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“We are feeling older than our age”: Vulnerability and adaptive strategies of aging people to cyclones in coastal Bangladesh

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Abstract

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Abstract: Bangladesh has been affected by the adverse impact of natural hazards such as cyclones, floods, erosion, salinity intrusion, and so on due to the changes in global climate variability. Among the environmental stressors, tropical cyclones frequently impact the coastal people of Bangladesh. This paper details a study on the vulnerability and adaptation strategies of older people in the face of cyclones in a coastal location in Bangladesh using qualitative strategy of enquiry. Field data have been collected through 32 semi-structured interviews, three focus group discussions, and three oral history in three selected villages (Lebubunia, Gabura and Dumuria) in the study area. In this research, we argue that the aged are more affected compared to an adult in a cyclone. Findings show that due to their fewer assets and dependency on young adult family members, older people experience high vulnerability in cyclone landfall. Moreover, their lesser physical strength and weakening mental capacity make them vulnerable. In the absence of appropriate essential initiatives—lack of social awareness, training, limited access to health facilities—vulnerability borders on the extreme. Often the elderly are deprived of proper sanitation and hygiene facilities, food security, and family care and support. Many also lack access to government income support. To increase older persons' adaptability to cyclone disasters, all levels of society need to pay them special attention. This necessitates government institutions, NGOs and other stakeholders working collectively to reduce the risk to and vulnerability of the aged to cyclones. An older people's agenda framework also needs to be created.

Key Words: Older People, Cyclone, Vulnerability, Assets, Adaptation, Coastal Area

1. Introduction

Globally, the vulnerability to climatic disaster because of global environmental change is critically visible in different sectors and groups [1-3]. Among the major changes that is expected to take place by global environmental change is the intensity of cyclones [4]. Cyclones are already one of the deadliest natural hazards to which the coastal people in the less developed and developing countries are particularly vulnerable [5, 6]. They regularly hit countries such as Bangladesh, India, Philippines, China, and Vietnam, with an enormous impact on lives and livelihoods because of the very high population density along the coastlines of these nations and the dependency of coastal inhabitants on those areas for their livelihood [2, 6-10]. Climate variability change is expected to increase the frequency and intensity of such events, resulting in even greater impact on already vulnerable populations. In the population pyramid, the elderly as well as children are more susceptible to impacts in comparison to young adults [11, 12]. A change in the population pyramid to a larger proportion of aged (as is occurring, see further below) provides additional challenges.

Over recent decades, when compared among the countries of the global south, Bangladesh has experienced a significant number of climatic events (e.g. experienced around 50 cyclones in the last five decades [13-15]) due to its location on the Bay of Bengal, the effects of which have been worsened by its funnel-shaped deltaic coastal landscape [16-18]. Many extreme climatic events have created devastating situations across the country [19-22]. Different forms of climate change effects, such as inconsistent rainfall, frequent and high magnitude floods, droughts, and tropical cyclones, are experienced throughout the country [21, 23, 24] but, notably, the coastal areas are most susceptible to severe tropical storms referred to as tropical cyclones [19, 24]. From 1990 to 2009, Bangladesh witnessed several deadly cyclones, which resulted in the deaths of 150,000 people and displaced a vast number of people [24] while an earlier cyclone (1970) resulted in an estimated 250,000 (official) to 500,000 (unofficial) deaths [25].

Over the last five decades, the coastal people of Bangladesh have been affected by several significant cyclones, including *Bhola* (11 November 1970), *Bangladesh* (29 April 1991), *Sidr* (15 November 2007), *Rashmi* (27 October 2008), and *Aila* (26 May 2009) [24, 26]. About 40% of the total global storm surges are recorded in Bangladesh, and the deadliest cyclones in the past 50 years to 2011, in terms of deaths and casualties, are those that have struck Bangladesh [27, 28] . More recent cyclones have included *Roanu* (21 May 2016) with at least 24 dead and 500,000 affected [29], *Mora* (30 May 2017) with over 50,000 houses damaged or destroyed, rendering a quarter of a million people without shelter [30] and *Bulbul* (13 November 2019) where it was reported that 17 lives were lost and over 2 million people were displaced into 5,500 cyclone shelters across 14 districts [31].

Coastal people usually depend on agriculture, salt farming, fishing, and forestry resources to secure their livelihood [19, 21]. Tropical cyclones and storms bring massive devastation (e.g. According to world bank estimation US $1.7 billion losses caused by cyclone Sidr [32]) to the lives and livelihoods of coastal inhabitants by affecting their sources of income [18, 24]. In addition, health, education, social institutions and other physical resources are also damaged due to these climatic challenges [16, 20]. Cyclone impacts are visible in all sectors of the coastal area life, including agriculture, drinking water supplies and access, natural resources, health and sanitation [18, 33]. Furthermore, the vulnerability of people residing in the coastal belt is higher due to their limited capacity to deal with such events due to factors such as low income or dependency on their son or daughter, lack of social awareness and training, limited access to health facilities and so forth [34]. Among the coastal people, the impacts are not the same for all persons; children, adults with disabilities, women and older people are particularly vulnerable to cyclone impacts [17, 35], and it has been noted that those who are less able to battle the consequences of disaster become more vulnerable [36]. An analysis of vulnerability among those in the different age groups is a pre-requisite for building the resilience of individuals, groups or communities who are seriously exposed to climate change induced disasters.

Aging people living on the Bangladeshi coast are particularly vulnerable due to their lower mobility, and economic and cultural dependency on their children [37, 38]. Specific normative changes are associated with the aging community unlike other members of the total population. Older adults face higher risks, and they are more likely to be affected throughout all stages of a disaster [39]. In the calamitous situation brought by a cyclone, older persons face certain losses both physical (or material) and emotional. Losses include the death of beloved family members, who are their dearest ones and on whom they often depend, as well as the loss of their property and so on [16, 38, 39]. Aging people also experienced additional damage, such as the loss of culture and friendships through death and dislocation [40]. Loss of culture includes the loss of traditional practice and ways of living. Moreover, the culture and cultural duties/roles and experiences of individual older persons are inextricably entwined with their family members, relatives, friends, neighbors, and with belonging to a community [41]. These duties and roles help form their sense of personal identity and meaning. The loss of any of the above-mentioned components can be considered personal loss and also contribute to cultural loss within the family and the broader community [42]. For instance, when (due to a cyclone) an older adult loses a neighbor or childhood friend who is linked to their regular life activities then it impacts their emotions and daily life practice. The more such people are affected (and the greater the number affected), the broader the community impacts and the higher the risk of cultural disruption at both family and community level as older persons are a valuable reservoir of traditional cultural knowledge and practices which might otherwise be utilized to strengthen the community [41, 42].

