 https://doi.org/10.17576/geo-2026-2202-04

Household preparedness for natural hazards: The role of financial readiness, training programs, and disaster-specific actions

Lim Chee Ann[1], Siti Rahyla Rahmat[2], Ahmed Nur Dirie[2], Fadzli Mohamed Nazri[3], Umme Saima Sorna[2,4]

[1]School of Distance Education, Universiti Sains Malaysia
[2]School of Social Sciences, Universiti Sains Malaysia
[3]School of Civil Engineering, Universiti Sains Malaysia
[4]Department of Development Studies, Daffodil International University

Correspondence: Siti Rahyla Rahmat (email: rahyla@usm.my)

Received: 11 April 2025; Accepted: 9 April 2026; Published: 21 May 2026

Abstract

Natural Hazards are a critical concern that all members of society need to address, especially vulnerable individuals living in disaster-prone areas. The purpose of this study is to examine household preparedness levels for natural hazards, considering various factors including financial readiness (e.g.: financial savings for natural hazards and recovery), training and education programs, and specific preparedness actions. Guided by Protection Motivation Theory (PMT), the study employed the Pearson correlation coefficient, multivariate logistic regression, and heat map analysis to investigate the complex relationships between a household's preparedness level and various influencing factors. Findings revealed that savings for natural hazards are the most significant financial factors determining readiness for risks, while other indicators like family money and insurance coverage do not. Training and knowledge sharing positively impact household preparedness for hazards, with multivariate results showing a strong positive relationship of 80% between first aid/CPR training and having trained household members, a trend further visualized through correlation heat maps. Moreover, the study found a strong positive correlation between household hazard preparedness measures like storing emergency supplies, discussing hazard risks, and preparing first aid kits. It also highlighted the importance of communication, strategic planning, and safety measures in enhancing disaster preparedness. The study recommends promoting emergency reserves, financial literacy, and education on natural disaster risks to help families with low savings and encourage precautionary measures.

Keywords: Financial readiness, household preparedness, logistic regression, natural hazard, training programs

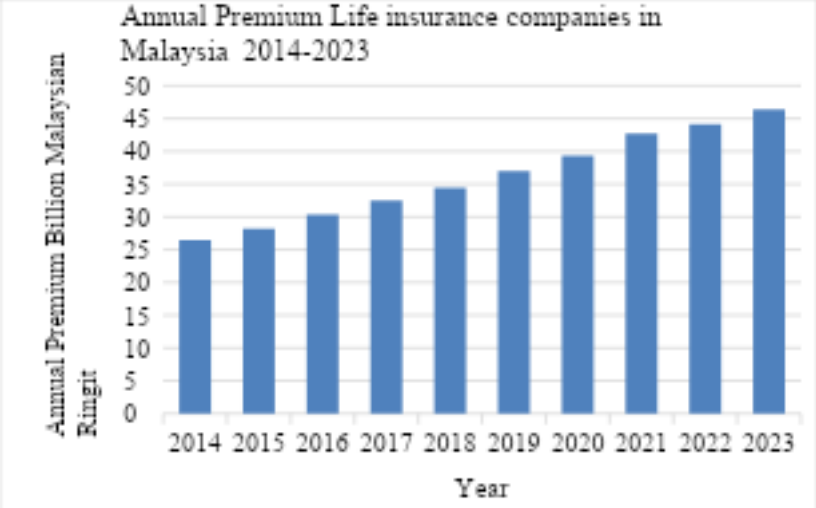
Introduction

The responsibility for disaster preparation is shifting to individuals and households, as they must adapt to fluctuations in vital services, increasing costs for food and insurance, psychological strain, and structural changes (Heidenstrøm & Kvarnlöf, 2018). Natural disasters are significant disturbances in society caused by hazardous incidents, resulting in extensive negative consequences. Individual acclimatization and disaster readiness are interconnected, with preparedness involving the acquisition of information and skills to address and recover

from catastrophes, and adaptation behaviours encompassing urgent emergency reactions to long-term strategies. Household readiness encompasses proactive measures such as stockpiling emergency food and water, ensuring the availability of heating tools, developing emergency response strategies, and actively participating in evacuation drills (Nikkanen et al., 2021). Obtaining insight into the connection between human behavior and natural hazards is essential for efficient risk mitigation, including individual, community, and national measures. Despite the implementation of preventive measures, many families residing in areas prone to hazards need to take adequate action (Harvatt et al., 2011).

