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Assessment of Psychological Well-Being in Hazard Prone Area

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Abstract: Bangladesh is in South Asia's low-lying region. For this unique geographic location, this country is endowed with immense natural beauty. The flip side of the coin, on the other hand, is extremely enraged. Bangladesh faces devastating damages every year for this kind of geographic and geologic setting. Bangladesh has been ranked 7th among the countries which are severely affected by hazardous events since 1998. Besides economic and social damages, hazards are known to impact individuals' mental well-being severely. Also, a poor psychological state works as an influential factor to increase hazard consequences. For this research, both secondary and primary data sources have been considered. Satellite imageries, published documents, and maps are secondary data collected from Google Earth and other online platforms. Also, MHI-5, a self-assessed questionnaire, has been used to estimate and calculate the psychological well-being as well as the psychological vulnerability of individuals. Several statistical methods were used to analyze data, such as ROC curve analysis and several GIS techniques throughout the research. Results show that biophysical vulnerability in the study area creates psychological vulnerability. Government and policymakers should consider this dimension in disaster management to identify the most vulnerable individuals because only structural recovery will not be enough to reduce vulnerability in a holistic approach.

Keywords: MHI-5, Vulnerability, ROC Curve, Geographic boundary.

1. Introduction

Both Geologically and geographically,Bangladesh is located in a high-risk area to natural hazards, including cyclones, floods, riverbank erosion, coastal erosion, landslides, drought, and groundwater contamination. Bangladesh is only at risk from earthquakes as far as endogenous hazards are concerned, and there is no danger of volcanic activity. Bangladesh faces devastating damage every year, and these hazards have a significant impact on our society and economy (Hossain and Miah, 2011). Over the past 40 years, nearly 5,20,000 deaths recorded due to cyclones, floods, storm surges, and other associated natural hazards. In 2007, Cyclone Sidr alone caused worth 1.7 million USD in the coastal areas of Bangladesh (GFDRR, 2019)

Bangladesh is in the 7th position in the damage index for its damages due to severe hazards events since 1998. In 2018, Germanwatch claimed that about 407 people lost their lives in several hazardous events like cyclones, floods, landslides, and storms in Bangladesh. Also, the country sustained a total loss of 2826.68 million U.S. dollars (Eckstein, Hutfils and Winges, 2019; DhakaTribune, 2019; The Finance Express, 2019, UNB 2018; The Daily Star, 2019). Besides that, depending on locations, Bangladesh endured 1 to 35 million U.S. dollar economic loss in livestock and 1 to 11.8 million U.S. dollars in poultry sectors due to these natural hazards (Biswas, 2019). UNDRR has

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estimated that Bangladesh's average annual loss is more than 3084.33 million U.S. dollars (Ozaki, 2016; Kamal, 2016).

Though economic implications are commonly considered after or during disasters, social and human impacts are frequently overlooked(Short, 1987; Dekens, 2008). Community displacement, degradation of social status, and disturbance in going to school are serious hazards tothe societal system. But nowadays, social impact assessment is getting the concern of many researchers in disaster management.Not only on society and economy,but hazards are also known to substantially affect the affected population's physical and mental health (Kim, et al., 2008, Rahman, and Shaw, 2015; Jha, 2010; Ericson, 2005) besides other structural damages. Hazard-affected people suffer from long-term trauma and poor mental health (Freedy and Simson, 2007; Gruebner et al., 2015). WHO's epidemiological projections show that "post-disaster mental health problems range from mild distress to very severe mental health problems. Almost 20-40% of the affected populations suffer from mild psychological distress, while 30-50% suffer from moderate to severe psychological distress" (WHO, 2019).

During a disaster, those with poor mental health are more vulnerable, and they cannot adapt and overcome the circumstance along with others. They are less resilient to hazard due to psychological vulnerability. The level of psychological exposure of a community can tell us about the intensity of other impacts of a hazard on mental health besides other structural damages, their coping capacity level, and positive adjustment to that hazard (Fingerle, 2009). Considering these facts, researchers wanted to measure the psychological vulnerability of the local community to different threats.

2. Methods

2.1 Study Area Selection:

Based on the nature of this research, several assumptions were considered for selecting the study area. Considered assumptions are:

- Area with a geographic boundary with isolation
- Vulnerable area to hazards
- Vulnerable and stressful community

Natural hazards might have geological or geographical extend. Such earthquakes generally occur where the earth's plate is tectonically active, and the extent of damages will depend on the intensity. Hazard impacts have no administrative boundary. That's why a geographic area of Inani in Jalia Palong union of Ukhia Upazila in Cox's Bazar district has been selected as the study area.

Two different rivers bound the study area in the north and south directions. Both rivers flow westward and fallen into the Bay of Bengal, which draws the west side boundary. On the Eastside, there are hills and a channel connected to both rivers. The channel has been considered as an east side boundary for the study. These geographic settings have given a unique geographic boundary to the study area. Also, this area is potentially vulnerable to various kinds of hazards for its geographic location.

On the other hand, the studied community's majority population is involved in fishing and boating with no significant subsidiary occupation. A very small group of the people engaged in farming, and few people work as day labor. Moreover, the women of that community are not directly involved in any economic activity. It is very alarming for a community and any society when most of that population engages in primary activity rather than other economic activity. This type of engagement indicates underdeveloped community practices (Pettinger, 2016).For all these facts, this area has been chosen for this kind of research.

