

## Original Research Article

# Risk perception and coping strategy taken by flood victims in Kuching division, Sarawak, Malaysia

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### ABSTRACT

**Background:** Nine per cent of the total areas of Malaysia is subjected to flood. The individual's risk perception is one of the fundamental values in determining the subsequent behaviour, action, coping mechanism and effective strategy towards possible risk. Thus, this study aims to determine the risk perception and coping strategy among the flood victims in Kuching, Sarawak, and its factors.

**Methods:** The 200 respondents were systematically selected from three districts in Kuching division, Sarawak. Data were collected through face-to-face interviews using interviewer-administered questionnaire.

**Results:** The analysis revealed that about three-fifths (72.5%) of the respondents were inundated last year. The most definite perceptions of risk by the flood victims were a physical health risk, followed by the capacity to mitigate flood and the perception of the social consequences. The respondents had a moderate (score of 4 to 6) to good (score of 7 to 9) level of coping strategy, which was influenced by ethnicity and level of education ( $p < 0.05$ ).

**Conclusions:** Though the flood risk perception was good, it needs to go hand-in-hand with the coping measures to minimise flood impact. The planning for flood-related health programs and activities should be more community-centred by assigning villagers and the vulnerable group as committee members.

**Keywords:** Risk perception, Strategy, Flood, Sarawak, Malaysia

### INTRODUCTION

Flooding is among the three most serious natural hazards that commonly occur in Malaysia. The tremendous impact on every level of the community or society in various aspects of life, especially for those who live in the flood-prone areas.<sup>1</sup> It is a climate-related hazard that is influenced by the increasing frequency of more intensified extreme weather.<sup>2</sup> Department of irrigation and drainage (DID), Malaysia stated that approximately 29,800 km<sup>2</sup> or 9% of Malaysia's total area, is vulnerable to flood.<sup>3</sup> In Kuching, the susceptible communities live near the 21 basins of Sarawak and Samarahan river channels. A post-flood forensic analysis showed two

types of flood in that area, internal and external flooding.<sup>4</sup> The internal flooding occurred around the water catchment areas after heavy rainfall during the northeast monsoon due to the existing small channel's inability to accommodate the runoff from high rainfall volume. The external flood occurred when the high intensity of rainfall coupled with Sungai Sarawak's high tides (local river name). The condition is worsened when both internal and external flooding happened at the same time. Ministry of Housing, Sarawak, pointed out that the current drainage system as one of the leading causes of flash flood due to its inability to hold up for the total amount of calculated rainfall at the Kuching South city council (KSCC).<sup>5</sup>

Social, economic, and health perspectives are among the areas of concern following a flood. The level of flood impacts varies and may become unpredictable.<sup>6</sup> The flood disaster affecting northeast Malaysia in December 2014 was the worst flood threatening the country, with more than 500,000 people involved and estimated loss from the damaged infrastructure at RM 2.851 billion.<sup>7</sup> The flood in 2009 was a combination of hefty rainfall due to the monsoon surge with the high tide and weak La Nina phenomenon. Almost all part of Sarawak was involved in flooding within this period. A total of 27,404 flood victims were evacuated during the flood, several occurrences of landslides causing road damage, 246 schools were closed, and five victims were trapped and killed due to the landslides.<sup>8</sup>

Risk perception is defined as subjective estimation or possibility of judgement made by individuals based on their capability regarding the available information and experience.<sup>9</sup> Although local authorities have several mitigation plans in handling and reducing the effects of the flood, risk perception, and coping strategies by local communities are equally crucial in disaster risk reduction management.<sup>10</sup> Study on the people's beliefs, attitudes, judgements and feelings towards events is also a part of risk perception and disaster mitigation. Thus, flood risk perception is the direct cause of flood risk prevention awareness and response behaviours.<sup>11,12</sup> Study on risk perception is a vital issue pertinent to implementing effective flood risk management and disaster reduction policies.<sup>13</sup> The perceived threat and concern of flood influenced by previous experiences with flooding. This leads to people aware of the risk and willingness to take the counter-measures.<sup>14</sup> The term coping mechanism is defined as practices applied by the individual or community.<sup>15</sup> The level of coping mechanism taken to reduce the flood's impact is very much dependent on the individuals' risk perceptions. Their risk perceptions are usually parallel to their mitigation acts; for example, if the estimation of the risk perception is low, most likely, the mitigation action or coping strategy taken is also little as compared to those with higher risk perception. However, there is no guarantee of adequacy for the self-protection action against the risks, regardless of the risk perception level.<sup>16</sup> Shinge et al in Nigeria showed that it is not much different in the level of risk perception among the respondents concerning the location of stay in either low, moderate or high-risk flood-prone areas.<sup>17</sup> Besides, the flood risk perception is influenced by factors such as gender, length of stay and the type of building materials. Thus, assessing the risk perception and coping strategy among the flood victims would help understand the relationship between these two variables and other associated factors. It would also help policy-makers, either government or non-government institutions, improve and plan for more effective policies and intervention programme of flood and its impacts. This study aimed to assess risk perception and coping strategies taken by flood victims in Kuching division, Sarawak.