Physically, older people might struggle to move to many places owing to age-related complications, such as frailty or physical disability. Moreover, inadequate financial resources also decrease their mobility. Deteriorating physical and financial circumstances render them increasingly dependent as they age. Additionally, older persons have a very limited social circle, usually consisting of a few

friends and relatives [43], upon whom they can call in an emergency. These factors, as well as older persons' psychological condition (which may involve depression, and/or greater attitude of acceptance of disaster as 'fate' or Divine Will or the Will of Allah rather than something to be fought) and other undefined causes may reduce their ability (and willingness) to evacuate prior to a cyclone's landfall and imperil their post-cyclone recovery [44]. Hence older persons are extremely vulnerable when a disaster strikes.

Older adults are defined by their age [37]. In Bangladesh, generally, people aged above 60 are regarded as 'old' or 'aged'. Evidence shows that the number of older adults is increasing every year. According to the population census held in 1974, a total of 1,682,629 people were aged between 60 and 64 years; by 2011 this figure was 3,218,974 [45]. Aged people require an array of essential supports (food, shelter, and daily care that generally increases with age and infirmity); usually only the family can provide such intensive support [22, 26]. In general, Bangladesh has social norms and values which align with people's religious views and culture. Bangladeshi norms dictate that the family has a mandatory obligation to take care of their older members [37, 46]. However, with the passage of time, family and kinship bonds are weakening owing to social transformation, extreme poverty, degradation of social and religious ethics, and the adoption of western (less family-centric) practices [40, 47].

Improvement in the health care system, education, social support sectors and an increase in per capita income have contributed to a rise in the average life expectancy of Bangladeshis from 47 in 1971 to 72 in 2017 [48-51]. It was further anticipated to rise to 75 by 2019 [26]. Hence older people continue to grow in number. The overall population continues to increase at about 1.4% per annum (2011 census) but the population profile is changing. The rate of increase in number of the aging persons has risen from 1.6 per cent in 1950–1955 to 2.9 per cent in 2000–2005 and it has been estimated that this will further increase to 3.1 per cent by 2045–2050 [26]. Rising living standards (including higher income and access to better health care) will continue to contribute to increasing longevity, the rising number of aged and their increasing proportion in the country's population profile. In 2010, one in 10 people was elderly; by 2050, approximately one in 5 will be elderly [26]. Bangladesh will struggle with the massive challenge of meeting the needs of older people [19]. As in the developed western economies, at the individual family level there will increasingly be fewer family members to share the responsibility (and cost) of caring for aging relatives, while—at a national level—as the proportion of wage earners in the overall population falls, income tax and other government receipts may not match the projected need for Aged Allowances to assist in the care of, and provide income for, the elderly.

In Bangladesh, aged people remain heavily dependent upon their families. In times of disaster, older persons are usually looked after by their family. However, although they may get considerable attention during the disaster period, they can sometimes be victims of ignorance and neglect. Their requirements need to be considered in planning for disasters, the actual events themselves and their aftermath. Therefore, older people require particular attention from government and non-government organizations because they are less active socially and, unlike younger and middle-aged adults, they have fewer economic and physical resources (which makes them especially vulnerable).

The scale of vulnerability is related to the extent of the existence and use of successful adaptive strategies exist—greater the vulnerability indicates less adaptive capacity. Therefore, when assessing the cyclonic vulnerability of older people, older people's adaptive strategies to cyclones need to be identified and factors that inhibit the adoption of proven strategies also assessed. The coastal people of Bangladesh have had a long history of being affected by cyclones, therefore, in order to cope with cyclones and recover from the losses sustained by their impacts, a range of local level adaptation and recovery strategies have been introduced and followed at an individual, household and community level [1, 52]. Despite the increase in the frequency of cyclones on the

Bangladeshi coast and the area's relative inadequate capacity to cope, recover and build resilience, the rate of loss of lives and damage when compared to the previous cyclones has been decreasing due to several successful initiatives [8, 18, 24, 53]. These include the existence of higher quality weather forecasting, better communication, the adoption of warning systems, the use of volunteers to assist evacuations, the construction of cyclone shelters, and research into flooding prevention and mitigation strategies (although these can suffer from less than optimal implementation) [1, 18, 28]. Although, like other adults, older adults respond to cyclones in their own ways [45, 54], it can be observed that older people usually try to maintain their relationships with other adult family members, neighbors, friends and relatives active by various means [16, 36, 43, 55]. Some of them also migrate to urban areas to live with their sons or daughters [37, 43, 45, 56], where incomes are less reliant on coastal livelihood activities and homes less affected by cyclonic activity. Moreover, governments are increasing the budget for older people to help secure their normal life [57].

Coastal peoples of the world are affected by climate-induced disasters such as cyclones, storm surges, and salinity intrusion [22, 34]. Climate scientists predict that their frequency and magnitude (and consequent losses) will increase over time due to the changes in atmospheric phenomena [4, 58]. The countries of the global south, especially developing and less developed countries, have suffered more because of their limited ability to deal with the effects of disasters [4, 35]. Disaster events affect the socio-economic characteristics of people living in the coastal belt, and the more severe and frequent such events, the greater the effects [21]. Among the different vulnerable groups that have been identified and focused on for the provision of specialized care and support by NGOs and donors are women, children and the disabled. However, the plight of older people is less recognized, though they are no less vulnerable than the groups mentioned. In some cases, they are in such a position that they require priority. In an assessment of the vulnerability of older people, it is necessary to explore the ways in which older people become vulnerable; to what extent they are vulnerable and what adaptation strategies have been taken to reduce their risk in the face of cyclones. In this paper, we particularly focused on the vulnerability and adaptation of aging people of a coastal community to cyclones.

2. Theoretical Background

The term vulnerability is used in different disciplines including ecology, psychology, sociology, gerontology, economics, geography, natural hazard and disaster studies etc. There is a debate across different disciplines in terms of the concept of vulnerability and its definition [58-65]. Vulnerability is discussed in many areas like livelihoods, land cover change, security, poverty, economic development, disaster risk reduction and, of course, climate change [35, 66-68]. Hence, many of the discrepancies in the meanings for vulnerability arise from the different epistemological approaches and methodological practices adopted in various fields [59, 60, 62]. In addition, there is remarkable variation in the choice of events (e.g., climatic, human, technological), the scale (global vs local, coastline vs administrative units), and in the region studied (developing vs. developed)[69, 70].