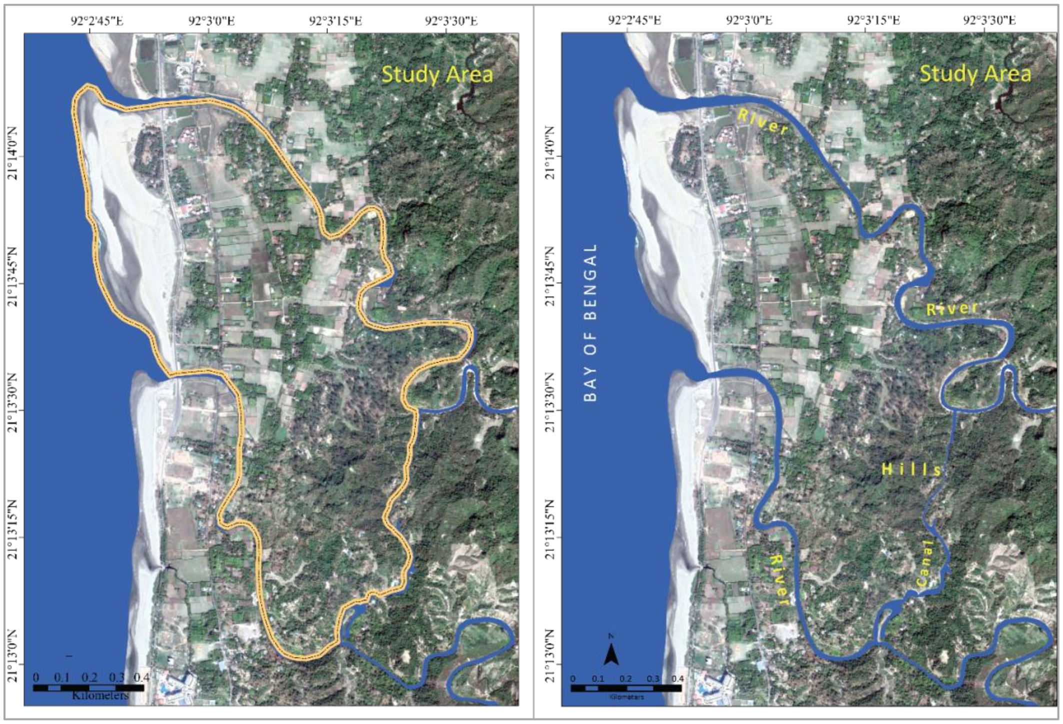


Figure 1: Study area

2.2 Sampling:

The sampling process has been stratified into two layers for this study. First, a rectangular box has been drawn around the study area and then divided into small boxes with an area of 10000 sq meters (100m*100m) for each small box. Besides, boxes that cover the study area have been taken into account for the further sampling process.

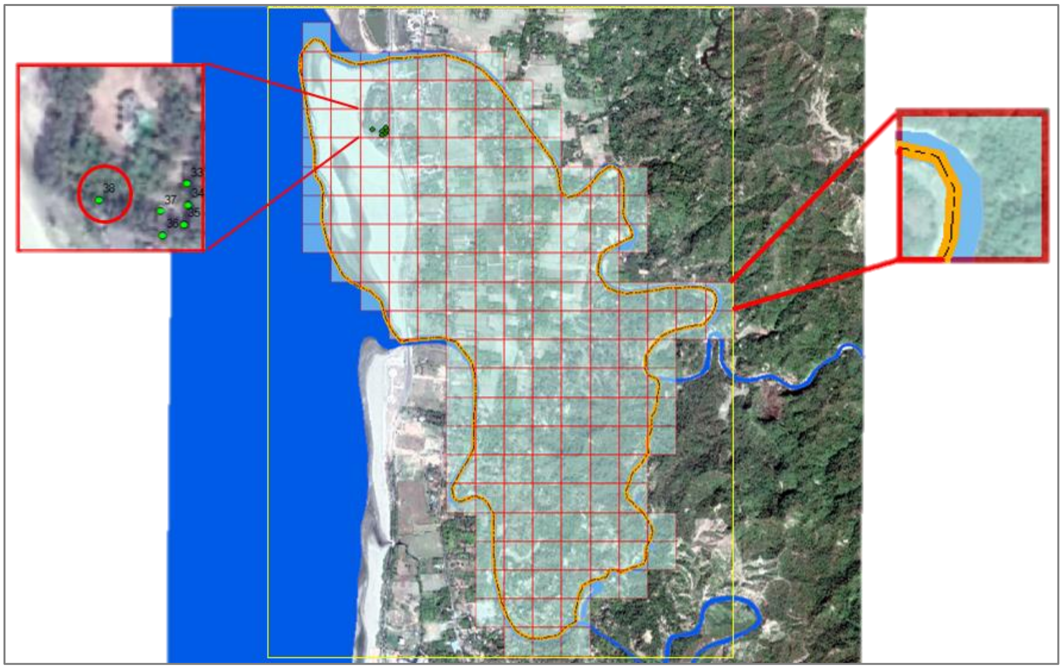


Figure 2: Sample selection procedure

Secondly, for determining the possible settlement of sample collection, random number table has been considered. Because the population from the study area will have an equal and independent chance to get selected as a sample in the sample selection process.