## METHODS

### *Study design and sampling procedure*

A cross-sectional community-based study was conducted among flood victims who live in selected areas affected by flood from November 2015 to December 2016 in Kuching division, Sarawak. All Malaysian flood victims aged 18 years old and above, who lived in the last flood-affected areas in Kuching, Bau and Lundu Districts were included as the study population. A total of 138 respondents were calculated based on the 10% anticipated proportion of the people affected by the flood, with a 95% confidence interval and absolute precision of  $\pm 0.05$ . However, an attrition rate of 30% was included in considering the possibility of non-response or incomplete questionnaires. Finally, the required samples were rounded to 200. Five villages were randomly selected among the severely affected flood areas in each district. Systematic random sampling was used to select 14 houses in each village. The head of the family was targeted as the respondent. However, any family member aged 18 years old and above and fulfilled all the inclusion and exclusion criteria were selected in the absence of the family's head.

### *Data collection instrument and data collection procedure*

A structured interviewer-administered questionnaire was adapted from previous studies.<sup>18,19</sup> A pre-test of the questionnaire was conducted in a non-sample area with similar characteristics to the studied population. The questionnaire was again reviewed and revised by the researchers to ensure its practicality.

The questionnaire was divided into five main parts. Part A was about the respondent's socio-demographic characteristics such as age, gender, ethnicity, religion, marital status, the highest level of education, occupation, number of household members who lived with the respondent, estimated monthly household income and length of stay in the current residential area. Part B was aiming to gather environment information. It was further subdivided into two parts. Part B (I) was about the resident's house, or building information included the age of the house or building, ownership status of the building, types of material used to build the building, the level of damage, and the cost spent to repair the damage of the building due to previous flood event. Part B (II) was intended to explore in detail the amount of damage to the content of the building due to flood and the respondents' practise to raise the content of the building to higher places during the flood event. Part C was about the flood experiences and flood-related-health problems among the respondent's family members. The frequency, duration and maximum level of flood inundation, evacuation status and place, causes of flood in the respondent's area, the occurrence of health problems among the respondent's family members during and after the flood,

under five years old morbidity related to flood, sources of flood and flood-related health information were explored in this section.

The risk perception towards flood was assessed in part D through 2 general questions on the safety and probability of future flooding and subsequent 36 items of question-based on a Likert scale, ranging from 1 to 5. The '1' was being strongly agreed, '2' agree, '3' neutral, '4' disagree, and '5' strongly disagree. Part E was about the coping strategies currently practised by the respondent in dealing with the flood, assessed through five questions in this part. A face-to-face interview was done to collect data. Respondents were allowed to give a free answer to their coping practices through the 'other' option in the answer section. All this information was gathered from the selected respondent who lived in the flood-affected study, aged 18 years and above and is the eldest member in the household available during the data collection.

The risk perception was operationally defined as the respondents' subjective estimation or possibility judgment on three main domains: health problem, social consequences of the flood, and capacity to mitigate or manage the flood. The term coping mechanism was operationally defined as the strategy practised before, during and after flood covering physical, economic and social aspects. The flood-related health problem referred to any flood-related health problem or disease occurring within a month after the flood event.

#### **Data entry and analysis**

The collected data were inspected and checked manually for any missing or incomplete data. The complete data was coded and entered into Microsoft office excel 2013 and transferred into statistical package for social science version 22.0.<sup>20</sup> The data was first cross-checked for any missing values, outliers or wrong coding. Descriptive statistics, consisting of continuous variables, were analysed to get the mean, standard deviation, median, minimum and maximum value, and categorical variables to get frequency and percentage. The inferential statistics for bivariate analysis and categorical data were analysed with chi-square and continuous data with an independent sample t test. A p value of less than 0.05 was considered statistically significant.

#### **Ethical issues**

This study's ethical approval was obtained from the ethics committee of university Malaysia Sarawak [UNIMAS/NC-21.02/03-02 Jld.2(55)]. A letter was sent to the Kuching, Bau and Lundu district council to inform and seek permission from the council's Chairman to survey their districts. The local headman of the villages and all respondents were informed and briefed about the study and its objectives. The interview was conducted only after obtaining written, informed consent from each participant.

