes stay with relatives but usually in shelters. With many people forced together in the shelters during flooding, girls face sexual violence in different forms. As earlier explained, parents are fully aware of the negative effect of sexual violence on their family's reputation, and by marrying daughters off, they will preserve it. A female head from Chandi whose girl was subjected to sexual violence did not consider shelter houses safe and secure for younger girls and women.

"One of my girls was so beautiful. She was bothered by boys a lot when she went to school. After the 2013 cyclone we had to take shelter in a shelter camp. I thought that it was not a secure place for my girl with so many people there together. The shelter was not secure for girls. The women and girls from our area are so conservative: they don't leave home without the men, and they wear a veil when they are outside the home. It was really embarrassing having to take a bath and go to the toilet in public. It is difficult for unmarried girls and women to go to a long way to toilet. So I sent my girl to my relatives' home so that she could be in safe surroundings." (Female, 40, Chandi)

Qualitative findings thus highlight the link between sexual violence and early marriage. A female household head lives in a better situation—she runs a small entrepreneurship business (a local grocery shop) and her income is more than BDT 8000 (Euro 78/USD 96) per month—and she described the prevalence of sexual violence and her fear of it:

"As I am a woman, I know how to protect the reputation of my girls. During extreme flooding, we have to take shelter in a primary school where everyone gathers, including men, which restricts the movement of unmarried girls. In the shelter, we have to sleep in rows like in a hospital, which is really embarrassing for the unmarried girls and women. I had to stay awake for the whole night to protect my girls from any kind of violence. A few years ago, during floods when we were in the primary school as a shelter house, my youngest girl was grabbed by a younger man who also regularly followed her when she went to take a bath or to the toilet. And so the longer the flood periods last, the more my worries about the possible sexual violence on my girl increase. Last year, after the flood, I arranged the marriage of my 15-year-old girl, as I had no way of protecting her reputation and that of the family." (Female, 45, Alipur)

The respondents mention that sexual violence happened during extreme flooding, and this influenced the parents to arrange the marriage of their daughters as early as possible. As seen earlier, the incidence of early marriage is higher in Alipur than in Chandi. A mother from Alipur also explains how worries about sexual violence against daughters may lead to the need to marry them off quickly.

“During the 2004 floods, we took shelter in the primary school. There were a lot of people in that small building. Some people spent their whole time in a boat. My family, including my two unmarried girls, had to stay in the school’s corridor. There were also young boys. One of the boys annoyed the eldest of my two unmarried girls. I feared for my unmarried girls. We care about the unmarried girls because we want to protect our girls’ and our family’s reputation. If people find about the sexual violence against my girls, they will blame my girls, and this will eventually discourage marriage proposals. Fearing this, I decided to marry off my girls at an early age.” (Female, 50, Alipur)

Following an extreme weather event, those affected stay together in shelters until conditions improve. In Chandi, after the cyclone in 2013, people had to stay in the shelter for more than 30 days, while in Alipur, they need shelter for 7 to 10 days every year. During floods, most tube wells (water wells, the main drinking water source in Bangladesh) are under water, which contaminates the drinking water and creates an unsafe environment for bathing. In a typical village of Bangladesh, women and girls usually take bath and dress within the round wall of the tube well. If women take bath in a pond or a river, they usually change their dress within the round wall of the tube well. However, they cannot do so when the tube well is under water.

“In our traditional society, unmarried girls feel very shy about having to stay in a shelter alongside young men. During the 2004 floods, when we were staying in a shelter, we had to take baths in an open tube well. My younger girl felt very shy about having to bath there as there was no privacy for getting dressed. I would like to share a story. One of my girls was subjected to sexual violence when she was taking a bath in a tube well that was surrounded by a broken fence. Through the fence a young man watched her taking a bath and changing her clothes. My girl was scared to share this with me or anyone else as she felt shy about it. Since then, she prefers bathing in the darker at night. This is why my unmarried girls fear sexual violence during devastating floods. Having unmarried girls, I feel more vulnerable staying in a shelter. Thus, the occurrence of floods creates a fear of sexual violence that forces parents to pursue the early marriage of their girls.” (Female, 43, Alipur)

In summary, because of extreme weather events such as cyclones and floods, people have to seek shelter in schools and other public buildings, where lack of privacy may prompt sexual violence against girls and young women. Such an experience, or the fear of it, may lead parents to marry off their daughters quickly to protect the reputation of their daughters and of the family.