2.3 Study Variables and Tools:

Both primary data and secondary data were used to conduct this research work. Various hazards information and satellite imageries are the secondary data, and those were collected respectively from published websites, atlases documents and Google Earth. Also, several informal interviews and discussions were arranged with the community members to observe theirsocial conditions and psychological state. Thenthe value of psychological vulnerability has been collected and measured by MHI-5, which is a self-assessed questionnaire.Besides, GIS and remote sensing have been used throughout the study for georeferencing, digitizing and producing new maps.

2.3.1 Hazard potentiality identification:

Researchers considered three spheres of the earth to identify the hazard vulnerability of the study area. Because natural hazards' occurrences or processes that occur naturally in the earth's system. (GFDRR, 2009). Different types of tools have been considered to explore the hazard vulnerability, which have been categorized as follows-

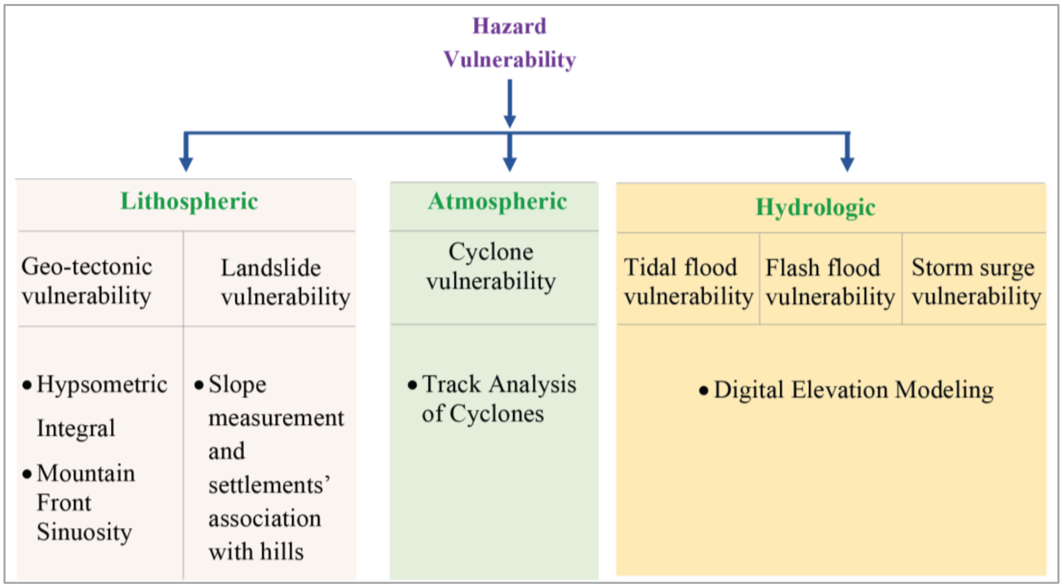


Figure 3: Hazard potential identification

2.3.2 Mental Health Inventory-5 (MHI-5):

Veit and Ware developed MHI-5 in 1983 (Multiple Sclerosis Centers and Ritvo, et al., 1997). MHI-5 has the advantage that it is equally suitable for assessing psychological distress symptoms and psychological well-being in non-psychiatric people. Because it is developed considering the psychological state and information from general people, making it convenient to community population measures (Marques, Ribeiro and Lopez, 2011). In below there has been given a sample of MHI-5-

Table 1: Sample of Mental Health Inventory-5 (MHI-5)

Questions	All the time	Most of the time	Most of the time	Some of the time	A little of the time	None of the time
5 Questions	1	2	3	4	5	6

3. Calculation and Analysis

3.1 Hazard Potential Analysis-

Geo-tectonic vulnerability:

There are several indices to calculate the geo-tectonic activity of an area. Some of the most useful geomorphic indices in active tectonics research are Hypsometric Integral by Strahler (1957), Mountain Front Sinuosity by Bull and Mc Fadden (1977), etc. These two geomorphic indices have been calculated for the selected study area.

- Hypsometric Integral:

  Hypsometric Integral refers to the study of landmass's horizontal cross-sectional area distribution with respect to elevation. Using Google Earth, the elevation was directly collected for the study area. Then, Hypsometric Integral has been calculated using the following formula:

$$H_i = \frac{Mean\ Elevation - Min\ Elevation}{Max\ Elevation - Min\ Elevation} \quad \text{------- (3.1a)}$$

- Mountain Front Sinuosity

'Mountain front sinuosity' is a common investigationapproach for locating regions with tectonic activity. Researchers have collected the study area image from Google Earth and analyzed it in ArcGIS for this study. Mountain Front Sinuosity is usually calculated by using the following formula:

$$S_{mf} = \frac{L_{mf}}{L_s} \quad \text{------- (3.1b)}$$

Where,

S_{mf} = Mountain Front Sinuosity Index

L_{mf} = Total length of the mountain front

L_s = Straight line length of the mountain front

Landslide Vulnerability:

Researchers have reviewed previously published documents and used a clinometer to collect the slope measurements of the study area. Also, the placement of settlement is taken into consideration. All data was compiled and analyzed in ArcGIS to produce a landslide vulnerability map.

Cyclone Vulnerability:

Various published maps and documents and cyclone track analysis have been used to explore the cyclone vulnerability in the study area.