Vulnerability is the sum total of characteristics of people (and the event) that can account for the different impact on persons of a disaster of the same magnitude [71]. The impact might be injuries, property loss, and disturbance of social and business activities [72]. In this direction, social scientists have made it their task to operationalize the concept of vulnerability as an explanation, a description, and for measurement [62, 73, 74]. They have categorized vulnerability into three principal divisions according to the following criteria: Firstly, that which is due to an unequal exposure to ultimate natural calamities; secondly, as that which is due to the social impact status of hazards and disasters; and thirdly, as that which is due to the integration of potential exposures and societal resilience with a specific focus on places or regions [34, 59, 75]. Socio-demographic characteristics, political and social power structure, access to property and social services shape the vulnerability of people [34]. Age, sex, culture, marital status, ethnicity, language barriers are the much-discussed demographic

factors of vulnerability worldwide [76]. Family structure, income, education, access to land and property, membership of social and political networks are also mentioned as indicators of vulnerability in a wide variety of vulnerability studies [52, 77]. Most of the vulnerability assessment used quantitative approaches including inductive, deductive and data driven approaches [78, 79]. The major disadvantages of quantitative approaches used in vulnerability assessment is the over-generalization of the variables used as part of the indicators and factors and the omission of so many issues related to the characteristics of the people in relation to vulnerability [80]. Qualitative approaches to vulnerability assessment are able to fill the gap in quantitative approaches as they are participatory and consider the stakeholders directly involved in disaster risk reduction processes [81].

Vulnerability can be reduced by adopting appropriate adaptation measures. An inverse relationship is found between vulnerability and adaptation (often referred to as 'capacity') in most vulnerability assessment [15]. People having the highest adaptive capacity form the least vulnerable group and those with the least adaptive capacity form the most vulnerable group. We considered a specific age group (older persons) of the coastal people to assess their vulnerability to cyclone. The adaptive capacity is hazard specific. The characteristics of the cyclone hazard shape the adaptive capacity of coastal people. The destructive characteristics of cyclone hazard are the high wind speed and height of the storm surge water that have direct and indirect impacts on lives and livelihood of coastal people. The direct impacts include death from injuries sustained from sharp-edged building materials (i.e., metal sheets), branches of trees, or drowning due to inundation by storm surge affected waters etc. while a person is being evacuated to shelter [32]. The indirect impacts include loss of livelihood, mental stress, reduction in income etc. The nature and extent of both types of impacts are directly related to the age of the people impacted by the cyclone. The child and old people are more susceptible to the impact of cyclone as they are physically dependent to others for their evacuation before a disaster hits, survival during the disaster and recovery in the post-disaster phase. Their financial dependence and inability to sustain themselves independent of others also renders them more economically and physically vulnerable as they cannot purchase assistance, food, or shelter at the time of the emergency or subsequently. They are placed at the mercy of others' generosity.

3. Methods

To document the in-depth understanding of older people's experience with cyclones, and their attempts at responding to cyclones and the threat of cyclones, a qualitative research design was chosen. Choosing qualitative research design was allowed us to engage older community members who are differentially vulnerable to cyclones, and to discover the strategies they adopt for adaptation and the constraints of the adaptation process. To this end, semi-structured interviews and focus group discussions were the prime data collection techniques (Table 1). The figure 1 depicts the methodological flow chat of this study. The semi-structured interview focused on exploring the individual's experience of cyclones, their perception regarding early warning, and how the cyclone landfalls damage their assets and worsen their situation, making them even more vulnerable. In addition, from the focus group discussion (FGD), we gathered data regarding adaptation strategies that people usually adopt to reduce their vulnerability and on the challenges of adaptation strategies. Because of the participatory nature of FGD, participants could challenge each other and explain themselves [82, 83]. This helps in the assessment of the disparity of their views and opinions. Furthermore, three oral histories were recorded to help researchers visualize the scenario of cyclone landfalls that older people had faced in their lifetimes and could face again. The secondary literature related to vulnerability, disaster, climate change, and older people's status in the face of the catastrophe was reviewed.

Figure 1: A methodological flow chart that indicates the qualitative research design including data collection tools and how the data mining and analyzing for this research.

3.1. The location of the study

The research was conducted in a coastal union of Bangladesh. The Gabura Union (Figure 2) is located beside the mangrove forest 'Sundarbans' in the Shyamnagar sub-district of the Satkhira District. The Union is bounded by Sundarbans mangrove forest on two of its sides. Two rivers flow around the study area: Kopataska River flows on the north-west side and Kholpetua River streams along the south-east side. The total population of this Union is 31,115, and population density is 1137 per square kilometer [84]. Of the total population, 6.26% of the population is aged 60 and over (60+) years. [84]. The last population census (2011) shows around 96% population are Muslim, followed by 4% who are Hindu [85]. Pond sands filtering (PSF), rainwater harvesting, tube wells and some sweet water ponds are the sources of drinking water. According to the 2011 population census, only 21.62% people have hygienic latrines while 18.15 per cent of people have no structural sanitation system [85]. People of the villages mostly depend on fishing and collecting resources from the mangrove forest to secure their livelihoods. The major economic activities are the collection of forest resources (e.g. log collecting, honey harvesting), crab fattening, shrimp farming, agricultural laboring, and catching fish from the river. After consultation with local administrators and NGO officials, and based on the secondary data, three of the Union's nine wards were selected for data collection. From the three wards, three villages (namely Gabura, Lebubunia and Dumuria) were selected by following purposive sampling. At least one side of each village is bounded by the Kapotakshi or Kholpetua Rivers which meet below Persemari. The villages located near each river are reported to be more vulnerable due to storm surges that occur when cyclones make landfall.

Figure 2: (A) Map of the study area and location of surveyed villages with older participants. It also shows the location of community clinics, rural markets, cyclone shelters, union parisad (lowest level of local government body). The insert map (B) shows the location of Bangladesh with three sides, east, west, and north bordered by India, a short border with Myanmar in the southeast, and the south bordered by Bay of Bengal where the District location (Satkhira District) of the study area is located (colored red). The green color in the insert map (c) indicates the sub-district location (Shyamnagar) of the study area. The insert map (D) demonstrates the location of the study area (Gabura Union) in the Shymnagar sub-district (colored red).

3.2. Research participants and sampling

Older people were our main research participants for the semi-structured interviews; however, a few key stakeholders (such as school-teachers, NGO officials, local state executives, a community health care provider, and a social worker) were also interviewed. For FGD, members of the Gabura Union Disaster Management Committee also participated, along with older people and young adults. In Bangladesh, the retirement age for those in government employment is 59, except for a few positions (for example, High Court judges, university lecturers, scientists). In accordance with that, we considered someone 'older' as one whose age was 60 or above.

For the selection of older people and key persons for a semi-structured interview, a purposive sampling was used. We followed some pre-set criteria to choose the older participants. First, they should have been affected by at least one cyclone event. Secondly, they should be able to give consent. Thirdly, some of the participants should have young adult children. For FGD participants, we conducted three discussions—one with the Gabura Union Disaster Management Committee members, the second with older people, and the third one with other adults (less than 60 years of age). In addition, three oral stories were selected from among interview participants after their participation in the semi-structured interviews.

