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Research Article

Mental Health Symptoms Among Flood Victims in Madaripur District in Bangladesh: A Cross-sectional Study

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Abstract

An emerging public health issue is mental disorders. Natural disasters such as hurricanes, tornadoes, cyclones, droughts and earthquakes place tremendous psychological and social burden on the communities affected. The negative effects of flooding on human health are complex and substantial, including drowning, accidents and an increased prevalence of common mental illnesses. It can pose tremendous social and welfare challenges that can persist for long periods of time due not only to flooding (the primary stressor), but also to the ongoing secondary stressors that occur as people struggle to restore their lives, properties and relationships.

The purpose of this study is to assess the mental health impacts of flooding and to explore the key determinants of flood-related mental illness in the flood affected region of Bangladesh. In this research, data is obtained from all four upazillas, in the Madaripur district of Bangladesh. A total of 384 people surveyed after the flood events in three Upazillas in the month of September to November 2020. This study examines the relationship between flooding and developing of mental health symptoms.

Chi square test and fisher's exact test with cross tabulation were used to identify the extent of mental health symptoms on bsrs-5 scale against each variable to find out the extent of mental health symptoms among the blood victims.

We found 17% to 40% of anxiety which range from mild to extreme among the participants. We found 18% to 44% of mild to extreme level of depression in our study. Among male 31.03% were developed severe mental health symptoms which is significantly higher than female where only 20.49% of female were developed severe mental health symptoms. Among the age group from 20 years to above 60 years 45.05% of the participants aged 41 to 50 years developed severe mental health symptoms. Study participants who were with living more people together, having more children, less number of people as income source, less level of education, source of income along with monthly income have significantly increased the prevalence of mental health symptoms which is consistent with the literature review.

The findings of this study will help policy makers to improve early intervention and screening programs and will also have significant public health implications in the control and prevention of flood related mental illness in Bangladesh.

Keywords: Mental Health Symptoms; BSRS-5; Flood

Abbreviations

BP: Bodily Pain; BMD: Bipolar Mood Disorder; GDP: Gross Domestic Product; GH: General Health Perceptions; MH: Mental Health; MCS: Mental Component Summary; PCS: Physical Component Summary; PTSD: Post-traumatic Stress Disorder; RE: Role Limitations Due to Emotional Problems

Introduction

Mental health disorders are a burning public health issue. According to World Health Organization (WHO) Mental health problems account for thirty six percent of the illness burden of the whole world, together with neurological disorders and opioid use and which is more than incidences of cardiovascular diseases and cancer related disease burden in the whole world [39].

Climate change has become a growing global concern because effect of climate change on the health of human being is severe as because this effect is occurring frequently on human lifetime with more longevity and severity year after year. Extreme weather conditions bring so many consequences on human health [2,25]. Among these, some of the health consequences are directly impacting on human health such as direct physical injury, Permanent or temporary morbidity and lastly mortality [2,25]. On the other hand, there are some long term consequences due to extreme weather conditions, among them long term consequence on human mental health is the major one which is concerning to the public health in recent times [15]. Different aspects of Climate Change is affecting in different ways whether directly or indirectly on developing mental health symptoms ranging from mild, moderate and lastly severe mental health symptoms. Due to increase chance of having physical injury during weather extremities which is considered as a direct effect on human health in any climate change, causing anxiety among people living in the affected region. Repeated exposure to weather extremities such as during flood or storms anxiety disorders specially, acute anxiety disorder is increased. Mr. Berry illustrated different routes of climate change impact on health of human being (Figure 1) [5]. Now a days with the rapidly changing environment all the disaster specially flood increasing than previous years with more intensity and frequency [40]. With increasing number of disaster the presence of mental health disorders will increase in coming future among population

Flood may cause modification of psychological and social behavior of the affected community [22]. There are few mental health disorders which needs long time exposure to develop after disasters such as flood. For example, bipolar mood disorder (BMD). Anxiety disorder (Generalized), suicidal tendency and Paralysis trauma are most common mental health disorders which occur after repeated long time exposure to major disasters. Disaster prone population overcome any kinds of psychological trauma quickly after the end of disaster period because of their fighting mentality. Whatever the length of disaster duration some mental health problem are common at the beginning of disaster such as anxiety, neurosis and depression which may be seen among the disaster prone community people living in disaster prone areas experiencing major disasters years after years [25]. Sometimes experiencing a natural Calamities can be the most devastated events which cause mental trauma to someone's life living in a disaster affected areas. This devastated event causes several mental health disorders such as PTSD (Post Traumatic Stress Disorders) which is very common, another one is depression. These types of mental health disorders are due to either short term or long-term effect on someone's mental health after experiencing even one major disaster event in his/her lifetime. If we look backward to see the mental health conditions of flood victims in Mexico which occurred in the year 1999, we can see that people who were the victims suffered depression even after six months of flood event. Not only that people suffered PTSD after two years of that flood event [26].

On the basis of disaster affected countries who are suffering from disaster years after years Bangladesh ranks 9th in the 2017 Climate Risk Index worldwide. On the other hands Bangladesh ranks 7th among whole world in Climate Risk Index. Climate Risk Index specially focusing on long-term disasters affecting on countries around the globe. From 1998 to 2017 Bangladesh stands on 10th in the list of most affected countries by disasters. The geographical location and low-lying terrain of the country render it especially vulnerable to various types of natural catastrophe.

Flood is a major concern among all the natural disaster in Bangladesh. Due to geographical location Bangladesh is the home of delta which is the largest among the whole world. Ganges, Meghna and Brahmaputra these three rivers created this largest delta. Collectively, these rivers, including the Himalayan mountains, drain a total of around 1.7 million square kilometers and cause floods in Bangladesh every year.