Concluding discussion

This study was conducted to explore whether households living in areas vulnerable to extreme weather conditions in Bangladesh consider early marriage of girls as a coping strategy against poverty exacerbated by extreme weather events. This study also sought to understand how parents perceive their role of protecting their daughters against potentially threatening situations that can happen during extreme weather events, such

as increased poverty or sexual violence against their daughters, and to what extent parents consider early marriage as a means of protecting their daughters. Two villages were selected as study areas for this mixed-methods research: Alipur, a flash-flood-prone area in Sunamganj district in Bangladesh's northeast, and Chandi, a flood- and cyclone-prone area in Brahmanbaria district, east-central Bangladesh.

Our analysis reveals that the practice of girls' early marriage reduces the economic burden of children, especially in poor households and those headed by women. This is consistent with a great deal of prior research (Dyson and Moore 1983; Mathur et al. 2003; Bajracharya and Amin 2012; Dahl 2010; Hossain and Islam 2013; ICRW 2006; Islam et al. 2016a, b; Jensen and Thornton 2003; Kamal 2011; Maharjan et al. 2012; Otoo-Oyortey and Pobi 2003; Parsons et al. 2015). We add to this literature by showing that the practice of girls' early marriage is used by households in areas affected by flooding and cyclones to manage the economic effects of property loss and income shortages as well as the threat of sexual violence that occurs when families take shelter in public buildings. Our results concur with another study from Bangladesh which concluded that "the marriage of young girls is increasing as a result of climate challenges" (Alston et al. 2014, p. 141). This growing body of evidence suggests that climate change may have greater impacts on women than men.

A limitation of this exploratory study is the focus on only two villages, one of which experiences more severe impacts of extreme weather than the other. Future studies might include more villages that differ in the type and severity of extreme weather events. Such a study could generate more insights about the links between environmental hazards, sexual violence, and girls' early marriage. The main contribution of this study is to specify the ways in which household heads make decisions about their daughters' marriages in order to manage the effects of extreme weather events.

The increasing occurrence of extreme weather events such as flash floods and cyclones due to global warming disproportionately affect poor households in vulnerable areas. It is projected that "up to 325 million extremely poor people will be living in the 49 most hazard-prone countries in 2030," Bangladesh being among the 11 countries (Bangladesh, Democratic Republic of the Congo, Ethiopia, Kenya, Madagascar, Nepal, Nigeria, Pakistan, South Sudan, Sudan, and Uganda) which are "at most risk of disaster-induced poverty" by 2030 (Shepherd et al. 2013, p. 1). Such climate change-related events place greater economic burdens on poor householders, leading them to reduce the number of dependent daughters in their household through early marriage. These events also promote early marriage by creating shelter conditions that increase the risk of sexual violence against women. While extreme weather events cannot be stopped, village leaders (elected chairmen of the respective union or elected member of the respective ward) could attend to the fears of sexual violence against daughters expressed by household heads. They could designate separate shelters with protected toilets and bath areas for women and girls so that they are safe. More challenging is the problem of poverty. However, disaster recovery assistance could go far to compensating households for losses and allowing them to forgo marrying their daughters at young ages.