3.3. Field data collection

The data was collected over three months. Of the 32 semi-structured interview participants, 24 older participants were taken from three selected villages (Lebubunia, Gabura and Dumuria) of Gabura Union. From each village, eight older people were chosen according to the criteria mentioned in the sampling section (see 3.2). Primary information regarding participants was collected from the Union office. The eight key people interviewed included elected representatives, local state officials, NGO activists, community health care providers, teachers, and so on. The average duration of the interview was 30 to 40 minutes. In addition, three focus group discussions were conducted with three specific stakeholders' groups. Each focus group was conducted with 8 participants. The fundamental questions for the FGDs were dealt with in a series of open-ended questions. Each of the FGD included eight people and the duration of FGD was from 45 to 60 minutes. Table 1 describes the participants in detail and the rationale for the use of each research instrument.

3.4. Data analysis

With the consent of participants, all interviews, FGD conversations and oral histories were recorded with an audio voice recorder. The interviews, FGDs and oral histories were conducted in the Bengali language, so after transcription, all such materials were translated into English. All translated data was exported to Atlas-ti (a qualitative data analysis software) and analyzed by utilizing coding and developing themes. For the analysis of qualitative data, a simple descriptive narrative was used. Furthermore, GIS software used for mapping.

4. Results

4.1. Socio-demographic profile of participants

The number of older interview participants totaled 24, and of these, 15 were males and 9 females. Table 2 illustrates the socio-demographic characteristics of older participants in this study. As our research focused on older people, with the exception of key informants, interview participants were aged 60 and over, with the most populous age cohort those aged 65–69 (31.4%). About half (52.2%) of participants were uneducated, and just 2.1% had completed their bachelor's education.

The investigation recorded four kinds of housing conditions of older individuals. A surprising number lived in a tin shed (61.9%), and semi-concrete structure (27.5%). A good number of participants (70.4%) had their own homes, and the rest lived in NGOs and government-provided homes. About 66.7% of respondents relied upon a tube well as their drinking water source, which is multiple times higher than the other water sources, namely freshwater lake (20.5%) and rainwater harvesting (12.8%).

4.2. Living with cyclones—understanding the asset vulnerability of older people

> "(with a deep sigh) How could we ensure the safety and security of our lives against cyclones—cyclones that damage our lands, houses, housing goods. Cyclones make us older than our age, carry off our families, friends, and relatives. Many of we could not embark for cyclone shelters before a cyclone's landfall". (A male older adult (age 73) stated from Dumuria village)

Like this aged person, the older people of Gabura union suffered the loss of their various assets in the face of cyclones, in particular, cyclone *Aila* of 2009. From the in-depth semi-structured interviews and FGDs, five types of assets of older people are found to be vulnerable in the face of cyclones. These are physical, human, social, financial and cultural assets. The study shows these assets of older adult households are more vulnerable compare than the other age groups in the face of cyclones due to several reasons.

4.2.1. Vulnerability of physical and human assets

The physical assets of older people include housing and shelter, private land, adequate water and sanitation, energy, and access to information. One stock of physical asset is often related to others; therefore, the access to common social infrastructure (such as roads, shelter, embankments, utility services, and so on) are also considered as physical assets of older people.

As they live in a coastal area, the inhabitants of Gabura Union have faced innumerable cyclones over their lifespans [24]. However, when cyclone *Aila* came into their lives, it gave the word cyclone a different meaning because it damaged or destroyed vast quantities of physical assets and older adult interviewees often mentioned that they had lost much of their physical assets. The embankments protecting agricultural land and housing had failed in many places so that all the villages were inundated within moments, even before they were able to know anything about what was happening. As the second interviewee from Gabura village remembered:

> "My two sons lived in Khulna city with their family. Due to their absence, there were no [other] adults in my house. My wife and I went to a nearby primary school cum cyclone shelter with the help of neighbors, but surges came through the broken embankment, and we lost our house including household belongings. Therefore, in this situation, we are feeling older than our age".

After the catastrophic cyclone *Aila* event, the Gabura Union Disaster Management Committee (UDMC) members estimated that the number of damaged houses was greater where only older people lived in comparison to homes where at least one other younger adult was present. Although most of the older people (in particular, those who were aged more than 70) were physically unable to cultivate their agricultural land, they earned some money by leasing it to others. In some cases, this small income producing asset was deemed the only asset for their households. Due to cyclone *Aila* the whole area remained waterlogged for a couple of years before the floodwaters were fully returned to the river systems. As a result, people were unable to cultivate agricultural land and thus unable to earn income. Moreover, people also could not cultivate the land for a few more years because the saline nature of the estuarine river water that had breached the embankments had destroyed the fertility of the soil. One male older interviewee from Dumuria village said:

> "I have 30 decimals [about one-third of an acre] of land. Due to my inability to cultivate the land, I leased the land for BDT 7000 per annum to my neighbor. After cyclone *Aila,* the land has been not suitable [for cultivation] for six years. As a result, I lost an important source of earnings. That made me vulnerable at the end-stage of life".

Similarly, older people faced a drinking water crisis long after cyclone *Aila* hit. It is mentioned in the FGD, conducted with the Union Disaster Management Committee, that cyclone *Aila* resulted in all the drinking water sources, including tube-wells, being inundated. People then had to collect drinking water from a source that was located outside the area. Hence, it was difficult for older people (especially those who had no young adult in their family) to collect water for drinking and cooking purposes. Villagers currently need to collect drinking water from the PSF (pond sand filtering) and tube-well that are from two to three kilometers away, so the difficulty is ongoing.

With increased livelihood insecurity due to cyclone impact, older people suffer from being unable to access and control production. Even when the saline water has eventually drained away, they may often be unable physically and financially to prepare their lands for planting. The yield is reduced as a result. Hence there is a resulting increased dependency upon moneylenders.

Their human assets comprise their skills, knowledge, good health, strategies, and participation in the decision-making process. In terms of human assets, older people may be injured physically and mentally by cyclones and that reduces their skills, capacity, and decision-making power to adopt an existing or new strategy. Participants stated that human assets, particularly health, suffered as older people could not receive proper health care for several reasons. First, although the union has four community clinics for very general treatments, older people may be unable to access the community clinic due to the poor road network. Second, during cyclones, older people need special care, and it was found that everybody was treated the same in the cyclone shelter. Third, older people are less mobile, especially those who are more than 70 years old, and they could not access sub-district and district level health care center without the help of young adults. As a result, when any older people suffered any physical injuries due to a cyclone, there was often a long delay before they presented at the hospital or were hospitalized; this also often caused mental distress and illness. One older adult stated from Dumuria village said:

> (with deep sorrow) How am I feel good at a time of cyclone? I need regular care because of diabetes and *hapani* (asthma) problem. Last time (referring cyclone *Aila*), my wife and I went to cyclone shelter for two days; however, I forget to bring my medicine. Nobody cared for me at that time and after that, I had to be hospitalized with the help of the rescue team".