According to the recent 2019-19 National Mental Health Study, about 20 million people in the country have suffered from various forms of mental illness. 16.8% of people with the highest incidence of depression suffer from some type of mental illness (6.7 percent). There are so many community people who are living in the disaster affected areas which we don't have enough data about their mental health conditions before, during or after the disaster in Bangladesh. Among the disaster prone community people, costly individuals develop mental health disorders due to factors related to mental health disorders [3]. As Bangladesh is one of the most affected country by natural disaster such as flood in every points of view but there is not enough documentation or study of developing of mental

health symptoms among the disaster prone community people living in the disaster prone areas in Bangladesh [9,30]. Community People who are affected by disasters, a report which is published by WHO indicates that there are about thirty to fifty percent of population among them who suffers from mental health disorders. The main reasons behind developing mental health disorders are distress related to disasters, Previous traumatic exposure, fear of injury, fear of death, fear of seeing family member sufferings, lack of support from the surroundings specially from society where they live in [6,41]. As there is very minimum study in Bangladesh to understand disaster related mental health symptoms, this cross-sectional study is performed to understand post-flood stress and mental health symptoms among flood-affected individuals in Madaripur district in Bangladesh.

The results which will obtain through the study will help understanding mental health symptoms among flood prone areas after flood. This study findings will also assist in relevant decision making by the authority to decrease mental health symptoms among flood affected people. Prevention of developing mental health related symptoms due to any disaster events which will occur in coming future this study findings may act as a valuable resource.

Materials and Methods

Study design

This cross-sectional analytical study performed in September to November, 2020 after the flood events in Madaripur district. Subjects in the study population were randomly selected across three upazillas in Madaripur district of Bangladesh and the results are assessed by comparing outcomes.

Target population and sample population

The study population was 20 years and above age group people consisting of both male and female in Madaripur district who experienced the flood disaster in 2020 and the representative sample population fulfilled the inclusion criteria of the study.

Study site and area

The research was performed in 4 upazilas in the district of Madaripur (Madaripur Sadar, Kalkini, Rajoir, Shibchar). The study area was next to the River Padma and Meghna river in which peoples are suffering from flood every year with a huge loss in every aspect of their lives. Flood is affecting in these areas due to its geographic location which makes community people vulnerable due to frequent flooding. The community people who are living in this flood prone vulnerable areas in Madaripur district were selected for this research purpose. This area's total population is 12,12,198 (Population and Housing Census, 2020). Riverine floods have been experienced almost every year by people in this region. On average, the respondents found the flood duration was 50-60 days.

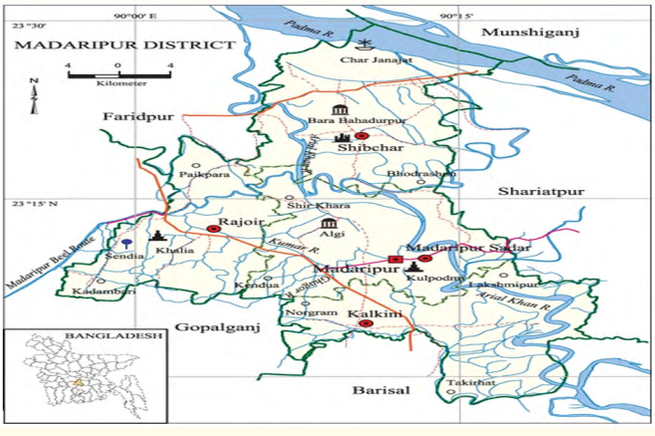

Figure 1: Madaripur District.

Study period

Study duration was six months from 1st September 2020 to 28th February 2021.

Sample size

Since it is a cross-sectional study, the following formula was used for sample size collection: $n = \frac{z^2pq}{d^2}$.

Sample size calculation

Here,

q = 1-p

z = Confidence level of interest (for 95% = 1.96)

p = 0.50 (Mental health symptoms, here it is assumed as 50%)

n = Sample size

d = Degree of accuracy, [Here d = 0.05]

$$n = \frac{z^2pq}{d^2} = (1.96)^2 X [(0.5) * (1 - 0.5)] \div (0.05)^2 \cong 384.$$

Sample size 384.

Inclusion criteria

- People who are residing in the flood-affected union of Madaripur district

- Aged 20 years and/or above
- Both male and female participants who agreed to give consent
- Able to understand the questions of BSRS-5.

Exclusion criteria

People who belongs from the same family.

Sampling technique

The method of convenience sampling was used to test the impact of post-flood stressors and mental health symptoms. In this survey, there were a total number of 384 participants who previously fit the inclusion criteria.

Data collection tools

After obtaining informed consent, a self-administrated questionnaire (pre-coded and open-ended) used to collect the demographic information and the BSRS-5 questionnaire was administered to measure every aspect of mental health symptom among participants by face to face interview technique. However, no measures were taken as part of the analysis.

Data management and analysis plan

There was different measuring score for different mental health conditions and socio-economic data which was used in this study to assess individual mental health conditions for every adult individual.

The prevalence of each post flood mental health symptoms in Madaripur district assessed by using the Pearson chi-square test and Fisher's exact test where any cell in Pearson chi-square test was is less than or equal five. Descriptive analyses of the socio-demographic and exposure variables and mental illness was conducted for examination of the distribution of each variable and also descriptive statistics calculated for each variable. Pearson chi-square and Fisher's exact test was used to assess the bivariate association between the socio-demographic and the exposure variables along with regression analysis to find association between dependent and independent variables. The statistical significance level was fixed at 5% of 95% confidence interval. All analyses were carried out using STATA-16.

Quality control and quality assurance

The study was aiming to identify post flood stressors and mental health symptoms in a waterlogged region and thus collect data through face to face interview. The instrument of the study was a questionnaire created by the researchers to collect data and consisted of many sections which aimed at finding out the respondent's opinion. Furthermore, it addresses study plans, analysis and methods of evaluation and we are using simple random sampling which represent the whole population. For data interpretation and evaluating the study hypotheses T-test, ANOVA and Z-test were used. Data review and final report writing was done by Researcher himself. Quality was maintained during data collection and report presentation with the required guidance from the department of public health, NSU.

Ethical considerations

Before starting the study, all necessary administrative approvals will be obtained from the responsible authorities (NSU ethical committee, NGH and CRI authorities, GoB). The confidentiality of the respondents will be assured and maintained by the researcher. Before Conducting the study, verbal consent was ensured from study participants.

Limitations of the Study

- All the participants in this study answered the questionnaires which was self-rated. Recall bias is a concern in self-assessment which can lead to increase or decrease the number of mental health cases.
- Data were assessed only in post flood period using self-rated questionnaire. No pre flood data were assessed in this study using same questionnaire.
- This study is not a cohort study only one cross sectional survey is conducted for data collection after the flood period, pre and post flood direct comparison of mental health symptoms at the individual level is not possible in this study.