## **RESULTS**

### **Socio-demographic characteristics**

Table 1 illustrates the socio-demographic characteristics of the respondents. The respondents' mean age was 47.8 (14.0) years, with a minimum age of 18 years and a maximum of 79 years. There were nearly equal numbers of males (51.5%) and females (48.5%). The majority of the respondents were Malays (39.5%), followed by Bidayuh (36%), Iban (20%) and other ethnic groups, including Chinese, Indian and other natives of Sarawak (4.56%). More than half of the respondents were Christian (55.5%), followed by 42% of Muslim respondents. Three-fifths (59.5%) were married, and about one-third (32%) were still single. More than one-tenth of the respondents (11.5%) never had any formal education. Almost half of them (45.5%) were either employed by the government or private. The mean (Standard deviation) length of stay in the current residential area was 25.6 (18.1) years with a minimum stay of one year and a maximum of 79 years. The mean (SD) family size was 5.0(3.0), with a mean (Standard deviation) estimated monthly household income of MYR 1,890.50 (MYR 1,239.60).

### **Level of risk perception towards flood**

More than two-thirds (67%) of the respondents perceived no risk of flood soon, and about one-fifth (19.5%) believed that they have the risk of flood in the future. Nearly half of the respondents (47.5%) thought that there would be a moderate chance of flood in the future; one-third (32.5%) believed that the probability would be high, and only 5.5% felt that it to be very high. In summary, the mean (SD) for the total of the three domains scored between 'neutral' and 'agree'. Among all three domains, the most critical risk perceived by the flood victims was a risk of physical health problems related to flooding followed by the management or mitigation against flood and the perception towards risk of social consequence of flooding. The reliability analysis of each domain was more than a 0.6 reliability coefficient, with a total of 25 items had a total of 0.83 of the reliability coefficients (Table 2).

### **The pattern of coping strategy**

In comparing all the flood victims' coping measures, a different approach was taken in different stages of the flood event. Economic coping was mostly practised (91.5%) before flooding. However, during the flood event, social coping was a common strategy (84.5%). The physical coping strategy was mostly implemented (94%) after the flood event. In analysing the coping strategy level among respondents, each coping strategy's total score would have a minimum of 0 and a maximum of 3 scores. The score of each type of coping strategy was summed up to get the level of the coping strategy taken by flood victims, as shown in the Table 3. Three-fifths

(61.5%) of the respondents had partial economic coping behaviour; more than half of them (58.5%) had full physical coping and partial coping in social strategy (50.5%). The summation of all three types of coping strategies was further classified into poor coping (scored as 0 to 3), moderate coping (scored as 4 to 6) and good coping (scored as 7 to 9). Overall, it showed that almost three-quarters (71.5%) of the respondents had a good coping strategy and others (28.5%) had a moderate coping strategy (Table 3).

#### **Factors related to coping strategy**

The total level of the coping strategy taken against flood-by-flood victims was tested with the Chi-square test of Independence for its' association with other factors. Among all the socio-demographic characteristics, only ethnicity (p value  $<0.001$ ) and level of education (p value  $<0.05$ ) were significantly associated with the

level of coping. Bidayuh appeared to have the highest percentage of good coping (84.7%) as compared to others. Higher educational level was significantly related to a better level of coping. Based on flood experience, those who had more than one inundation annually with a flood duration more than one day had a significant relationship with a good coping level. The household that had the occurrence of illness among family members after flooding and among children below five years old significantly had a good level of coping. A better level of coping was also shown among those who were seeking treatment. The Independent samples t-test was used to determine the difference in the level of coping within each domain of risk perceptions. The significant difference in coping level can only be seen in the perceived capacity to manage or mitigate. Thus, there was a significant difference between a moderate and good level of the coping in perceived ability to control or mitigate with the  $t(df)=5.726(159.649)$ ; p value of  $<0.05$  as shown in the Table 4.