Tidal flood, Flash flood and Storm surge vulnerability:

Researchers have identified the flood vulnerable area by using Digital Elevation Modelthatseveral field visits have verified.

3.2 Psychological Vulnerability Calculation-

The calculation and Scoring system for the MHI-5 is relatively complex.There are five questions with six possible responses (scored from 1 to 6) for each in the MHI-5 (table 1). The total value (total value is from 5 to 30) was converted into a scale of 0 to 100 using a linear transformation. In this score range, 100 represents optimal mental well-being.

Total score on MHI- 5 = 100* {(score a + score b + score c + score d + score e)-5}/25.

However, there is no formal categorization scale of MHI-5 and that's why a cut-off point has to be determined. Because a cut-off point is necessary to define the condition of mental health as vulnerable or resilient in MHI-5. This cut-off determining method is extensively used and delivers the finestSensitivity and specificity for identifying psychometrics signs.

3.3 SPSS analysis

A statistical analysis has been executed for determining the cut-off value of MHI- 5. For the statistical analysis, SPSS software has been used.

ROC curve analysis uses the following equation for calculation-

$ROC\ (.) = \{FPR(c), TRP(c),\ \ c \sum(-\infty,\ \ +\infty)\}$ ------- (3.3a) [source: Calì and Longobardi, 2015]

Where,

$TRP(c) = \rho(T \geq c|E+)$

$FRP(c) = \rho(T \geq c|E-)$

In the 3.3a equation, *FRP* is the specificity, specificity (negativity in the variable) is the proportion of subjects without the target condition and gives negative test results. *TRP* is the Sensitivity; Sensitivity (positivity in the variable) refers to the proportion of subjects who have the target condition (reference standard positive) and give positive test results. Positive predictive value is the proportion of positive results that are true positives, whereas negative predictive value is the proportion of negative results that are true negatives. Furthermore, *c* is the cut-off value.

4 Results

4.1 Hazard Potentiality in the study area:

Geo-tectonic vulnerability:

- Hypsometric Integral:

The difference between erosional landforms at different stages during their evolution can be assessed by hypsometric analysis (Strahler, 1957; Schumm, 1956).The calculated value of Hypsometric Integral for the study area is **0.56, indicating that the watershed is matur**e and susceptible to erosion.

Table 2: Value of Geomorphic Indices to identify Geo-tectonic vulnerability

Geomorphic Indices	Calculated Value	Standard
HypsometricIntegral	**0.56**	<0.5 means relatively stable land

- Mountain Front Sinuosity

The mountain front sinuosity index is a measure of the equilibriumamong the trend of stream and slope processes to create an uneven mountain front and active upright tectonics to generate a distinctive straight front (Bull and Fadden, 1977). For the study area,the mountain front sinuosity index value is **1,** which means that the land is decreasing the levels of tectonic activity and is susceptible to erosion.

Table 3: Value of Geomorphic Indices to identify Geo-tectonic vulnerability

Geomorphic Indices	Calculated Value	Standard
Mountain Front Sinuosity	1	> 1 means that the land decreasing the level of tectonic activity

Landslide Vulnerability:

Landslide sites in Bangladesh have a natural slope angle of 34 to 84 degrees. Nonetheless, most slopes are greater than 40 degrees, which is higher than the typical angle of internal friction of slope materials (26–34 degrees). As a result, slopes are more unstable (Ali, et. al., 2018; Islam,et.al., 2014; Tabassum, Sharmin and Chowdhury, 2019). Moreover, several settlements in the study area are built near the hills, creating vulnerable conditions for the studied community.

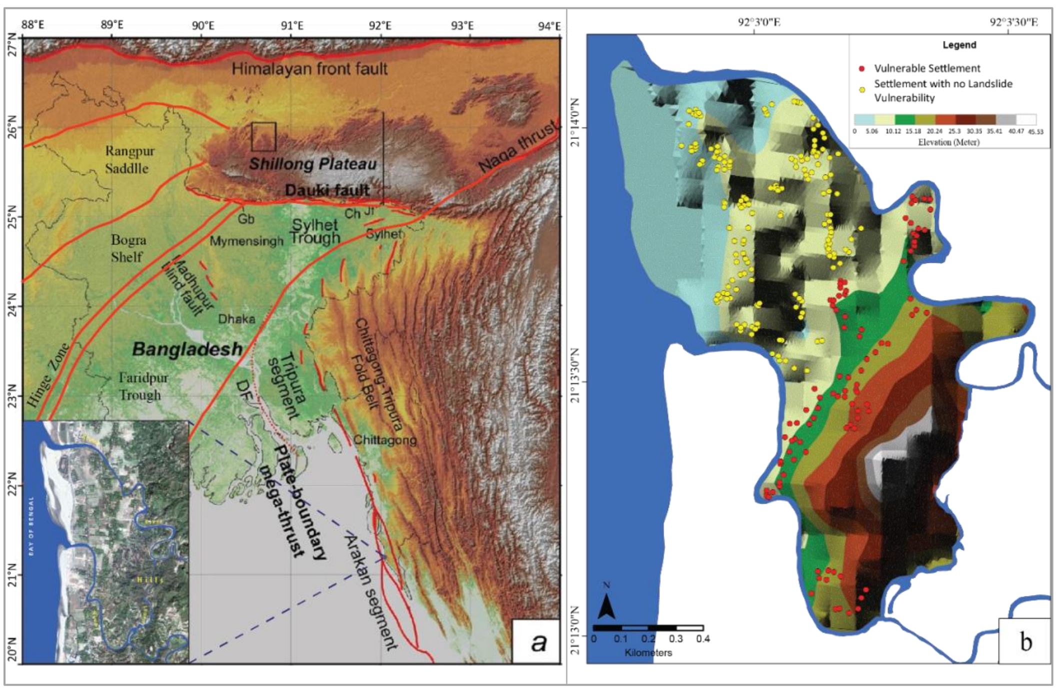


Figure 4: Lithospheric Vulnerability in Study Area; A (left pane): Geo-tectonic vulnerability (Source: Compiled by Author, 2019 after Morino et al., 2018), B (right pane): Landslide vulnerability