Results and Discussion

Sample Characteristics	Sample distribution (n = frequency)	Percentage (%) Mean (SD)
Age	384	39.16
Sex		
Male	262	68.23
Female	122	31.77
Age Group		

Young (21-30)	88	22.92
Young Adult (31-40)	131	34.11
Middle Age (41-50)	111	28.91
Old (51-60)	47	12.24
Older (Above 60)	7	1.82
Upazilla		
Shibchar	220	57.29
Rajoir	60	15.63
Madaripur Sadar	104	27.08
Marital Status		
Single	10	2.61
Married	365	95.05
Divorced/ Separated/Widow	9	2.34
Total house Member		
Small (<4)	32	8.33
Medium (<6)	163	42.45
Large (<9)	174	45.31
Very Large (Above 8)	15	3.91
No of Children		
No Children	23	5.99
One Child	85	22.14
Two Child	96	25.00
Three Child	108	28.13
Four Child	45	11.72
Five Child	22	5.73
More than five Child	5	1.30
Number of Sources of income		
One person	244	63.54
Two persons	130	33.85
>Two persons	10	2.61
Education		
No education and Preschool	9	2.34
Primary	80	20.83
Secondary	170	44.27
Higher	72	18.75
College	43	11.20
University	10	2.61
Income		
Pre Flood		
Low (Upto 10k)	52	13.54
Middle (10-20k)	156	40.63
Upper Middle (>20k)	176	45.83
During Flood		
Low (Upto. 10k)	119	54.95
Middle (10-20k)	182	39.58
Upper Middle (>20k)	83	5.47
Source of Income		
Agriculture	119	30.99
Transport	41	10.68
Garments	28	7.29
Day labour	63	16.41
Self Employed Business	44	11.46
Fishing	13	3.39
Poultry	7	1.82
Government	25	6.51
Private	18	4.69
Others	26	6.77
Domestic Violence		
No violence	294	76.56
Physical violence	23	5.99
Verbal/Emotional	67	17.45
Living in Self House		
Yes	333	86.72
No	51	13.28
Presence of Chronic Disease		
Central Nervous System		
Yes	12	3.13
No	372	96.88
Cancer		
Yes	6	1.56
No	378	98.44
Respiratory Disease		
Yes	96	25
No	288	75
Diabetes		
Yes	46	11.98
No	338	88.02

Table 1: Sample characteristics of the study population (n = 384).

Sample characteristics of the study population

Table 1 shows the sample characteristics of the study population of Madaripur district among them 57% were from Shibchar upazilla, 27% were from Sadar upazilla and 16% were from Rajoir Upazilla, Madaripur. Total 384 people participated in this study, among them 262 (68%) were Male and 122 (32%) were Female. The average age was 39.16 years among the study population. In the study population 34% were aged 31-40 years, 29% were aged 41-50 years, 23% were aged 21-30 years,12% were aged 51-60 years and 2% were aged above 60 years. 95% were married, 3% were single and only 2% were divorced in the study population. 45% of respondents were from those family where family members are less than nine but more than five people.43% of respondents were from those family where family members are less than six but more than three people.8% of respondents were from those family where family members are less than four people.4% of respondents were from those family where family members are more than eight people.28% of the respondent were having three children, 25% of the respondent were having two children, 22% of the respondent were having one children, 12% of the respondent were having four children, 6% of the respondents were having No children and five children each. Only 1% were having more than five children.64% of the respondents were the only income source in their family.34% of the respondents had another one to contribute to family income source besides him/her.2% of the respondents were having more than two persons to contribute to family income besides him/her. Majority of the respondents (44%) completed upto secondary level education. 21% of the respondent completed upto primary level education.19% of the respondent completed upto higher secondary level education.11% of the respondent completed upto college level education. 3% of the respondent completed upto university level education. There were 2% of the respondents who were uneducated.31% of the respondents were dependent on agriculture as source of income, Day labour were 16%, Self-employed business were 11%, Transport were also 11%, 6% each were Garments, Government employee, and Others profession each, 5% were private job holder, 3% were fishing and 2% were poultry as their source of income among the participants.

During preflood period 46% of the participants monthly income were more than 20000 BDT, 41% of the participants monthly income were between 10000 to 200000 BDT, 14% of the participants monthly income were upto 10000 BDT but during flood period only 5% of the participants monthly income were more than 20000 BDT, 41% of the participants monthly income were between 10000 to 200000 BDT, 55% of the participants monthly income were upto 10000 BDT.

87% of the participants were living in their own houses. Rest of the participants were living in rented house.

In case of family violence whether physical or verbal or Emotional to female partners by male partners it was observed that only 17% of female partners suffered verbal/Emotional violence and 6% of female partners suffered Physical violence by their male partners. 77% of female partners did not suffer any kinds of physical or verbal or Emotional by their male partners.

On the basis of Chronic diseases, it was seen that 97% of the participants did not have any central nervous system diseases. Only 3% of the participants had central nervous system diseases.

98% of the participants did not have any Cancer related diseases. Only 2% of the participants had Cancer related diseases.

75% of the participants did not have any Respiratory related diseases. Only 25% of the participants had Respiratory related diseases.

88% of the participants did not have any diabetes. Only 12% of the participants had diabetes.

BSRS-5		
B-1 Feeling tense or keyed up (Anxiety)	Mean: 2.661458	SD: 1.355763
Not At All	30	7.81 %
A little Bit	66	17.19%
Moderately	61	15.89%
Quite a bit	74	19.27%
Extremely	153	39.84%
B-2 Feeling blue (Depression)	Mean: 2.742188	SD: 1.368688
Not At All	28	7.29%
A little Bit	68	17.71%
Moderately	49	12.76%

Quite a bit	69	17.97%
Extremely	170	44.27%
B-3 Feeling easily annoyed or irritated	Mean: 2.169271	SD: 1.142574
Not At All	35	9.11%
A little Bit	67	17.45%
Moderately	131	34.11%
Quite a bit	100	26.04%
Extremely	51	13.28%
B-4 Feeling inferior to others (Inferiority)	Mean: 1.932292	SD: 1.163231
Not At All	58	15.10%
A little Bit	80	20.83%
Moderately	95	24.74%
Quite a bit	132	34.38%
Extremely	19	4.95%
B-5 Trouble falling asleep (Sleep Disturbance)	Mean: 2.049479	SD: 1.117228
Not At All	30	7.81%
A little Bit	107	27.86%
Moderately	94	24.48%
Quite a bit	120	31.25%
Extremely	33	8.59 %

Table 2: Prevalence of anxiety, Depression, Feeling easily annoyed or irritated, feeling inferior to others and Trouble sleeping due to flooding.