Similarly, because of their deteriorating physical and mental capacity or injury, and loss of skills, older people usually could not continue to participate in any economic activities. As a result, while they owned properties, they may not be able take any decision regarding these properties if they had a potential heir who has taken over administration of the property. This person can also be the only one physically capable of restoring the property. In the event of the loss of this person (through death or severe injury during a cyclone), a family can be rendered almost totally helpless in terms of being physically able to restore their property. They may be forced to seek funds from moneylenders to pay for others to restore the property. Other older landowners may be unable to make decisions relating to their property due to mental incapacity. Even, if they were able to make a judgement, nevertheless the landholder may not be able to restore their physical assets due to a lack of financial capacity to do so.

4.2.2. Vulnerability of social, cultural and financial assets of older people

Any disaster affects the social, financial and cultural components of peoples' lives. The older people of the Bangladeshi coast face cyclone impacts on their social, financial and cultural assets. Social assets comprise the bonding (i.e., connection with immediate family members, sons, daughters, brothers, sisters), bridging (i.e., connection with neighbors and friends) and linking (e.g., connection with government and non-government organizations, local public representatives, and political leaders) relationships [86-89]. Cultural capital is the accumulation of knowledge, skills and behaviors that enable a person to identify with and tap into particular social networks. It includes people's attitudes to change, their beliefs or religious faith that sustain them during disaster or continue to give their lives meaning when family members perish and livelihoods are lost. However, such beliefs may also include an inbuilt reluctance to deal with preparation for hazards and their consequences (for example, due to fatalism), or a reliance on or hope to obtain external support, and so on. In addition, financial assets include access to credit, availability of banking facilities, and so on.

From the response of participants in interviews and FGDs, it was found that the social capital of older adults is susceptible to cyclones. Sometimes, older people lose their income generating family members due to a cyclone. The cyclones affect their 'bonding' relationships. As coastal inhabitants, a significant number of family members are involved in fishing in the seas and coastal rivers,

collecting wood and harvesting honey from Sundarbans mangrove forest. Some older people also participate in those activities with their sons, brothers or a nephew. This too can make older people more directly vulnerable. People engaged in these professions are more likely to die in cyclone events. For older people's households, the loss of a son, brother, nephew, wife or other family member due to cyclone impacts increases that household's vulnerability. One oral history participant recalled:

> "(with a deep sigh) it's excruciating to recall this memory that my nephew could not back to the coast before cyclone *Aila*'s landfall from the seas. Even, we did not get the dead body yet. He was a big source of earning for the family. My 65 years old younger brother is still not normal after losing his son. This grief even drives us apart. And, now my brother is struggling to survive with his family".

Similarly, older people can lose their family due to the impact of a cyclone, not only directly through the death, but also due to subsequent migration of younger adult family members to urban areas for income to sustain them during the immediate aftermath. The study also shows that young skilled and educated family members may migrate internally to urban areas with the intention of securing increased opportunities, a regular income and a better life away from the cyclone-prone coastal areas. One respondent from Lebubunia village described the results of cyclone *Sidr* on their family.

> "I have two sons, and both of them now live in the city. The elder son is working and living in Dhaka, and younger son migrated to Khulna city after cyclone *Sidr*. We even lost our relatives—those also migrated to Satkhira district town. We could not accept the urban physical and cultural landscape, so I live alone with my wife. The absence of sons and relatives makes us vulnerable during the cyclone period".

In terms of their 'bridging' relationships, the study shows that the impact of cyclones severely affect and these relationships and increase the vulnerability of older adults of Gabura union. Older people, particularly those who are living without any young adult immediate family members, are more dependent on neighbors and friends. For instance, despite access to information concerning a cyclone, older people of any family experience greater vulnerability than other adults as, in general, older people are unable to go to cyclone shelters or other safe places because of their limited capacity for movement which renders them dependent on another's assistance. Moreover, participants reported that some older people were injured before taking shelter because they had arrived at the shelter after the cyclone's landfall. They could not move quickly enough to the distant shelter. In our second focus group discussion, one older person recalled:

> "Somehow, I reached the cyclone shelter without any injury with the help of my adolescent grandson, but my neighboring friend did not come before cyclone landfall because his young adult son lives in Khulna city and his neighbor's son did not come back from fishing before the cyclone's landfall. Finally, he arrived at shelter place—[but] with an injury—with the help of a Red Crescent volunteer as surge water started to overrun his house".

However, the effectiveness of early warnings are not gender neutral in costal Bangladesh. There is a religious matter also involved, in particular a requirement for women to first obtain permission from male family members to leave their home to head to a cyclone shelter. Hence, older women whose male family members [or male guardians] are not at home with them can be in a particularly vulnerable position in the event of a cyclone. With such constraints, FGD participants reported that older women were very often carried to a safe place at the last moment and that make them more susceptible to death and injury than the male older adults. One older woman described her experience thus:

> "We never felt comfortable to seek a secure position at the shelter without our family members who were outside the home, without the permission of our husband, brother or son".

From the responses of interview and FGD participants, it was found that the linking relationships, which are an essential part of the social capital of older people, were weakening, and that this increases their vulnerability in comparison to other age groups. Due to their lower mobility capacity, poor memory, the inadequate transport system, and knowledge gaps, older people's connections to public representatives, state officials, and non-government organizations are not strong enough to offer them the real support that they needed. In Gabura, the study found that if the staff of the above mentioned organizations would not come to assist older people willingly or if others in a bonding relationship to them (e.g., immediate young adult family member) or in a bridging relationship with them (e.g., young neighbor or friends) would not work to assist them, then most of the older people would be deprived of any aid and social safety net programs.

The cultural capital of aged people is also rendered more vulnerable due to cyclones. The cyclone can negatively affect their personality and reduce their sense of hope. They can become habituated to external support. Their already lonely lives can make them lose their sense of confidence and can foster a negative attitude towards any changes. They may believe that the frequent cyclones are due to the curse of God/Allah. When such beliefs are combined with their emotional attachment to their home (physical property), they may be unwilling to take shelter at cyclone shelters or delay leaving their homes, thereby increasing physical risk to themselves and others.

Similarly, emotional or cultural attachment to place increased older people's vulnerability. The study shows that when a son or daughter of older people who has migrated internally to the nearest city area (such as Satkhira, Khulna, Jessore)) want their older parents to be with them, especially during the cyclone season, they find this is unlikely to occur. Older people cannot leave their place for several reasons. Among them is their cultural and behavioral attachments to the place where they (and their forebears) have dwelt for a very long time. Another reason for their reluctance to move is that they do not feel comfortable living in an urban environment due to factors such as pollution, noise, predominance of crowded areas, lack of access to a food-producing field, and generally a city's 'super busy' characteristics. If, however, they fail to move to be with younger adult family members and stay in their existing location, there are negative consequences for them. The absence of other adult family members and relatives make older persons vulnerable not only during cyclone periods but also at other times, such as when attempting to access different social services (including the Old Age Allowance) or when dealing with different levels of government, state and private organizations, and with society more generally.