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Appendix

Survey Questionnaire

Sociodemographic information

1. Gender of the household head: (a) male, (b) female
2. Education of the head:
(a) cannot read and write, (b) can read and write, (c) primary, (d) secondary, (e) higher secondary
3. Number of members in the household:
4. Income (per month) of the household:
5. Income sources:
(a) agriculture, (b) business (small), (c) fishing, (d) working others' land, (e) day labor
6. Land ownership: (a) yes, (b) no
7. Having a loan: (a) yes, (b) no
8. Number of daughters:
9. Number of daughters married:
10. Age of all daughters when they were married:

Daughters	Did she face sexual violence? (a) yes (b) no	Age of daughters when they were married							
12	13	14	15	16	17	18	19	20	20+
1									
2									
3									
4									
5									
6									
7									

11. Do you have a fear that any of your unmarried daughter may face sexual violence in the coming days? (a) yes, (b) no
12. Where do you stay if there is an extreme flood or cyclone?
(a) Shelter house, (b) In house, (c) Others (please specify)

In-depth Interview Guide

1. Gender of the household head: (a) male, (b) female
2. Age:
3. Can you tell me how many daughters, both married and unmarried, you have?
4. How many of them are married?
5. Can you recall the age of their marriage?

(Questions from 1 to 5 were picked up from the information obtained during questionnaire survey. However, these questions were asked again for crosschecking.)

6. How many daughters were married before 18? Why were they married before 18?
7. Can you tell me what are the problems that you and your household faced during the extreme flood or cyclone? Do floods or cyclones happen frequently?
8. We know that this village is vulnerable to regular flash flooding (or cyclones). When there is an extreme flood (or cyclone), do you go to a shelter house with your unmarried daughters? Do you face any troubles with the daughters?

Now, you will be asked a few more questions about the impacts of extreme weather events on your household, when you go to shelter house, the problems faced by your daughters during extreme weather events, and whether and why you preferred an early marriage for your daughters.

Extreme Weather Events and Shelter Houses

- Where do you stay when there is an extreme flood or cyclone? Did/do you go to a shelter house? When did you go?
- What are the reasons to go to a shelter house? Do you find it convenient? What are the drawbacks? Did you or any member of your family face any problem during the stay?

Sexual Violence

- During an extreme weather event, did your daughters face any problem either in your house or in a shelter house? When did it occur?
- In your opinion, where are the daughters safe and free from any abuse?
- How many of your daughters were subjected to sexual violence?
- In your opinion, what factors create an environment conducive to sexual violence? How?
- Did you arrange a marriage for any of your daughter(s) after she had faced sexual violence or due to a fear of sexual violence in future?
- Was it an early marriage? Why?

Early Marriage

- Do you find any challenges before giving off your daughter(s) for an early marriage?

- What are the challenges before giving off your daughter(s) for an early marriage?
- Were there any changes in your household after having your daughters married? What are these changes?
- Are these changes for the better or the worse?
- What was the main reason for your opting for an early marriage for your daughter(s)?
- How do you think that opting for an early marriage for your daughter can affect your family's and daughter's reputation?
- Do you prefer your daughter(s) to be married off into an area not subject to extreme weather events? Why?
- Have you received any support from the bridegroom's family during extreme weather events? What kind? When?
- When and at what age would you prefer your daughter(s) to be married? Why?