The prevalence of anxiety, Depression, Feeling easily annoyed or irritated, Feeling inferior to others and Trouble sleeping due to flooding is showing in table 2.

Among 384 Participants 7.81% didn't have any anxiety. 17.19% had a little bit anxiety, 15.89% had moderately anxiety, 19.27% had quite a bit anxiety and 39.84% had extremely anxious due to flooding [Mean = 2.66, SD = 1.355].

Among 384 Participants 7.29% didn't have any depression. 17.71% had a little bit depression, 12.76% had moderately depression, 17.97% had quite a bit depression and 44.27% had extremely depressed due to flooding [Mean = 2.74, SD = 1.368].

Among 384 Participants 9.11% didn't feel irritated or annoyed easily any, 17.45% had annoyed easily, 34.11% had moderately feel irritated or annoyed, 17.97% had quite a bit feel irritated or annoyed and 44.27% had extremely feel irritated or annoyed due to flooding [Mean = 2.16, SD = 1.14].

Among 384 Participants 15.10% didn't have any inferiority feeling. 20.83% had a little bit inferiority feeling, 24.74% had moderately inferiority feeling, 34.38% had quite a bit inferiority feeling and 4.95% had extremely inferiority feeling due to flooding [Mean = 1.93, SD = 1.11].

Among 384 Participants 7.81% didn't have any trouble falling asleep. 27.86% had a little bit trouble falling asleep, 24.48% had moderately trouble falling asleep, 31.25% had quite a bit trouble falling asleep and 8.59% had extremely trouble falling asleep due to flooding [Mean = 2.04, SD = 1.117].

Gender	Mental health symptoms (BSRS-5)				Pearson chi2(3)	P value
	Normal	Mild	Moderate	Severe		
Male	27(10.31%)	62(23.66%)	91(34.73%)	82(31.30%)	7.5899	Pr = 0.055
Female	22(18.03%)	29(23.77%)	46(37.70%)	25(20.49%)		

Table 3: (a): Gender based differences on prevalence of mental health Symptoms.

The Gender based differences in the prevalence of mental health symptoms on bsrs-5 scale is showing in table 3(a). Among 262 male and 122 female participants in madaripur district 31.3% of male participants had severe mental health symptoms in comparison to female who had severe mental health symptoms to 20.5%. 34.7% of male and 37.7% of female had moderate mental health symptoms. 23.6% of male and 23.7% of female had mild mental health symptoms. 10.3% of male and 18% of female participants had no mental health symptoms during the flood period [Pearson chi square = 7.5899, p = 0.005]. The results of the Pearson chi square test showed that there is a significant Gender based differences in the prevalence of mental health symptoms during flood period in madaripur district.

Age category	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
21-40 Years	37(16.89%)	51(23.29%)	82(37.44%)	49(22.37%)	0.000
41-50 years	2(1.80%)	17(15.32%)	42(37.84%)	50(45.05%)	
51- Above 60 years	10(12.76%)	23(42.59%)	13(24.07%)	8(14.86%)	

Table 3: (b): Age group wise differences on prevalence of mental health Symptoms.

The age group wise differences in the prevalence of mental health symptoms on bsrs-5 scale is showing in table 3(b). Out of 211 participants aged 21-40 years 22.37% had severe, 37.44% had moderate, 23.29% had mild mental health symptoms.16.89% had no mental health symptoms. Out of 111 participants aged 41-50 years 45% had severe, 37.8% had moderate, 15.3% had mild mental health symptoms.1.8% had no mental health symptoms. Out of 54 participants aged 51- above 60 years 14.81% had severe, 24.07% had moderate, 42.59% had mild mental health symptoms.18.52% had no mental health symptoms [Fisher's exact = 0.000]. The results of the Fisher's exact test showed that there is a significant age group wise differences in the prevalence of mental health symptoms during flood period in madaripur district where the more vulnerable age group is 41-50 years where 45% participants had severe mental health symptoms.

Socio-economic diierence wise prevalence of mental health symptoms

Upazilla name	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
Shibchar	38(17.27%)	45(20.45%)	82(37.27%)	55(25.00%)	0.025
Rajoir	6(10.00%)	15(25.00%)	1(35.00%)	8(30.00%)	
Madaripur Sadar	5(4.81%)	3129.81%)	34(32.69%)	34(32.69%)	

Table 4: (a): Upazilla wise differences on prevalence of mental health Symptoms.

Upazilla wise differences in the prevalence of mental health symptoms on bsrs-5 scale is showing in table 4(a). Out of 220 participants in shibchar upazilla 25.00% had severe, 37.3% had moderate, 20.45% had mild mental health symptoms.17.3% had no mental health symptoms. Out of 60 participants in Rajoir upazilla 30.00% had severe, 35.00% had moderate, 25.00% had mild mental health symptoms.10.00% had no mental health symptoms. Out of 104 participants in Sadar upazilla 32.7% had severe, 32.7% had moderate, 29.8% had mild mental health symptoms.4.81% had no mental health symptoms [Fisher's exact test = 0.025].

Marital status	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
Single	2(20.00%)	8(80.00%)	0(0.00%)	0(0.00%)	0.000
Married	46(12.60%)	83(22.74%)	132(36.16%)	104(28.49%)	
Divorced/Separated/Widow	1(11.11%)	0(0.00%)	5(55.56%)	3(33.33%)	

Table 4: (b): Marital status wise differences on prevalence of mental health Symptoms.

Marital status wise differences in the prevalence of mental health symptoms on bsrs-5 scale is showing in table 4(b). Out of 10 single participants no one had severe or moderate mental health symptoms, 80.00% had mild mental health symptoms.20.00% had no mental health symptoms. Out of 365 married participants 28.5% had severe, 36.1% had moderate, 22.74% had mild mental

health symptoms.12.6% had no mental health symptoms. Out of 9 Divorced/Separated/Widow participants 33.3% had severe, 55.6% had moderate. 11.1% had no mental health symptoms [Fisher's exact test = 0.000].