Cyclone Vulnerability:

Researchers have reviewed the published map, documents, articles of cyclone events (1965 to 2017) from various sources and produced a cyclone vulnerability map of the study area. The map clearly represents that the study area has witnessed several major cyclones and is affected by them. Also,the study area is situated in a high-risk area for the cyclone.

Tidal flood, Flash flood and Storm surge vulnerability:

For the study area, flash flood due to excessive rainfall, tidal floods due to the rise of water in the ocean, and excessive rainfall and storm surge due to cyclone caused damage in previous years. This area is highly vulnerable to these hazards. Storm Surge vulnerable area marked with red dotted line, whereas flash flood vulnerable area marked with red arrow. Tidal flood vulnerable area has been marked with a purple dotted line.

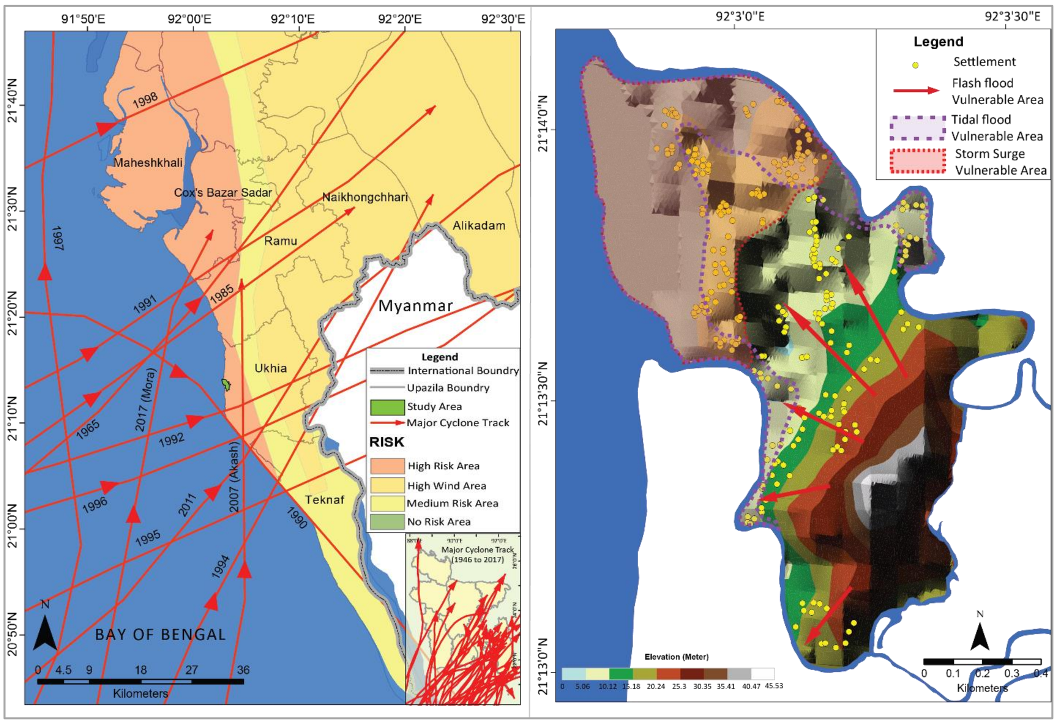


Figure 5: Left pane: Cyclone vulnerability (1965- 2017), Right pane: Flash flood, Tidal flood and storm surge vulnerability

4.2 Level of Psychological Vulnerability:

After the proper execution of the selected method, the psychological vulnerability value has been estimated. But there is no formal scalethat can distinguish between vulnerable and resilient individuals. That's why researchers worldwide in this sector usually calculate a cut-off point to conclude the results. Because cut off point divide the test results into two category allowing to differenciate the outcomes. A simultaneous assessment of sensitivity and specificity is required to determine the cut-point value. When a cut-point correctly classifies the majority of the people, it is said to be efficient finding. For that reason, researchers have calculated a cut-off point for the psychological vulnerability for this research work.

Area Under the Curve

Test Result Variable(s): CalculatedValue

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.951	.026	.000	.901	1.000

The test result variable(s): CalculatedValue has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

Case Processing Summary

Overall	Valid N (listwise)
Positive[a]	16
Negative	43

Larger values of the test result variable(s) indicate stronger evidence for a positive actual state.