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References

- Advancing Public Interest Trust (APIT). (2009). *A study on change in women's life after Sidr—based on a case study—OGB after Sidr 2007 in Bangladesh*. Oxford: Oxfam Great Britain.
- Ahmed, A. U. (1986). Marriage and its transition in Bangladesh. *International Journal of Sociology of the Family*, 16(1), 49–59.
- Ahmed, F., Ahmad, N., Khan, M. A., Jolliffe, D., Mahbub, M. A., Sharif, I., Yoshida, N., Zaidi, S., Swaroop, V., & Zutt, J. (2010). *Poverty maps of Bangladesh 2010 (vol. 2): technical report (English)*. Washington, DC: World Bank Group Retrieved on November 28, 2018 from <http://documents.worldbank.org/curated/en/160611468014459434/Technical-report>.
- Alston, M., Whittenbury, K., Haynes, A., & Godden, N. (2014). Are climate challenges reinforcing child and forced marriage and dowry as adaptation strategies in the context of Bangladesh? *Women's Studies International Forum*, 47, 137–144.
- Amin, S. (1998). Family structure and change in rural Bangladesh. *Population Studies*, 52(2), 201–213.
- Anik, S., & Khan, M. (2012). Climate change adaptation through local knowledge in the north eastern region of Bangladesh. *Mitigation and Adaptation Strategies for Global Change*, 17(8), 879–896.
- Azad, A. K., Hossain, K. M., & Nasreen, M. (2013). Flood-induced vulnerabilities and problems encountered by women in northern Bangladesh. *International Journal of Disaster Risk Science*, 4(4), 190–199.
- Bajracharya, A., & Amin, S. (2012). Poverty, marriage timing, and transitions to adulthood in Nepal. *Studies in Family Planning*, 43(2), 79–92.
- Ballesteros, M. M. (2010). *Linking poverty and the environment: evidence from slums in Philippine cities*. Discussion Paper Series No. 2010-33. Philippine Institute for Development Studies, Makati City, Philippines. Retrieved on November 29, 2018 from <https://dirp4.pids.gov.ph/ris/dps/pidsdps1033.pdf>.
- Bates, L. M., Schuler, S. R., Islam, F., & Islam, K. (2004). Socioeconomic factors and processes associated with domestic violence in rural Bangladesh. *International Family Planning Perspectives*, 30(4), 190–199.
- Bhuiya, A. A., Chowdhury, M. R., Momen, M., & Khatun, M. (2005). Marital disruption: determinants and consequences on the lives of women in a rural area of Bangladesh. *Journal of Health, Population, and Nutrition*, 23(1), 82–94.
- Blaikie, P., Cannon, T., Davis, I., & Wisner, B. (1994). *At risk: natural hazards, people's vulnerability and disasters*. London: Routledge.
- Broom, A., Hand, K., & Tovey, P. (2009). The role of gender, environment and individual biography in shaping qualitative interview data. *International Journal of Social Research Methodology*, 12(1), 51–65. <https://doi.org/10.1080/13645570701606028>.
- Brouwer, R., Akter, S., Brander, L., & Haque, E. (2007). Socioeconomic vulnerability and adaptation to environmental risk: a case study of climate change & flooding in Bangladesh. *Risk Analysis*, 27(2), 313–326.