**Table 1: Socio-demographic characteristics of the respondents from the Kuching division.**

Variables	N	Percentage/mean (SD) (%)	Min, max
<b>Age (years)</b>	200	47.8 (14.0)	18, 79
<b>Gender</b>			
Male	103	51.5	
Female	97	48.5	
<b>Ethnicity</b>			
Malay	79	39.5	
Bidayuh	72	36.0	
Iban	40	20.0	
*Others	9	4.5	
<b>Religion</b>			
Christianity	111	55.5	
Islam	84	42.0	
**Others	5	2.5	
<b>Marital status</b>			
Married	119	59.5	
Single	64	32.0	
Divorced/Widow/widower	17	8.5	
<b>Level of education</b>			
No formal education	23	11.5	
Primary	37	18.5	
Secondary	101	50.5	
Higher education	39	19.5	
<b>Occupation</b>			
Unemployed	35	17.5	
Self-employed	44	22.0	
Private sector	54	27.0	
Government sector	37	18.5	
Others (Homemaker, retired)	30	15.0	
<b>Length of stay in the residential area (years)</b>	200	25.6 (18.1)	1, 79
<b>Household size</b>	200	5.0 (3.0)	1, 20
<b>Monthly household income (MYR)</b>	200	1,890.5 (1,239.6)	150, 7000

\*Others (ethnicity): Chinese, Indian and other natives of Sarawak, \*\*Others (religion): Buddhism and Freethinkers

**Table 2: Descriptive statistics of the domain of risk perception among the respondents from the Kuching division, (n=200).**

Domains	No. of item	Mean (SD)	Reliability coefficient
<b>Physical health</b>	13	4.0 (0.4)	0.73
<b>Social consequence</b>	4	3.0 (0.5)	0.68
<b>Management/mitigation</b>	8	3.3 (0.6)	0.78
<b>Total</b>	25	3.4 (0.3)	0.83

**Table 3: Percentage distribution of the respondents by their level of the coping strategy taken in the last flood in Kuching division.**

Coping strategy*	Frequency	Percentage (%)	Statistics
<b>Economic</b>			
Poor coping (0)	4	2.0	Mean (SD)=2.4 (0.5); min, max=1, 3
Partial coping (1-2)	123	61.5	
Full coping (3)	73	36.5	
<b>Physical</b>			
Poor coping (0)	4	2.0	Mean (SD)=2.6 (0.5); min, max=1, 3
Partial coping (1-2)	79	39.5	
Full coping (3)	117	58.5	
<b>Social</b>			
Poor coping (0)	14	7.0	Mean (SD)=2.4 (0.6); min, max=1, 3
Partial coping (1-2)	101	50.5	
Full coping (3)	85	42.5	
<b>Total coping</b>			
Poor coping (0-3)	0	0.0	Mean (SD)=2.7 (0.5); min, max=2, 3
Moderate coping (4-6)	57	28.5	
Good coping (7-9)	143	71.5	

\*Multiple responses

**Table 4: Significant factors related to the coping strategy among the respondents in the Kuching division.**

Variables	Frequency	Level of coping		Chi-square (df)/t (df)
		Moderate, (n=57)	Good, (n=143)	
<b>Socio-demographic characteristics</b>				
Ethnicity				
Malay	79	27.8	72.2	x <sup>2</sup> (df)=16.28 (2)***
Bidayuh	72	15.3	84.7	
Iban and others	49	49.0	51.0	
Level of education				
No formal education	23	47.8	52.2	x <sup>2</sup> (df)=10.581 (3) *
Primary school	37	29.7	70.2	
Secondary or high school	101	30.7	69.3	
Higher educational level	39	10.3	89.7	
<b>Flood experience</b>				
Frequency of inundation				
Once a year	145	31.1	66.9	x <sup>2</sup> (df)=5.483 (1)*
More than once a year	55	16.4	83.6	
Duration of inundation in days				
Within 1 day	107	36.4	63.6	x <sup>2</sup> (df)=5.743 (1)*
More than one day	87	20.7	79.3	
<b>Flood-related health problem</b>				
Had sickness after flooding				
Yes	61	6.6	93.4	x <sup>2</sup> (df)=20.738 (1)***
No	139	38.1	61.9	

Continued.

Variables	N	Level of coping		Chi-square (df)/t (df)
		Moderate, (n=57)	Good, (n=143)	
<b>Flood-related health problem</b>				
Children below 5 had sickness due to flood				
Not significant	101	33.7	66.3	x <sup>2</sup> (df)=13.700 (2)***
Yes	35	2.9	97.1	
No	64	34.3	65.7	
Treatment seeking				
Yes	61	8.2	91.8	x <sup>2</sup> (df) = 22.416 (1) ***
No	33	51.5	48.5	
<b>Risk perception</b>				
Capacity to manage/mitigation	200	28.8 (3.2)	25.3 (5.0)	t (df)=5.726 (159.649)**