Household members	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
Less than or equal seven family members	38(17.19%)	52(23.53%)	77(34.84%)	54(24.43%)	0.013
Family member more than seven	11(6.75%)	39(23.93%)	60(36.81%)	53(32.86%)	

Table 4: (c): Household member wise differences on prevalence of mental health Symptoms.

On the basis of total household members living together the prevalence of mental health symptoms on bsrs-5 scale is showing in table 4(b). Out of 221 participants who were living in a house with less than or equal seven family members 24.43% had severe, 34.84% had moderate, 23.53% had mild mental health symptoms.17.19% had no mental health symptoms. Out of 163 participants who were living in a house with more than seven family members 32.52% had severe, 36.81% had moderate, 23.93% had mild mental health symptoms.6.75% had no mental health symptoms [Fisher's exact test = 0.013].

No of children in a family	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
No of children less than four	44(14.10%)	72(23.08%)	113(36.22%)	83(26.60%)	0.010
No of children Four	5(11.11%)	6 (13.33%)	15(33.33%)	19(42.22%)	
No of children more than four	0 (0.00%)	13(48.15%)	9 (33.33%)	5 (18.52%)	

Table 4: (d): Number of children in a family wise differences on prevalence of mental health Symptoms.

On the basis of total number of children in a family the prevalence of mental health symptoms on bsrs-5 scale is showing in table 4(d). Out of 312 participants who had less than four children living among them 26.60% had severe, 36.22% had moderate, 23.08% had mild mental health symptoms. 14.10% had no mental health symptoms. Out of 45 participants who had four children living among them 42.22% had severe, 33.33% had moderate, 13.33% had mild mental health symptoms. 11.11% had no mental health symptoms. Out of 27 participants who had more than four children living among them 18.52% had severe, 33.33% had moderate, 48.15% had mild mental health symptoms [Fisher's exact test = 0.010].

Number of income source in a family	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
One person	31(12.70%)	38(15.57%)	94(38.52%)	81(33.20%)	0.000
Two persons	18(13.85%)	48(36.92%)	38(29.23%)	26(20.00%)	
>Two persons	0 (0.00%)	5 (50.00%)	5 (50.00%)	0	

Table 4: (e): Total number of income source in a family wise differences on prevalence of mental health Symptoms.

On the basis of total number of income source in a family the prevalence of mental health symptoms on bsrs-5 scale is showing in table 4(e). Out of 244 participants who were only incoming members for their family among them 33.2% had severe, 38.52% had moderate, 15.57% had mild mental health symptoms. 12.70% had no mental health symptoms. Out of 130 participants who had two incoming members for their family among them 20.00% had severe, 29.23% had moderate, 36.92% had mild mental health

symptoms. 13.85% had no mental health symptoms. Out of 10 participants who had more than two incoming members for their family among them no one had severe but 50.00% had moderate, 50.00% had mild mental health symptoms [Fisher's exact test = 0.000].

Education level	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
Upto higher secondary	42(12.69%)	77(23.26%)	117(35.35%)	95(28.70%)	0.001
College	1(2.33%)	14(32.56%)	16(37.21%)	12(27.91%)	
University	6(60.00%)	0(0.00%)	4(40.00%)	0 (0.00%)	

Table 4: (f): Education level wise differences on prevalence of mental health Symptoms

On the basis of education, the prevalence of mental health symptoms on bsrs-5 scale is showing in table 4(f). Out of 331 participants who had finish school but didn't finish college education among them 28.70% had severe, 35.35% had moderate, 23.26% had mild mental health symptoms. 12.69% had no mental health symptoms. Out of 43 participants who had completed college level education but didn't start or complete university education, among them 27.91% had severe, 37.21% had moderate, 32.56% had mild mental health symptoms. 2.33% had no mental health symptoms. Out of 10 participants who had completed University level education among them no one had had severe but 40.00% had moderate mental health symptoms. 60.00% had no mental health symptoms [Fisher's exact test = 0.001].

Income source	Mental health symptoms(BSRS-5)				Pearson chi2	P value
	Normal	Mild	Moderate	Severe		
Agriculture	19(15.97%)	21(17.65%)	42(35.29%)	37(31.09%)	139.7794	Pr = 0.000
Transport	2(4.88%)	6(14.63%)	16(41.46%)	17(39.02%)		
Garments	4(14.29%)	8(28.57%)	5(17.86%)	11(39.29%)		
Day labour	8(12.70%)	4(6.35%)	17(26.98%)	34(53.97%)		
Self Employed Business	0(0.00%)	20(45.45%)	21(47.73%)	3(6.82%)		
Fishing	0(0.00%)	1(7.69%)	11(84.62%)	1(7.69%)		
Poultry	0(0.00%)	0(0.00%)	2(28.57%)	5(71.43%)		
Government	6(24.00%)	6(24.00%)	13(52.00%)	0(0.00%)		
Private	6(33.33%)	12(66.67%)	0(0.00%)	0(0.00%)		
Others	4(15.38%)	13(50.00%)	9(34.62%)	0(0.00%)		

Table 4: (g): Income source wise differences on prevalence of mental health Symptoms.