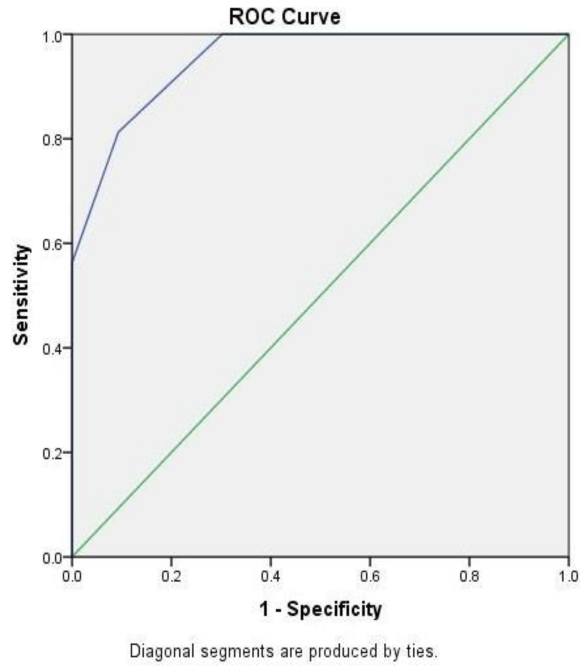
a. The positive actual state is 1.0.

Coordinates of the Curve

Test Result Variable(s): CalculatedValue

Positive if Greater Than or Equal To[a]	Sensitivity	1 - Specificity
27.000	1.000	1.000
30.000	1.000	.953
34.000	1.000	.837
38.000	1.000	.674
42.000	1.000	.581
46.000	1.000	.302
50.000	.813	.093
54.000	.563	.000
58.000	.313	.000
62.000	.125	.000
66.000	.063	.000
69.000	.000	.000

The test result variable(s): CalculatedValue has at least one tie between the positive actual state group and the negative actual state group.



a. The smallest cutoff value is the minimum observed test value minus 1, and the largest cutoff value is the maximum observed test value plus 1. All the other cutoff values are the averages of two consecutive ordered observed test values.

Figure 6: Cut-off value of psychological vulnerability

Additionally, the AUC (area under the curve) is a useful criterion for evaluating a test's overall accuracy rate. It allows numbers between 0 and 1, with 0 indicating a completely inaccurate test and 1 indicating a completely accurate test. The trapezoidal rule can be used to compute AUC. In general, an AUC of 0.5 indicates no discrimination, 0.7 to 0.8 is acceptable, 0.8 to 0.9 is excellent, and greater than 0.9 is excellent. The AUC value for this test is 0.951 which indicates the significance of this test.

Researchers have identified the cut-off point considering sensitivity and specificity and figure 6 presents the cut-off value of psychological vulnerability which is 46. This value indicates that the lower range of it will be considered psychological vulnerability (actual negative state) and the upper range will be considered psychological resilience (actual positive state).

All the values collected from the field to estimate psychological vulnerability ranges from 28 to 68. Considering the cut-off points researchers have differentiate the vulnerable psychological state from resilient state. People who present values lower than 46 are considered to be psychologically vulnerable, while people with greater value than 46 are psychologically resilient.

In Figure 7, the red line marked as cut-off point and the left section marked with orange color represents the value of psychologically vulnerable people. Whereas on the right side of the cut-off value, marked with green color, represent the value of psychological resilience.

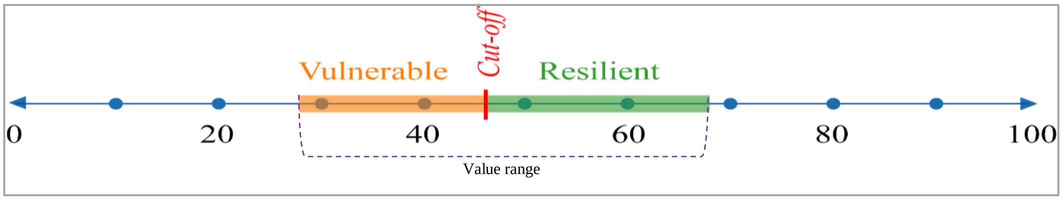


Figure 7: Graphical representation of the cut-off point, indicating psychological resilience and psychological vulnerability

Based on this cut-off value researchers were able to categorize the psychological well-being of the community. The identified two categories (vulnerable and resilient) with the psychological well-being value and the percentage of peopleare given in table 4 where 71.67% people present vulnerable state and 28.33% present resilient state. This results depicts that the majority of the community are psychologically vulnerable.

Table 4: Category of Psychological well-being

Psychological Well-being Value	Category	Percentage
0 to 45	Vulnerable	71.67
46 to 100	Resilient	28.33