Older people are vulnerable in terms of receiving messages from and responding to an early warning system. Like other coastal people of Bangladesh, it was found that the inhabitants of Gabura union are informed about cyclones through radio, television, sound systems of mosques (open-air broadcast systems routinely used for calls to prayer (*Azan/Adhan*)), or by Red Crescent Society volunteers, local government officers, word of mouth from friends, neighbors and relatives, and social networks. However, a lack of understanding about the system, as well as past failures, has reduced the trust placed in the official warning system. Some persons then refuse to take shelter in the cyclone shelter in a timely manner, if at all. One older person from Lebubunia village said that "very often it is difficult for us to believe in official warnings due to the failure of some past warnings and a lack of understating of the warning system". Thus people may ignore a cyclone warning because of their knowledge gap and illiteracy.

In the same vein, the people of the study area received such early warnings somewhat late during cyclone *Aila*, so they were unable to prepare themselves to evacuate within the short time then available to them. As a result, there was a heavy loss of life and severe damage to livelihoods and physical infrastructure in the research area during cyclone *Aila*. In particular, the older people faced more constraints to getting the news of cyclones landfall and to taking safe shelter in the shelter center before the arrival of the cyclone.

In terms of financial vulnerability, it is worth noting that there is no universal aged pension payable in Bangladesh. While former public servants access government pensions, other older persons, including agricultural laborers, farmers or other self-employed persons, industrial workers etc. do not. If aged over 65, persons may apply locally for an Old Age Allowance (introduced in 1998 and currently BDT 500 per month). The age requirement may be varied for women to 62. Such payment is to be allocated on the basis of greatest need (for example, ultra-poor with income below BDT 3,000 per annum who have no family support with priority given to the infirm, physically or mentally disabled, homeless, landless older persons, widows, divorced persons etc.). Persons who have lost their homes (but not vagrants, who are also ineligible) are also prioritized as are surviving freedom fighters. Unfortunately, this selection process is vulnerable to bias which can result in a degree of misallocation where financially solvent persons receive the allowance while the insolvent do not. The government's budget for the Old Age Allowance is limited but results in some 4.4 million of older persons receiving it. Hence many families bear the entire responsibility for older family members unaided, and some older persons endure even greater hardship (former maids, vagrants).

Finally, older people are not sophisticated or knowledgeable about the banking system. Instead, they keep money at their home and young adult participants mentioned that older people often lost their savings because cyclone surges wash away the money with other household goods. Moreover, older people have very marginal access to credit facilities because most of them no longer actively participate in economic activities. The study shows that when older people have lost their housing, household goods and land, it would then be difficult for them to rebuild their house by themselves due to lack of access to credit in such circumstances.

4.3. Adaptation attempts of young adults and older people to cyclones

With the increase in the frequency and magnitude of tropical cyclones and their adverse effects on older family members and their assets, the question arises as to how older people create strategies to cope with this extreme environmental stress. This section describes the strategies that older people depend on in adapting to the impact of the cyclone and the challenges they face. Older people inevitably possess less physical strength to combat environmental stresses—this increases their vulnerability. Generally, not only older but all types of households adopt multiple strategies to reduce their exposure to cyclones. A few adaptation strategies are differentiated by gender; however, the priority of some are the same. Table 3 shows the FGD findings that illustrate various adaptation measures employed by older people to protect themselves from the adverse effects of cyclones and adapt to the presence of cyclones in (or their threat to) their environment.

4.3.1. Role of young adult family members, neighbors and friends in adaptation to cyclones

Due to Bangladesh's socio-economic situation and cultural norms, older people have an expectation that younger adult family members will be responsible for caring for them or supervising that care. As a result, young adult family members, and neighbors and friends too, play a critical role in the efforts of older people to cope with and recover from cyclone damage. In a disaster situation, older people usually are unable to make it on their own to a shelter due to their much-decreased level of fitness. So, the absence of a young adult in a household containing elderly member/s during cyclone makes those older people extremely vulnerable during cyclones and associated flooding and/or storm surges. One older female opined, "I could not take shelter before the cyclone's landfall due to

the absence of my husband and son. My neighbor's son and a CPP volunteer took me to a safe place after the start of the cyclone".

Without other adult family members in the household, it is challenging to tackle a cyclone situation in the pre-, post-cyclone periods as well as during such an emergency. From the FGDs, we found that young adults provided different kinds of support not only for their older family members but also for the community. This support included rescuing or evacuating older persons pre-cyclone and post-cyclone; storing and supplying dry foods, drinkable water, and clothing; immediately repairing damaged houses, helping to search for livestock, and providing psychological support.

The role of young adults is not limited to the pre-disaster evacuation of older adults but is also crucial during the disaster and in the post-disaster recovery period. Young adults are involved in securing and supplying food and drinking water. This is crucial as these are immediately required by people arriving at a shelter as well as in the wake of a cyclone when local fields are inundated and unproductive and roads may be largely impassable after the cyclone. In the experience of interviewees, the disaster response by the government and other agencies took a few days to weeks for recovery and rehabilitation to occur. During the intervening period, older people ultimately depended on family members, neighbors, volunteers, and relatives. The strength of social connections with people outside of the affected area also played a vital role during that time. Those who had a young adult family member to aid them found that they could more easily reach the shelter facilities and return home from the shelter after a cyclone. Young adults can also communicate swiftly with the government and non-government aid agencies to ensure a more rapid recovery. One participant described his experience:

> "We did not bring food and drinking water to the cyclone shelter. If our elder son had not come from Khulna town immediately after the cyclone, it would have been difficult for us to survive. He brought dry food and drinking water from Khulna and repaired the damaged house within one week. If we had had no adult member living near to us, we would not have been able to not repair the damaged house quickly and that would have led to a longer stay in the temporary house at the embankment."

It was found that less mobile older adults depend on young adults to take them to shelter in a safe place. Hence, those older people who had no adult family members were comparatively more vulnerable than those whose households included young adults. Though the social nexus of the rural community is weakening, however, it remains unimpaired in some cases. For instance, most of the Red Crescent and other volunteers come from the local area and, along with the volunteers, the young adult neighbors also worked to ensure people's safe arrival at the cyclone shelter as well as taking care of them in the shelter center by providing food and water. This occurred because of the strong social relationship between young adult's neighbors and the older adults. Moreover, along with immediate young adult family members, young adults from neighboring houses, relatives, and other villagers came to assist them to rebuild their house, and replace other materials and products necessary for living. Furthermore, they also advocated on behalf of older people so that they could receive aid and support (ensuring, for example, that the older person's name was on the government's list of persons who had suffered damage in the cyclone. All of these aforementioned activities were done because of bonding and bridging relationships that existed. These were crucial in coping with and recovering from a cyclone. It can be seen in these reports from interviewees and in the FGDs that rural people did not only think about their own personal shelter but also tried to bring family members, neighbors and other community members to cyclone shelters.