- Caldwell, J. C., Caldwell, P., Caldwell, K. B., & Pieris, I. (1998). The construction of adolescence in a changing world: implications for sexuality, reproduction and marriage. *Studies in Family Planning*, 29(2), 66–78.
- CARE. (2016). *The cultural context of child marriage in Nepal and Bangladesh: findings from CARE's Tipping Point Project community participatory analysis*. Retrieved on November 28, 2018 from http://www.care.org/sites/default/files/documents/CARE_Tipping_Point_External%20Report_Web.pdf.
- Chowdhury, F. (2009). Theorising patriarchy: the Bangladesh context. *Asia Journal of Social Science*, 37(4), 599–622.
- Chowdhury, F. D. (2010). Dowry, women and law in Bangladesh. *International Journal of Law Policy and the Family*, 24(2), 198–221.
- Dahl, G. B. (2010). Early teen marriage and future poverty. *Demography*, 47(3), 689–718.
- Dasgupta, S., Şiriner, İ., & De, P. S. (2010). *Women's encounter with disaster*. India: Frontpage Publications Ltd..
- De Haen, H., & Hemrich, G. (2007). The economics of natural disasters: implications and challenges for food security. *Agricultural Economics*, 37(1), 31–45.
- Dyson, T., & Moore, M. (1983). On kinship structure, female autonomy, and demographic behavior in India. *Population and Development Review*, 9(1), 35–60.
- Ezra, M. (2001). Demographic responses to environmental stress in drought- and famine-prone areas of Northern Ethiopia. *International Journal of Population Geography*, 7(4), 259–279.
- Farouk, S. A. (2005). *Violence against women: a statistical overview, challenges and gaps in data collection and methodology and approaches for overcoming them*. Switzerland: UN Division for the Advancement of Women Retrieved on November 28, 2018 <http://www.un.org/womenwatch/daw/egm/vaw-stat-2005/docs/expert-papers/Farouk.pdf>.
- Felten-Bierman, C. (2006). Gender and natural disaster: sexualized violence and the tsunami. *Development*, 49(3), 82–86.
- Ferdousi, N. (2014). Child marriage in Bangladesh: socio-legal analysis. *International Journal of Sociology and Anthropology*, 6(1), 1–7.
- Fordham, H. M. (1998). Making women visible in disasters: problematising the private domain. *Disasters*, 22(2), 126–143.
- Geirbo, H. C., & Imam, N. (2006). *The motivations behind giving and taking dowry*. BRAC Research Monograph Series, No. 28. Dhaka: BRAC Research and Evaluation Division. Retrieved on November 28, 2018 http://research.brac.net/monographs/Monograph_Series_28.pdf.
- Godha, D., Hotchkiss, D. R., & Gage, A. J. (2013). Association between child marriage and reproductive health outcomes and service utilization: a multi-country study from South Asia. *The Journal of Adolescent Health*, 52(5), 552–558.
- Greiving, S., Fleischhauer, F., & Luckenkotter, J. (2006). Methodology for an integrated risk assessment of spatially relevant hazards. *Journal of Environmental Planning and Management*, 49(1), 1–19.
- Haq, S. M. A. (2018). Underlying causes and the impacts of disaster events (floods) on fertility decision in rural Bangladesh. *Environmental & Socio-economic Studies*, 6(3), 24–35. <https://doi.org/10.2478/environ-2018-0020>.
- Haq, S. M. A., & Ahmed, K. J. (2017). Does the perception of climate change vary with the socio-demographic dimensions? A study on vulnerable populations in Bangladesh. *Natural Hazards*, 83(3), 1759–1785.
- Haque, A. H. M. F., Rahman, M. N., Khan, A. Z., Mukti, I. J., & Lutfunnahar, B. (2014). Knowledge, approach and status of early marriage in Bangladesh. *Science Journal of Public Health*, 2(3), 165–168.
- Hayashi, T., & Yamane, Y. (2010). Meteorological characteristics of tornadoes in Bangladesh. Retrieved on November 28, 2018 from http://www.iawe.org/WRDRR_Bangladesh/Preprints/S3Hayashi-Yamane.pdf.
- Hoq, M. N. (2013). Regional differentials of age at first marriage among women in Bangladesh. *Asian Journal of Applied Science and Engineering*, 2(2), 76–83.
- Hossain, M., & Islam, R. (2013). Effects of socio-economic and demographic variables on age at first marriage in Bangladesh. *Current Research Journal of Biological Sciences*, 5(4), 149–152.
- Hossain, M. G., Mahumud, R. A., & Saw, A. (2016). Prevalence of child marriage among Bangladeshi women and trend of change over time. *Journal of Biosocial Science*, 48(4), 530–538.
- ICRW. (2006). *Child marriage and poverty*. Washington DC: ICRW Retrieved on November 28, 2018 from <https://www.icrw.org/files/images/Child-Marriage-Fact-Sheet-Poverty.pdf>.
- Islam, M. N. (2014). *An introduction to research methods*. Bangladesh: Book World.
- Islam, M. K., Haque, M. R., & Hossain, M. B. (2016a). Regional variations in child marriage in Bangladesh. *Journal of Biosocial Science*, 48(5), 694–708.
- Islam, M. M., Islam, M. K., Hasan, M. S., & Haque, M. A. (2016b). Marriage before 16 or 18 years: the effect of marital age on women's educational attainment in Bangladesh. *Journal of Population and Social Studies*, 24(1), 117–132.