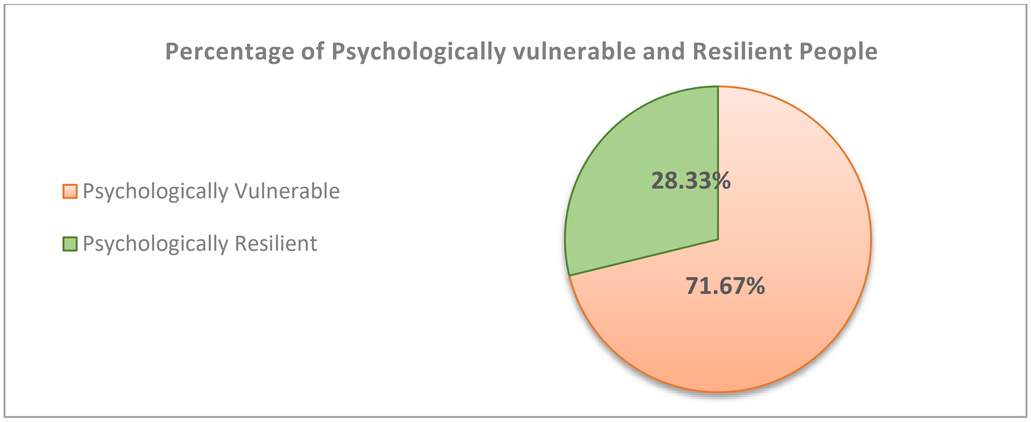


Figure 8: Percentage of psychologically resilient and vulnerable people

Figure 8 presents that psychological vulnerability holds 71.67%, and psychological resilience holds only 28.33%. This scenario indicates that more than half of the community is psychologically vulnerable due to different kinds of hazards and only some people are resilient who can "bounce back" psychologically during or after any hazards.

5 Discussion

Hazard Potential:

Geo-tectonic vulnerability:

Bangladesh's core structural framework is referred to as the tectonic framework. The folding intensity in the eastern Chittagong hill tracts is greater, resulting in a higher topographic elevation. The research area is located between the Arakan Segment and the southern part of the Sunda megathrust's Indo-Burma segment (Sieh, 2007).

There is a piece of historical evidence that this part of Bangladesh was highly active tectonically in the past, which caused a massive earthquake in 1762 with a magnitude of 8.5 to 8.8(Cummins,2007; Wang et al., 2013).Along Myanmar's west coast and Bangladesh's southeast coast, the consequences of the 1762 Arakan earthquake were documented (Alam and Dominey-Howes, 2014). Tsunami waves killed 200 people in Bangladesh's Chittagong region and 500 people in Dhaka, mostly due to upturned boats (Mondal et al., 2018).This evidence gives us a hint that this area might be tectonically still active and vulnerable, which can cause massive damage in the near future. The calculated value of Hypsometric Integral for the study area is **0.56** indicates that the watershed is in the mature stage (stabilized) and susceptible to erosion. Here channel processes play a larger role in developing the landscape. On the other hand,the mountain front sinuosity index value is **1,** which means that the land is decreasing the levels of tectonic activity and susceptible to erosion as well as the most active mountain front.

Landslide Vulnerability:

The term "landslide" refers to the downward movement of soil, rock, and organic materials due to gravity (Highland and Bobrowsky, 2008). Generally, landslides may result from a range of causes such as weaknesses in composition or structure of the rock or soil, high precipitation, changes in groundwater level, seismic activity, over-steepening of slopes, changes in surface water runoff, and heavy loads on slopes. Besides, human impacts (e.g., construction activity) significantly influence altering natural processes in the environment (Islam,etal., 2014).

In Bangladesh, every year during the monsoon period, due to heavy rainfall Rangamati, Bandarban and the Chittagong hill tracts face huge damages and many deaths for this hazard (Mia, Sultana and Paul, 2015; Ahmed et al., 2014). The number of deaths in 2017 was 170, which is significantly high (Anas, 2019; DhakaTribune, 2019). In 2019, atleast 26 landslideswere recorded in Ukhia and 273 shelters were affected (ERCC, 2019). In the study area, many people live under potential threat.

Cyclone Vulnerability:

Communities across the Bay of Bengal have experienced some of the world's biggest weather disasters. Because of theexceptional shape of the Bay of Bengtal along with its many creeks and the level low-lying terrestrialparts, cyclones generating in this part movesdistant inland, affectingthe coastal population of the study area (Khan, 1995; Liberto, 2017; Hossain and Miah, 2011; Habib, Shahidullah and Ahmed, 2012).

These geographical characteristics are one of the reasons why the Bay of Bengal has produced some of the world's deadliest tropical cyclones.The Great Bhola Cyclone "killed 300,000 to 500,000 people in Bangladesh" in 1970, is widely regarded as the deadliest on record. In 1991, over "140,000 people were killed in Bangladesh" by nother major storm surge at the chittagong coastal belt(Liberto, 2017; Choudhury, 2001; Hossain and Miah, 2011).

In recent times, cyclone Sidr caused huge economic damage to Bangladesh. Cyclone Sidr hit Bangladesh's southwest coast in 2007, with winds of up to 240 kilometers per hour. Tidal waves up to five meters high and surges up to six meters high accompanied the category four storm, smashing coastal and river embankments, flooding low-lying areas, and causing considerable physical damage.The death toll from Sidr is estimated to be 3,406, with 1,001 people still missing and more than 55,000 people injured. The entire damage and losses inflicted by the hurricane, according to the Joint Damage, Loss, and Needs Assessment were estimated to be 1.7 billion U.S. dollars (GFDRR, 2019). Cyclone Nargis struck Bangladesh in 2008 as a Category 4 storm with a storm surge of over 10 feet.

This evidence clearly shows that the coastal area of Bangladesh is highly vulnerable to cyclones and it has a devastating impact on resources and human life (Hossain, Islam, Sakai and Ishida, 2008; Farukh, Hossen and Ahmed, 2019). Similarly, the study area is situated in a high-risk zone and witnessed several deadliest cyclone events from 1965 to 2017. The studied community faced huge damage because of these events and suffered miserably.