4.3.2. Older people's attempts to respond to cyclones

To cope with and reduce their vulnerability, older people adopted multiple strategies. To save their physical assets from cyclones, older people mainly focused on repairing and rebuilding their damaged houses stronger than previously. Moreover, several participants indicated that they raised their voice to public representatives, political leaders and state officials to ensure that damaged community infrastructure, including embankments and roads, was repaired or new common physical infrastructure was built immediately after cyclones. Besides that, it was found that older people emphasized the need for the safe storage of potable water and dry food before any such event so that people could tackle the emergency circumstances that arise during a cyclone and the period immediately thereafter. FGD participants reported that they had taken initiatives in the planting of dense trees in the south-western corner of the settlement as they believed this could reduce the damage to homes.

The responses of interviewees and FGD participants mentioned that the use of training and informal education form an effective strategy to enhance the people's skill by increasing their understanding of the early warning system and their awareness of the importance of receiving and responding to it. They also mentioned that it is also important that older people's participation is increased in the decision-making process. In this way, the long experience of older people can help various bodies to make better decisions when they are creating policy. In addition, their participation would help to ensure greater justice in the distribution of resources.

Migration is an excellent adaptation strategy that can be considered as a social asset. With older people culturally dependent on a younger adult family member, many of the coastal aged people migrate to the city (and especially the nearby towns) where their children are now living as an adaptation strategy. The study shows that two types of migration take place—some migrate on a temporary basis, that is, only during cyclone periods, while others move permanently. A woman FGD participant opined:

> "I am a 69 year old widow. My son is working in a private company, and for that, he is living in Khulna. I lived with my son during probable cyclone months. It would be difficult to live alone here when a cyclone makes landfall".

Finally, a social network, strong relationships with family members, kin, neighbors and friends can reduce the vulnerability of older persons. In Gabura, after cyclone *Aila*, older people realized more that it was a good idea to build and sustain the relationship with the aforementioned individuals and groups because of counselling and training from the government and non-government organizations. Moreover, older people increase their awareness about information and they share and disseminate all kind of information (including cyclone events) to each other. Older people passed the information rapidly about impending or current cyclonic events to others through their social networks. They can also become better informed about impacts and successful or new and preferred mitigation approaches in and through their social network, and share that information. Moreover, older people have learnt to keep their savings in a safe place to ensure that they will have money for use during the emergency periods of cyclones.

5. Discussion and conclusion

This study adds to empirical research literature by exploring how a particular age group becomes vulnerable due to an extreme climatic event (cyclones) that directly affect their capital. Another objective of this research was to find out in what ways the affected older people respond to and cope with this adverse environmental stressor. This research is one of the first studies that mainly focuses on older people's vulnerability and adaptation to cyclones along the Bangladeshi coast. Development practitioners have undertaken some studies to develop projects in regard to cyclones;

however, they were intended to focus on overall vulnerability, although in some cases greater emphasis was given to women and children. We believe that this qualitative study enables a better understanding of how older people adopt multiple adaptation strategies and of the effectiveness of these strategies. Moreover, to develop an index for the assessment of social vulnerability, this research will fill the gap by contributing new indicators regarding a particular age group (older people).

The findings from this research suggest that, not unlike children, older community members face an extremely vulnerable situation to cyclones because of their marginal stocks of resources and the extent of their dependency on others. In terms of physical assets, older people lost their earnings from the land because its waterlogged condition prevents cropping, while its salinity further damages the soil and makes it obligatory for the land to be rested in order for it to recover its fertility. In addition, they are not easily able to access shelters before cyclone landfall due to their limited mobility [26]. This can result in injury and even deaths among older persons, further damaging older persons' social networks. Moreover, when their housing is lost due to water surging through damaged embankments damaged, they lack the physical, mental and financial capacity required to rebuild. Along with this, although drinking water crisis is a regular phenomenon for coastal people, during and after cyclones the crisis becomes extreme due to salinity intrusion [90-92] affecting water sources, including tube wells. Furthermore, they are deprived of proper sanitation and hygiene facilities, and often lack access to their Old Age Allowance, if they are eligible, due to physical constraints on their movement in flooded areas [11] and if they are not, their financial resilience is far less than might otherwise have been the case. A failure to use banking facilities further exacerbates their vulnerability. They also suffer food insecurity and can be without care and support from their family, who may live elsewhere [45].

However, all older people did not experience a similar degree of vulnerability [59, 61, 62]. Rather, vulnerability is differentiated by asset status [93]. For instance, those older persons who have a young adult living with them are less vulnerable during and after cyclonic events than those who do not. Younger adults can take older people to cyclone shelters before a cyclone's landfall, thus increasing the older family members' chances of survival. In contrast, without a younger and fitter adult, older people often must depend on neighbors or volunteers to rescue and/or transport them to shelters. This can cause a delay in their taking shelter in a safer place. Moreover, although the early warning system has improved due to technological development, it is reported that older people have less faith in the early warning system due to its past failures. In addition to that, due to a lack of understanding regarding the cyclone warning system and their own illiteracy, they tend to ignore the signal, just as they may ignore the request of local administration, rescue team, or volunteers for them to take shelter in a safer place [33].

Similarly, as is illustrated in the summarized findings, it was found that losing family members, relatives, neighbors and friends increases the vulnerability of older people culturally and financially [11, 36]. Not all the older people are active in terms of income generation, therefore, older people depend on the earnings of other members of the family [12, 26]. As a result, when an older adult lost or the income earning family member or that person was severely due to the cyclone, their vulnerability increased markedly. Similarly, cyclones reduce older people's sense of hope and increase their dependency on external support.

The presence of young adults in the family or in their social network can make a crucial difference to preparation for, experience of and recovery from cyclones. Due to their lower capacity for movement, their low earnings, poor memory, inadequate communication, older people mostly relied on other active family members to cope with and recover from cyclones. In contrast, those who had no young adult immediate family members (as their son, daughter, brother and sister etc. are living in urban locations or elsewhere, then they relied more on neighbors, relatives, friends and social