\*p<0.05, \*\*p<0.01; \*\*\*p<0.001

## DISCUSSION

The study's objective was to assess the risk perception and coping strategies taken by flood victims in Kuching division. Generally, the most significant risk perceived by the flood victims was the risk of physical health problems, followed by the perceived capacity to manage or mitigate against flood and, subsequently, the social consequences due to flood. This finding is supported by the relationship of flood experiences to the level of coping. A significant association has shown between frequency and duration of inundation with the level of coping. The level of coping is parallel to risk perception.<sup>16</sup> This means that a good level of coping has a higher risk perception towards flood. Roder et al found that less frequency of flood experience led to lower risk perception.<sup>21</sup> Experience in flood-related health problems is another significant contributor to risk perception and coping level. A meaningful relationship was found between coping level and sickness after flooding and among children below five years old and those seeking treatment. Abu revealed two categories of perceived health stressors of flooding in poor urban areas.<sup>22</sup> The health-related effects due to infectious diseases such as diarrhoea and malaria were a direct perceived health risk. Those non-disease but may be related to it, such as the source of disease outbreaks, was categorised under indirectly perceived health risk. Our study found that more than half of them perceived the indirect threat of compromised medication supply in flood area and the direct risk of death resulting from drowning, electrocution and others during flood.

Our study simply classifies the coping strategy into poor, moderate and good based on summative score. There was variety in the coping strategy taken in economic, physical and social interaction during flooding. There was a glaring weakness in implementing economic coping during the flood and social coping after the flood. The respondents preferred to stay at home during flooding to avoid disease, sickness, or medical problems and guard their properties. After the flood, the lack of social strategy was due to individual counter-measures for the

flood impact rather than community activity as everyone was busy at their residence. This finding is consistent with Okaka and Odhiambo<sup>1</sup> in Kenya.<sup>23</sup> That is, most of the flood victims were taken an adaptive coping mechanism. Another factor that had been revealed during the survey that can alter the physical coping strategy was the knowledge and awareness of the government's plan to the flood-affected area. One example is the Darul Hana housing project that has started and is carried out to move the affected population to a safe new settlement area.<sup>24</sup> This has changed the physical strategy of the involved community. They did not plan to do drastic or costly changes to their properties even though the said measures would minimise flood impact in the future. Thus, by focusing on the strengths and addressing weaknesses in the level of coping among flood victims, a better outcome would be achieved in the flood management and mitigation program.

The identified significant socio-demographic characteristics concerning the level of coping were ethnicity and level of education. Bidayuh ethnicity had a significant relationship with a good level of coping strategy. The analysis might be affected by the distribution pattern of the ethnic group in the Kuching division, where Malays contributed to one third (33.4%) of the total population, followed by Chinese, Bidayuh, Iban and others.<sup>25</sup> This finding might not be the same as other states of the country. Also, the respondent's selection criteria, who are the eldest household member available during the survey and aged more than 18 years old, may contribute to the level of education pattern among respondents. This indicated that respondents with higher education had a good level of coping strategy compared to no formal education. This finding is consistent with Cvetković et al.<sup>26</sup> The author arguably mentioned that higher educational levels had significant to the knowledge and preparedness against flooding. Tong et al also had identified education as one of the crucial determinants of coping or adaptive measures.<sup>27</sup> During the survey, an informal observation noted that respondents with risk-related occupations such as the military or occupation related to a better knowledge of

floods, such as officers in the civil defense department, might influence their risk perceptions and coping strategy. Mavhura et al also stated that the household head's occupation could change the household coping strategies against flooding.<sup>28</sup>

Recall bias is one of the limitations in this study as the flood event occurred about a year ago. Therefore, the respondent's information might not be correct, especially for elderly respondents whose ability to recall memories may be weaker than younger adults. The study sample might not be represented the whole scenario in Sarawak as only Kuching division was selected among 12 divisions. There was no comparison between the residents with and without flood inundation into the residential in this study. Thus, it should be extended to such a group of samples. Another limitation of the study concerns the validity of the risk assessment scale as it is a new scale created based on various sources. The factor analysis was not done as the sample size was small and not representative. Apart from that, selection bias can occur when other than the eldest household member was selected. It led to the inaccuracy of the information gathered, especially from teenage respondents, due to lack of experience and knowledge. The experience and perception of a younger respondent are expected to be different from an older person. Thus, the respondent's selection should be confined to the household's head or the eldest household member.

## CONCLUSION

The level of coping is determined by ethnicity, the higher level of education, level of exposure to flood and flood-related health problem among the family members. It could be concluded that experience with flood became a significant association in determining the risk perception and the level of coping. In general, the flood victims had moderate to good coping skills, but the respondent with a moderate level of coping had higher risk perception than those with an adequate level of coping. Theoretically, the perceived risk needs to go parallel with the coping measures, as failure to do so will not prevent flood impacts.

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