On the basis of income source, the prevalence of mental health symptoms on bsrs-5 scale is showing in table 4(g). Out of 109 participants to whom agriculture was the main income source among them 31.09% had severe, 35.29% had moderate, 17.65% had mild mental health symptoms. 15.97% had no mental health symptoms. Out of 41 participants to whom transportation was the main income source among them 39.02% had severe, 41.46% had moderate, 14.63% had mild mental health symptoms. 04.88% had no mental health symptoms. Out of 28 participants to whom garments was the main income source among them 39.29% had severe, 17.86% had moderate, 28.57% had mild mental health symptoms. 14.29% had no mental health symptoms. Out of 63 participants to whom day labour was the main income source among them 53.97% had severe, 26.98% had moderate, 6.35% had mild mental health symptoms. 12.70% had no mental health symptoms. Out of 44 participants to whom Self Employed Business

was the main income source among them 6.82% had severe, 47.73% had moderate, 45.45% had mild mental health symptoms. Out of 13 participants to whom fishing was the main income source among them 7.69% had severe, 84.62% had moderate, 7.69% had mild mental health symptoms. Out of 7 participants to whom day Poultry was the main income source among them 71.43% had severe, 28.57% had moderate mental health symptoms. Out of 25 participants to whom Government job was the main income source among them no one had severe but 52.00% had moderate, 24.00% had mild mental health symptoms. 24.00% had no mental health symptoms. Out of 18 participants to whom Private job was the main income source among them no one had severe and moderate but 66.67% had mild mental health symptoms. 33.33% had no mental health symptoms. Out of 26 participants to whom others job was the main income source among them no one had severe but 34.62% had moderate, 50.00% had mild mental health symptoms. 15.38% had no mental health symptoms [Pearson chi square = 139.7794, p = 0.000].

Domestic Violence	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
No violence	32 (10.88%)	78 (26.53%)	102(34.69%)	82(27.89%)	0.012
Physical violence	4(17.39%)	0 (0.00%)	9(39.13%)	10(43.48%)	
Verbal/Emotional	13(19.40%)	13(19.40%)	26(38.81%)	15(22.39%)	

Table 4: (h): Domestic violence wise differences on prevalence of mental health Symptoms.

On the basis of domestic violence by male partners to female partners in family the prevalence of mental health symptoms on bsrs-5 scale is showing in table 4(h). Out 0f 122 female participants 90 female participants who had faced domestic violence. Female participants who had faced physical violence suffered severe mental health problems upto 43.48%. On the other hand. Female participants who had faced verbal/Emotional violence suffered severe mental health problems upto 22.39% [Fisher's exact test = 0.012].

Sample characteristics (Self House)	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
Yes	49(14.71%)	88(26.43%)	122(36.64%)	74(22.22%)	0.000
No	0(0.00%)	3(5.88%)	15(29.41%)	33(64.71%)	

Table 4: (i): Living in self house wise differences on prevalence of mental health Symptoms.

On the basis of living in own house or not the prevalence of mental health symptoms on bsrs-5 scale is showing in table 4(i). Out of 333 participants living in their own houses among them 22.22% had severe, 36.64% had moderate, 26.43% had mild mental health symptoms. 14.71% had no mental health symptoms. Out of 51 participants not living in their own houses among them 64.71% had severe, 29.41% had moderate, 5.88% had mild mental health symptoms [Fisher's exact test = 0.000].

Income before flood	Mental health symptoms (BSRS-5)				Pearson chi2	P value
	Normal	Mild	Moderate	Severe		
Low (Upto 10k)	11(21.15%)	9(17.31%)	15(28.85%)	17(32.69%)	20.7472	Pr = 0.002
Middle (10-20k)	24(15.38%)	44(28.21%)	41(26.28%)	47(30.13%)		
Upper Middle (>20k)	14(7.95%)	38(21.59%)	81(46.02%)	43(24.43%)		

Table 4: (j): Income before flood wise differences on prevalence of mental health Symptoms.

On the basis of income before flood the prevalence of mental health symptoms on bsrs-5 scale is showing in table 4(i). Out of 53 participants who had monthly income upto 10000 BDT among them 32.69% had severe, 28.85% had moderate, 17.31% had mild mental health symptoms. 21.15% had no mental health symptoms. Out of 156 participants who had monthly income 10000 to 20000 BDT among them 30.13% had severe, 26.28% had moderate, 28.21% had mild mental health symptoms. 15.38% had no mental health symptoms. Out of 176 participants who had monthly income more than 20000 BDT among them 24.43% had severe, 46.02% had moderate, 21.59% had mild mental health symptoms. 7.95% had no mental health symptoms [Pearson chi square = 20.7472, p = 0.002]

Income during flood	Mental health symptoms (BSRS-5)				Pearson chi2	P value
	Normal	Mild	Moderate	Severe		
Low (Upto 10k)	9(7.56%)	36(30.25%)	33(27.73%)	41(34.45%)	20.9699	Pr = 0.002
Middle (10-20k)	34(18.68%)	32(17.58%)	70(38.46%)	46(25.27%)		
Upper Middle (>20k)	6(7.23%)	23(27.71%)	34(40.96%)	20(24.10%)		

Table 4: (k): Income before flood wise differences on prevalence of mental health Symptoms.

On the basis of income during flood the prevalence of mental health symptoms on bsrs-5 scale is showing in table 4(k). Out of 119 participants who had monthly income upto 10000 BDT among them 34.45% had severe, 27.73% had moderate, 30.25% had mild mental health symptoms. 7.56% had no mental health symptoms. Out of 182 participants who had monthly income 10000 to 20000 BDT among them 25.27% had severe, 38.46% had moderate, 17.58% had mild mental health symptoms. 18.68% had no mental health symptoms. Out of 83 participants who had monthly income more than 20000 BDT among them 24.10% had severe, 40.96% had moderate, 27.71% had mild mental health symptoms. 7.23% had no mental health symptoms [Pearson chi square = 20.9699, p = 0.002].

Chronic disease conditions and prevalence of Mental health symptoms:

Cancer	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
Yes	0(0.00%)	0(0.00%)	0(0.00%)	6(100.00%)	0.001
No	49(12.96%)	91(24.07%)	137(36.24%)	101(26.72%)	

Table 5: (a): Prevalence of mental health symptoms on the basis of cancer

On the basis of cancer disease present or not the prevalence of mental health symptoms on bsrs-5 scale is showing in table 5(a). Only 6 participants had cancer and all of them had severe mental health symptoms. Out of 368 participants who didn't have cancer among them 26.72% had severe, 36.24% had moderate, 24.07% had mild mental health symptoms. 12.96% had no mental health symptoms [Fisher's exact test = 0.001].

Sample characteristics (CNS)	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
Yes	4(33.33%)	5(41.67%)	0(0.00%)	3(25.00%)	0.004
No	45(12.10%)	86(23.12%)	137(36.83%)	104(27.96%)	

Table 5: (b): Prevalence of mental health symptoms on the basis of CNS disease

On the basis of CNS disease present or not the prevalence of mental health symptoms on bsrs-5 scale is showing in table 5(b). Out of 12 participants who had CNS disease among them 25.00% had severe, but no one had moderate but 41.67% had mild mental health symptoms. 33.33% had no mental health symptoms. Out of 362 participants who didn't have CNS disease among them 27.96% had severe, 36.83% had moderate, 23.12% had mild mental health symptoms. 12.10% had no mental health symptoms [Fisher's exact test = 0.004].