764 organizations. Maintaining such networks is an important strategy. An active adult can assist by
765 taking an older person take shelter before cyclone landfall, provide special care in the cyclone shelter
766 (e.g., get food and water), help the older person access aid easily and support recovery activities.
767 Therefore, it is evident from the results of this research that the presence of young adult support is
768 an important contributory factor to disaster preparation, the response of the older persons and their
769 household to the disaster (including their being able to survive) and, to some extent, to the older
770 persons' longer-term recovery.
771
772 Nevertheless, this research also found that older people adopt different strategies in accordance with
773 their assets to reduce their vulnerability. The priority of the adaptation strategies varies due to gender
774 dynamics. The provision of better housing, training, standby food security, nutrition and healthcare,
775 increased family and community care and social security will help them to survive and reduce their
776 vulnerability [26, 49, 94]. These are actions at a community / government, and non-government
777 organizational level. Disseminating information about any upcoming cyclone disaster before
778 landfall, and ensuring that information is accurate, timely and widely known, is a particularly
779 powerful tool for reducing impacts for any disaster-prone community [16, 18]. The increased the
780 effort to disseminate early warnings concerning cyclones *Sidr* and *Aila* has reinforced the reliability
781 of official warnings, and the fatality rate has decreased markedly [18, 95]. The death toll for more
782 recent cyclones is far lower than that for the 1970 and 1991 cyclones [9, 96]. Several participants
783 reported that the sources and dissemination of early warnings were good enough after cyclone *Aila*;
784 however, people's understanding of the seriousness of early warnings is still remains weak and
785 reduces timely compliance. Hence, to increase the level of understanding of and appropriate
786 responses to such signals, training and publicity should be increased. Moreover, although the
787 situation is improving, people still have less faith in warnings than is necessary for optimal outcomes
788 in times of emergency. Therefore, educating older people informally is essential. That would help
789 them to be better prepared when they hear the signal, and help them realize that they can to go to a
790 shelter before cyclone landfall. In addition to such education, the provision of an emergency medical
791 service is very much necessary for older persons, expectant mothers and children.
792
793 Increased financial security is another crucial matter when seeking to reduce older person's
794 vulnerability and increase their resilience to cyclone generated emergencies. Enlisting older people
795 in the appropriate social safety net program is a good way to reduce the vulnerability [57]. There is
796 a limit on the number (currently 4.4 million beneficiaries for the Old Age Allowance and the level
797 of the Old Age Allowance is low (BDT 500 (circa USD 6) per month) [40, 45, 57]; however, the
798 principle of supplementing or providing income for indigent older persons, the disabled and so forth
799 that was embedded in the country's Constitution and recent governments have begun to put it into
800 action, on a needs basis. In a developing nation, this is a 'giant leap forward'. Ensuring the principle
801 of social justice is observed in the distribution of the Old Age Allowance is very important as this
802 allowance can make older people more secure. The manual for its allocation is most detailed as to
803 order of priority; but many who might be otherwise eligible appear not to qualify. The government
804 has increased the budget over the years, but it still appears to be inadequate to address the number
805 of possible recipients. Participants reported that there is 'a crying need' to increase the number of
806 allowances (and the amount of the allowance) as more than 50% of older people are not included
807 under the scheme. Therefore, priority assessment for the distribution of the Old Age Allowance is
808 essential.
809
810 Finally, in this research, we presented how older people become vulnerable in the face of cyclones
811 in the Bangladeshi coast. This article also tried to illustrate the adaptation strategies that have been
812 adopted by young adults, the older people themselves and different government and non-government
813 organizations to cope with and recover from the cyclone-generated losses. In its use of qualitative
814 methods, this research contributes rich first-hand information regarding vulnerability and adaptation
815 of particularly the older age group. We argue that vulnerability is differentially experienced by

various age groups of people and, among the age groups, older adults (not unlike children) are more vulnerable than young adults in terms of physical, human, social, cultural and financial assets. For older adults to enjoy a sustained recovery and to reduce their disaster-related risks and vulnerabilities, aged people's knowledge must be enriched from the local to the national level through disaster risk reduction activities. Older people require particular types of tailored care (appropriate for their age and medical and dietary needs) as well as heightened awareness during a crisis period, but this care is not very common nor always available. So, an appropriate awareness program and training should be provided and promoted to them. Therefore, government institutions, NGOs and other stakeholders must work collectively to reduce their risk and vulnerability to cyclones. Additionally, there is a need to enact a framework for an aged people's agenda.

Acknowledgments

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1064 **Table 1. Data collection instruments, their participants and rationale**

Instruments	Participants	Rationale
Semi-structured interview (total 32 interviews were conducted)	Aging people and key stakeholders, such as local elected representatives, a school teacher, NGO officials, local state executives, a community health care provider, a social worker.	To collect data about people's perceptions of vulnerability, the way aging people become vulnerable, responses to cyclones, gender perceptions about responses, and so on.
Focus Group Discussion (FGD)—total three FGDs were conducted. Eight participants were participated in each focus group discussion.	Gabura Union Disaster Management Committee, older people and young adults.	From FGD, we obtain data about the role played by adult family members in the process of vulnerability and the adaptation of aging people in the face of cyclones. Aging persons are usually dependent on their younger family members.
Oral histories (Three oral histories were conducted)	Vulnerable older people	Using oral histories, the history behind socio-cultural and economic strengths to cope with cyclones are explored and become known.

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1067 **Table 2. Socio-demographic characteristics of older participants**

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Parameters	Respondents (%)	Parameters	Respondents (%)
Age		**Gender**	
60–64	20.4	Male	62.5
65–69	31.4	Female	37.5
70–74	25.3		
75–79	8.6		
80+	14.3		
Educational status		**Source of house**	
Illiterate	52.2	Self-constructed	70.4
Year five	14.2	NGO provided	20.1
Year eight	16.4	Government provided	9.3
Year ten	6.2	Other	0.2
Year twelve	8.9		
Bachelor	2.1		
Housing type		**Water sources**	
Hut	7.2	Tube well	66.7
Tin shed	61.9	Freshwater pond/lake	20.5
Semi-concrete structure	27.5	Pond sand filtering	-
Concrete structure	3.4	Rainwater harvesting	12.8

1069 Source: Fieldwork, 2015–2016

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1077 **Table 3. Adaptation strategies for cope with and assets recovery of older people to cyclones**

Assets	Adaptation Strategies
Physical and Natural	• Repair and rebuild their damaged houses within a short period of time • Plant trees beside the south-western side of the settlement as this reduces the speed of a cyclone • Create drainage to remove the saline water after a storm surge • Raise their voices collectively to the government for the quick repair of damaged common infrastructure such as roads, embankments, and other utilities • Engage young adult people as a community to co-operate with government and non-government agencies • Ensure safe potable water and dry food as an emergency response for shelter place and immediately after the cyclone
Human	• Provide training to older people regarding cyclone risk and evacuation • Educate older people to understand the early warnings and procedures they are required to follow • Ensure the participation of aged people in the decision-making process to explore and benefit from their long experience • Arrange an emergency medical response with the medicines for the different diseases that commonly affect older people • Ensure enough volunteers for the rescue of older people
Social	• If there is a young man in the family, ensure his presence during a cyclone • Provide counselling so persons are better able to develop a relationship with kin, friends, neighbours and rescue volunteers • Ensure the principle of social justice is applied in the distribution of food, water, clothes and other materials
Cultural	• Rely on early warnings from different sources • Counselling about natural hazards, their consequences, combat negative attitudes towards change and negative beliefs • Migrate to city area to live with an adult son or daughter
Financial	• Increase the number of older people under the government's Old Age Allowance system • Increase the government old-age allowance • Give priority to those older persons who have no adult family member that they can depend on • Provide a concession for older persons so that they can more easily access transport and health facilities

Source: Fieldwork, 2015-2016