- Jensen, R., & Thornton, R. (2003). Early female marriage in the developing world. *Gender and Development*, 11(2), 9–19.
- Kabeer, N. (2011). Between affiliation and autonomy: navigating pathways of women's empowerment and gender justice in rural Bangladesh. *Development and Change*, 42(2), 499–528.
- Kamal, S. M. M. (2011). Socio-economic determinants of age at first marriage of the ethnic tribal women in Bangladesh. *Asian Population Studies*, 7(1), 69–84.
- Kamal, S. M. M., Hassan, C. H., Alam, G. M., & Ying, Y. (2014). Child marriage in Bangladesh: trends and determinants. *Journal of Biosocial Science*, 47(1), 120–139.
- Kamruzzaman, M., & Shaw, R. (2018). Flood and sustainable agriculture in the Haor basin of Bangladesh: a review paper. *Universal Journal of Agricultural Research*, 6(1), 40–49.
- Kaufmann, J.-C. (1998). *Dirty linen: couples and their laundry*, Middlesex University Press (Material Culture Series).
- Krug, E. G., Dahlberg, L. L., Mercy, J. A., Zwi, A. B., & Lozano, R. (2002). *World report on violence and health*. Geneva: World Health Organization.
- Kümbetoğlu, F. B., & User, I. (2010). Gender aspects of the disaster recovery process. In S. Dasgupta, İ. Şiriner, & P. De Sarathi (Eds.), *Women's encounter with disaster* (pp. 22–51). London: Frontpage Publications Limited.
- Lindell, M. K., & Perry, R. W. (2004). *Communicating environmental risk in multiethnic communities*. Thousand Oaks: Sage Publications, Inc..
- Maharjan, R. K., Karki, K. B., Shaky, T. M., & Aryal, B. (2012). *Child marriage in Nepal: A research report*. Kathmandu: Plan Nepal, Save the Children Nepal, and World Vision Nepal Retrieved on November 28, 2018 from https://resourcecentre.savethechildren.se/node/8239/pdf/child_marriage_research_report_final.pdf.
- Malhotra, A. (2010). *The causes, consequences and solutions to forced child marriage in the developing world*. Washington, DC: International Center for Research on Women Retrieved on November 28, 2018 from <https://www.icrw.org/files/images/Causes-Consequences-and%20Solutions-to-Forced-Child-Marriage-Anju-Malhotra-7-15-2010.pdf>.
- Mathur, S., Greene, M., & Malhotra, A. (2003). *Too young to wed: The lives, rights and health of young married girls*. Washington, DC: International Center for Research on Women (ICRW) Retrieved on November 29, 2018 from <https://www.issuelab.org/resources/11421/11421.pdf>.
- Mehta, M. (2007). *Gender matters: Lessons for disaster risk reduction in South Asia*. Kathmandu: International Centre for Integrated Mountain Development (ICIMOD) Retrieved on November 29, 2018 from https://www.preventionweb.net/files/2406_GenderandDisasters.pdf.
- Nasreen, M. (1998). *Women in disaster: An analysis of division of labor and survival strategies in disaster*. Dhaka: Academic Publishers.
- Nasreen, M. (2008). *Violence Against Women during flood and post-flood situations in Bangladesh*. Dhaka: Action Aid, Bangladesh.
- National Institute of Population Research and Training (NIPORT), Mitra and Associates, and Macro International. (2016). *Bangladesh demographic and health survey 2014*. Calverton: NIPORT, Mitra and Associates, and Macro International Retrieved on November 28, 2018 from <http://www.dghs.gov.bd/index.php/en/home/1365-the-preliminary-report-on-the-bangladesh-demographic-health-survey-2014>.
- Otoo-Oyortey, N., & Pobi, S. (2003). Early marriage and poverty: exploring links and key policy issues. *Gender and Development*, 11(2), 42–51.
- Oxfam. (2005). *The tsunami's impact on women*. Oxfam briefing note, March. Retrieved on November 28, 2018 from <https://www.oxfam.org/sites/www.oxfam.org/files/women.pdf>.
- Parsons, J., Edmeades, J., Kes, A., Petroni, S., Sexton, M., & Wodon, Q. (2015). Economic impacts of child marriage: a review of the literature. *The Review of Faith & International Affairs*, 13(3), 12–22.
- Peduzzi, P., Dao, H., Harold, C., & Mouton, F. (2009). Assessing global exposure and vulnerability towards natural hazards: the disaster risk index. *Natural Hazards and Earth System Sciences*, 9(4), 1149–1159.
- Philip, D., & Rayhan, M. I. (2004). *Vulnerability and poverty: What are the causes and how are they related?* Bonn: Center for Development Research, University of Bonn, Germany Retrieved on November 28, 2018 from http://www.zef.de/fileadmin/downloads/forum/docprog/Tempapers/2004_3a_Philip_Rayan.pdf.
- Plan International. (2011). *Weathering the storm: Adolescent girls and climate change*. London: Plan International Retrieved on 29 November, 2018 from <http://www.ungei.org/files/weatherTheStorm.pdf>.
- Rashid, S. F., & Michaud, S. (2000). Female adolescents and their sexuality: notions of honour, shame, purity and pollution during the floods. *Disasters*, 24(1), 54–70.
- Schuler, S. R., Bates, L. M., Islam, F., & Islam, K. (2006). The timing of marriage and childbearing among rural families in Bangladesh: choosing between competing risks. *Social Science & Medicine*, 62(11), 2826–2837.
- Shepherd, A., Mitchell, T., Lewis, K., Lenhardt, A., Jones, L., Scott, L., & Muir-Wood, R. (2013). *Executive summary: The geography of poverty, disasters and climate extremes in 2030*. London: ODI Retrieved on