Sample characteristics (Respiratory)	Mental health symptoms (BSRS-5)				Fisher's exact
	Normal	Mild	Moderate	Severe	
Yes	2(2.08%)	17(17.71%)	39(40.63%)	38(39.58%)	0.000
No	47(16.32%)	74(25.69%)	98(34.03%)	69(23.96%)	

Table 5: (c): Prevalence of mental health symptoms on the basis of respiratory disease.

On the basis of respiratory disease present or not the prevalence of mental health symptoms on bsrs-5 scale is showing in table 5(C). Out of 96 participants who had respiratory disease among them 39.58% had severe, 40.63% had moderate but 17.71% had mild mental health symptoms. 2.08% had no mental health symptoms. Out of 288 participants who didn't have Respiratory disease among them 23.96% had severe, 34.03% had moderate, 25.69% had mild mental health symptoms. 16.32% had no mental health symptoms [Fisher's exact test = 0.000].

Discussion

We studied mental health symptoms after flood events among flood victims in different flood affected upazillas of Madaripur district. We found significant percentage of mental health symptoms among the study participants of different upazillas in madaripur district and was significantly associated with independent variables.

There were 384 participants participated from different upazillas of madaripur district in this study among them 57% were from Shibchar upazilla where flood affected every year.68% of participants were male and 32% were female and among the participants average age was 39 years. 34% of the study population were aged 31 to 40 years.

Anxiety is one of the major concern in worldwide that's why it is seen as an separate entity but we didn't exclude comorbidities where we found 92.19% of anxiety which range from mild to extreme among the participants where several studies which were conducted before found out post flood anxiety varies from 3% to 58% [4,19]. Anxiety is considered one of the most important psychological disorders related to flood but in our country this anxiety disorders is overlooked most of the times. The finding of this study may gain attention of upcoming researchers to work with flood related anxiety which may help our government to take logical action to the most vulnerable people against flood related anxiety.

There were several studies outside Asia pacific region which compared with post flood effects and depression. We found 92.71% of mild to extreme level of depression in our study. Due to exposure to repeated flooding every year people living in the flood prone areas always lives stressed life due to fear of loss of lives, Livelihood, Domestic animal loss along with loss of income deepens their stress level. Several studied found out that around 6% to 53% depression is associated with post flood effects among the flood affected population [4]. As there are limited studies in Asia pacific region which actually assessed post flood related depression it is very difficult to predict the risk factors, but it is clearly seen that flooding is directly related to prevalence of depression. In our country the people who live in the flood prone area are usually low incoming people. Many of the struggles to maintain day to day livelihood due to financial crisis. Being affected by flood every year made their lives even more worsen and after the flood they were hopeless to live a tension free life where they live with tension of giving food to their family. Despite the willingness of the government their livelihood cannot be changed due to limited resources of government. As there were few studies in our country related to flood and depression, this study can be one of the baseline information for upcoming study. Government officials may look into the result of the study for their planning to

prevent depression by arranging various program on prevention of depression and also to provide financial and rehabilitation support during flood times to the people living in flood prone areas to help them fight against depression.

Along with Anxiety and Depression, this study reveals around 17% to 34% participants is associated with mild to extreme feeling of irritation, 5% to 34% of participants is associated with mild to extreme inferiority and 9% to 31% participants is associated with mild to extreme sleep disturbance after flood events which are some features of PTSD.

The result of the study shows that among 262 male participants 235 were developed mild to severe mental health symptoms on BSRS-5 scale scoring system and on the other hand among 122 female participants 100 female participants were developed mild to severe mental health symptoms on BSRS-5 scale scoring system. Among male 31.03% were developed severe mental health symptoms which is significantly higher than female where only 20.49% of female were developed severe mental health symptoms. In different upazillas of madaripur district males living in flood prone areas are farmers or field workers and are the mainly responsible and main income source for the entire family. But during flood time the scope for work and earn the same amount of money is squeezed or become workless which leads to developments of severe mental health symptoms. During flood periods due to insecurity of food supply to his family members deepens the stress which leads to severe mental health symptoms more than female. In case of female who are mainly responsible for household work and look after family members suffered less severe mental health symptoms during flood period.

The result of the study also shows significant difference of prevalence of mental health symptoms among the participants in different upazillas of Madaripur district. Among the age group from 20 years to above 60 years 45.05% of the participants aged 41 to 50 years developed severe mental health symptoms. Participants age which was grouped from 41 to 50 years are mainly incoming source from different professions for their respective family hence during flood time the scope for work and earn the same amount of money is squeezed or become workless which leads to developments of severe mental health symptoms along with during flood periods due to insecurity of food supply to his family members deepens the stress which leads to severe mental health symptoms among the age group from 41 years to 50 years than other age group participants. There is no study conducted before focusing on age group wise prevalence of mental health symptoms therefore the result of this study may gain interest to researchers to work with various age group wise prevalence of mental health symptoms which may help our government to take action to the most vulnerable age group of people against flood related development of mental health symptoms.

The result of the study shows that a number of socio-economic factors are significantly related with the prevalence of mental health symptoms on BSRS-5 scale. The results of the study show that prevalence of severe mental health symptoms higher in madaripur sadar upazilla which is around 32.69%. In shibchar and Rajoir Upazilla prevalence of severe mental health symptoms is 25% and 30% respectively.

On the basis of marital status, the study result shows that divorced people have highest tendency of prevalence of severe mental health symptoms which is 33.33% than married which is 28.49% and single people who didn't develop any severe mental health symptoms.