Tidal flood, Flash flood and Storm surge vulnerability:

Flooding is a natural phenomenon, which cannot be prevented. Whenever a flood strikes in our country, it creates a miserable situation for people and creates challenges for the government to face the damages. It damages agriculture, people's livelihood, environment, infrastructure (roads, embankment, buildings etc.) along with health conditions (both physical and mental) of the affected people (Stanke et al., 2012; Milojevic, Armstrong and Wilkinson, 2017). These damages are ongoing with the flood. Flash floods and tidal floods are common types of floods that Bangladesh faces every year. Heavy or severe rainfall, or upstream flooding, in a short period of time across a relatively small area, causes flash floods. Water levels increase and decrease quickly during flash floods, with little or no caution (ACAPS, 2019). On the other hand,the tidal flood also caused by excessive rainfall, storm surge along with natural tidal effects. Tidal floods cause salinity intrusion in the study area.

Beside flash flood and tidal flood, the study area is also vulnerable to storm surge. Storm surges, which are caused by atmospheric forces in the weather system, cause the waterline in a coastal area or in the interiorwetland to fluctuate for a time which may range between a minutes to a couple of days. Storm surges are created by pressure variances within a cyclonic storm and also by powerful winds blowing straight onto the water. As a result, a large wave of water moves at the same rate as the cyclone. A exclusive mix of high tides, a funnel shaped coastal design, low level coastal topography, and a densle populated group in the northern Bay of Bengal has resulted in some of the highest storm surge casualty rates (Flierl and Robinson, 1972; Habib, Shahidullah and Ahmed, 2012).

Psychological Vulnerability:

However, in a general sense, vulnerability emphases on the state of a system prior to a catastrophe.The "exposure and Sensitivity" are two characteristics of vulnerability. Whereas resilience is a strategy that helps to improve the system's ability to resist and recover from hazards during and post-disaster periods. (Lei, et al., 2013). A system's vulnerability is an internal characteristic that inevitably leads to the negative impacts of a hazard. It identifies the structural and functional faults that are vulnerable to external stressors. Under specific hazard intensities, vulnerability generally determines the likelihood of a disaster and the associated losses; therefore a system with a higher vulnerability may maximize its disaster risk.In the disaster risk field, resilience is frequently expressed as a reactive response to a specific catastrophe. It encapsulates the ability to resist, absorb, and recover from the effects of a hazard quickly and effectively (Berkes et al. 2003; Folke 2006). For example, when a damaging earthquake strikes, a resilient community can quickly function normally after the disruption..

Hence, "psychological vulnerability is defined as the set of cognitive schemes that increase the Sensitivity to stress" (Sinclair and Wallston 1999). It's a normal part of being human, and each of us has a level of vulnerability that might lead to psychological issues when we're exposed to stressful situations (Zubin & Spring, 1977). In contrast,psychological resilience is the ability to adapt in a certain difficult circumstances and risks (Masten et al. 1990). According to a behavioral definition, "it is the ability to go through negative situations using positive feelings and it can be used to explain the psychological state of those who can successfully deal with negativity"(Tugade et al. 2004).

Researchers have measured psychological vulnerability and a cut-off point has been determined (figure 6). Based on the cut-off point researcher categorized the psychological well-being of the studied community (table 4). The calculated data has concluded that 71.67% of people in the study area are psychologically vulnerable and 28.33% are psychologically resilient (figure-8). This percentage indicates that 71.67% of people might suffer psychologically during and after a hazard. And the psychological distress intensity will be varied with the value below 46; a lower value increases the psychological distress. Psychologically vulnerable people of the study area might develop psychological disorders over time, such as post-traumatic stress disorder (PTSD), generalized anxiety disorder (GAD), generalized depression disorder (GDD) etc. Psychological vulnerability significantly influences the loss and damage intensity of any hazards. On the other hand, only 28.33% of people are psychologically resilient, which means that this small number of people can bounce back psychologically after any hazards. These resilient people have the absorbing and adaptive capacity.

So, the studied community has a higher chance of being highly damaged by any hazards because not only being situated in a bio-physically vulnerable place and because more than 70% of people are psychologically vulnerable. These psychologically vulnerable people are affected more than those who are psychologically resilient. Psychological vulnerability is one reason why a community takes time to recover the damage, and so much research has been done to prove this statement. In 2002, Norris et al. studied 61396 hazard victims worldwide and concluded that 77% of them suffered from various psychological problems, including post-traumatic stress, depression, anxiety, and psychiatric problems. Furthermore, even three years after the earthquakes in Turkey, a study based on a sample population found that the prevalence of PTSD was 11.7 percent (Onder et al. 2006).

6. Conclusion

Though for a long-time mental health condition have always been ignored during and aftermath of any hazards. The discussion in this research indicates that mental health conditions during and aftermath hazards can negatively impact the damage. On the other hand,psychological resilience plays a constitutional and essential part in disaster management.(Carver, 1998; Tugade, Fredrickson and Feldman., 2004; Sherrieb, Norris and Galea, 2010; McFarlane and Williams, 2012). In addition, the need for mental health services is significant before and after the disaster. That's why psychological vulnerability and psychological resilience associated with mental health during and after a hazard cannot be ignored. Government and policymakers should consider this dimension in disaster management to identify the most vulnerable individuals because only structural recovery will not be enough to reduce vulnerability in a holistic approach.

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