- November 29, 2018 from <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8634.pdf>.
- Siddiqui, M. R., & Hossain, T. (2013). Geographical characteristics and the components at risk of tornado in rural Bangladesh: a case study of Brahmanbaria tornado. *Journal of Geography and Natural Disasters*, 3(2), 1–4.
- Streatfield, P. K., Kamal, N., Ahsan, K. Z., & Nahar, Q. (2015). Early marriage in Bangladesh: not as early as it appears. *Asian Population Studies*, 11(1), 94–110.
- Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative techniques in the social and behavioral sciences*. Los Angeles: Sage.
- UNDP. (2004). *Reducing disaster risk: a challenge for development*. A Global Report. New York: United Nations Development Programme (UNDP). Retrieved on November 29, 2018 from http://www.undp.org/content/dam/undp/library/crisis%20prevention/disaster/asia_pacific/Reducing%20Disaster%20risk%20a%20Challenge%20for%20development.pdf.
- UNICEF. (2001). *Early marriage: child spouses*. Retrieved on 28 November, 2018 from <https://www.unicef-irc.org/publications/pdf/digest7e.pdf>.
- UNICEF. (2011). *The state of world's children 2011: adolescence*. New York: UNICEF.
- Urama, N. E., Eboh, E. C., & Onyekuru, A. (2017). Impact of extreme climate events on poverty in Nigeria: a case of the 2012 flood. Published online September 22, 2017. *Climate and Development*. <https://doi.org/10.1080/17565529.2017.1372267>.
- Van der Geest, K., & Warner, K. (2015). Vulnerability, coping and loss and damage from climate events. In J. F. Shroder, A. E. Collins, S. Jones, B. Manyena, & J. Jayawickrama (Eds.), *Hazards, risks and disasters in society* (pp. 121–144). Boston: Academic Press.
- Verma, R., Sinha, T., & Khanna, T. (2013). *Asia Child Marriage Initiative: Summary of research findings in Bangladesh, India and Nepal*. New Delhi: Plan Asia Regional Office Retrieved on November 28, 2018 from <https://www.icrw.org/wp-content/uploads/2016/10/PLAN-ASIA-Child-Marriage-3-Country-Study.pdf>.
- World Vision UK. (2013). *Untying the knot: Exploring early marriage in fragile states*. Milton Keynes: World Vision UK Retrieved on November 28, 2018 from http://0c43c196086d41d35679-60e8a72e2d60353e590e84e3562c2b51.r53.cf3.rackcdn.com/files/7613/7164/5845/UNTYING_THE_KNOT_-_March_2013.pdf.
- Yamane, Y., Hayashi, T., Dewan, A. M., & Akter, F. (2010). Severe local convective storms in Bangladesh: Part I. Climatology. *Atmospheric Research*, 95(4), 400–406.
- Zaman, H. (1999). Violence against women in Bangladesh: issues and responses. *Women's Studies International Forum*, 22(1), 37–48.

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