Study participants who lives in a family consisting of more than seven persons are more prone for prevalence of severe mental health symptoms which is around 32.86% than the participants live with less than seven persons. On the other hands in the family if the number of children is four the study participants have most prevalence of severe mental health symptoms which is around 42.22% way more than the participants who have less than four children. The study reveals thats in a family if the income source people is more than they have less prevalence of severe mental health symptoms than in a family if income source people is one. The study results show that participants who have completed only upto higher secondary level have a greater prevalence of mental health symptoms than the participants who have completed university level education. Participants who are day-labourer have highest prevalence of severe mental health symptoms than others profession due to lack of working opportunity during flood times. Among the female participants who suffered domestic violence in the past one month have high prevalence of mental health symptoms than the female participants who didn't suffer any kinds of physical violence by their male partners. Participants who didn't have any own house to live developed more mental health symptoms than the participants who have their own house to live.

The study results show that participants whose monthly income is less than 10000 BDT have high prevalence of severe mental health symptoms than participants whose monthly income is higher than 20000 BDT both pre flood and during flood period.

Participants who are suffering from cancer and respiratory diseases have higher prevalence of mental health symptoms than participants who don't have those diseases. The above mentioned study results shows that having divorced or married along with living more people together, having more children, less number of people as income source, less level of education, source of income along with monthly income have significantly increased the prevalence of mental health symptoms which is consistent with the literature review [7,19,28,33].

Strength of the study

As the limitations of this study is discussed in research methodology section 3.15, the strength of this study is stated below as:

- It is one of the few studies that accesses prevalence of mental health symptoms of adult population of a district in Bangladesh. Socio-economic and flood related factors along with Education level, Marital status, Number of family member, Number of children, Number are income source,Source of income, domestic violence, Disease conditions are compared with prevalence of mental health symptoms in this study. Data were collected from the participants of severely flooded area in different upazillas of Madaripur District.
- In this study we assess socio-economic and independent factors with flood exposure and found a significant association which is consistent with the study conducted by kar., *et al*. in 2004 [19].
- In this study we found male suffered more than female in terms of prevalence of mental health symptoms which may reflect the vulnerability of male population in flood prone areas of Bangladesh but several studies didn't find any gender based association [28].
- In this study samples were collected from different upazillas of madaripur district, for that reason there no chance of data overlapping or inclusion of same participants more than one time.

Direction for future research

- Cohort study design is needed for future studies to assess prevalence of mental health symptoms of flooding because previously cross-sectional studies are used in most of the studies.
- Long term effects of flooding on mental health need to be assesses to know the exact causes as almost all the previous studies have assessed immediate impacts of flooding on mental health.
- Most of the previous studies have focused on anxiety and depression and its relations with flooding but for future studies researchers should give more emphasis to the other mental health disorders like suicide, Co-morbidities of diseases present or not along with mental health symptoms.
- To find out similarities and differences of mental health symptoms of flooding between developed and developing countries researchers should compare mental health symptoms of flooding of all the regions.
- To minimize and mitigate mental health related stress of flooding future studies should give emphasis on social support as well as social strategies, early intervention and medication process in the development of mental health stress to improve disaster preparedness strategies regarding mental health.

Conclusion

Every year people who are living in the flood prone area suffered by flooding. This study examined the effects of flooding on mental health symptoms among those people living in flood prone areas. Each and every year flooding impacts on people specially on their mental health [5]. In this study after the 2020 flood events people in madaripur district suffered heavily. Many of the affected people developed mental health symptoms. Most of the Peoples are from lower Socio-economic background in flood prone upazillas of madaripur. After this flood events they suffered from massive financial changes. There was further reduction of monthly income along with that losing of lives and lose of their property. To bear the losses during flood along with to cope up with the losses related to flood causes stress and that's leads to development of mental health symptoms. Despite the need of financial support to a great extent they received a very little financial support from the government. As a results people suffered more emotionally and developed mental health symptoms in more extent.

The prevalence of mental health symptoms found in great percentage after the flood events. The analysis show that independent factors caused mental health symptoms are mostly in lower income population along with lower education level, widowed or married population, High number of family member, High number of children, Less number income source, Day labour as Source of income, Facing domestic violence, having disease conditions. Male have more percentage of prevalence of mental health symptoms than female.

The findings of this study will help policy makers to improve early intervention and screening programs and will also have significant public health implications in the control and prevention of flood related mental illness in Bangladesh.

Recommendation

Mental health disorders are a burning public health issue. WHO states that mental health problems account for thirty six percent of the illness burden of the whole world, together with neurological disorders and opioid use and which is more than incidences of cardiovascular diseases and cancer related disease burden in the whole world. In this study we assessed relations between prevalence of mental health symptoms and flooding and found potential relationship between prevalence of mental health symptoms and flooding.

To Control and prevent the onset of mental health symptoms due to flooding this will help the public health government authority to take necessary public health intervention as well as public health planning and public health implementation. As this study also focused on the population living in the flood prone areas which is considered as on of the most vulnerable group of people affecting by development of mental health symptoms, to prevent such happening the disaster preparedness program in all developing countries specially in Bangladesh needs to be upgrade strategically.

The government policy makers should frequently assess the flood related risk factors which can lead to development of mental health symptoms and take necessary steps for early preventive intervention and improve surveillance system so that incidence of mental health symptoms never occurs in the flood prone areas among the flood affected population. The government should also focus on early detection of vulnerable population to minimize mental health related cases.

There are no psychology consultant and consultation facilities in the flood prone areas and hard to reach areas to treat mental health disease for that reason it is urgently necessary to stablish psychological consultation facilities along with regular presence of psychology consultant to strengthen mental health related diseases for the ultimate control and prevention of mental health related diseases. Mental health services must be included with the emergency first aid services in the the disaster preparedness program. Every Upazilla Health complex (UHC) must have the capacities to treat mental health cases. There should introduce separate health workers who will work in the field by visiting door to door to search for mental health cases and if any cases found urgently refer them to a psychiatrist. This mechanism will reduce the number of long-term metal health cases.

Health education and health promotion among the rural people needs to be intensified in order to increase mental health knowledge among them. Early forecasting about flooding and Frequent disaster management education will significantly help people to cope up with the flooding situation in efficient way.

During flood times all the government, Non-Government and public health services need to come forward provide utmost support to the vulnerable people and vulnerable communities as well as necessary health care in order to minimize financial burden of vulnerable families and also help them to cope up with the incidence of mental health symptoms resulting from financial crisis. To reduce long term mental health symptoms and problems after the flood both mental health interventions and occupational rehabilitation are urgently needed.

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Conflict of Interest

None.

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