In 2008, researchers documented a total of 326 natural catastrophes and 259 technological accidents worldwide. Despite the smallest figures observed within the previous decades, the number of casualties resulting from natural disasters ranked as the second most significant over the last decade (Levac et al., 2012). Floods alone, affecting 250 million people annually, cause significant human and economic damage. It caused over 5000 deaths and $45.9 billion in economic damages in 2019. Low-income nations often suffer more deaths, while high-income nations experience more significant property and infrastructure destruction (Muzamil et al., 2022). Between 1998 and 2018, 431 flood disasters in Southeast Asia affected over 100 million people, resulting in USD 58.74 billion in economic damages (Azimi et al., 2019). Malaysia is subject to a variety of natural disasters, including droughts, smog, landslides, tsunamis, and floods, with floods inflicting the most economic harm during the last 30 years. Residents along the East Coast are at heightened risk as a result of persistent rainfall and rising sea levels, which in turn lead to economic losses, increased stress levels, and vulnerability to illnesses like cholera and dengue. Flood-related catastrophes are the most frequent natural disasters, resulting in financial risks and economic losses for enterprises. During December and January 2022, floods resulted in RM6.1 billion worth of losses, with commercial properties, manufacturing, and agriculture together contributing to 25% of the overall damages. The federal government disbursed RM1.2 billion in financial assistance. The combination of climate change and rapid economic growth poses a risk of heightened flood occurrence and severity, hence impacting the economic outlook of both enterprises and households. Additionally, recovering from recurring floods and being ready for future ones are ongoing requirements (World Bank & Bank Negara Malaysia, 2024).

According to Michel-Kerjan and Kunreuther (2011) for disaster management, insurance, and government support are essential for societal and economic resilience. In recent decades, insurers have paid out large claims, while the government assists those without insurance. Moreover, flood insurance or takaful programs provide predefined payments for natural disasters, enabling immediate monetary recovery. Protected households can speed up economic restructuring, reducing financial hardship in various sectors. These programs can rebuild destroyed properties, farms, and companies without imposing significant financial burdens on authorities (Ashikin et al., 2020).



Source: Statista Research Department, Jun 25, 2024

Figure 1. Annual premiums of life insurance companies in Malaysia from 2014 to 2023 (in billion Malaysian ringgit)

Figure 1 illustrates the annual premium of life insurance in a billion Malaysian Ringgit. From 2014 to 2023, life insurance firms in Malaysia recorded an annual premium of nearly 46.35 billion Malaysian ringgit, indicating growth compared to the previous year. The low penetration rate of life insurance among the population presents significant development prospects for the insurance market in Malaysia. This study aims to stress the factors that influence the preparedness level of natural hazards to decline the current and intense natural disasters that have had a profound impact on Malaysia, especially Penang. This research makes a significant contribution to the existing body of knowledge through the proposition of a comprehensive analysis of disaster preparedness strategies in Malaysia. The study encompasses multiple facets including financial preparedness (comprising life and property insurance, allocation of funds for post-disaster recovery in the event of natural calamities), provision of training programs for evacuation, and implementation of immediate measures like the distribution of emergency kits in households and vehicles. These measures collectively aim to establish a comprehensive strategy for hazard risk reduction and management. The rest of the paper is organized as follows: Section 2 summarizes previous studies, Section 3 describes the methodology, followed by the results and discussion, and the paper concludes with key suggestions and implications for future research.

Literature review

Malaysia, situated outside the Ring of Fire and typhoon trajectories, is mostly impervious to natural calamities such as volcanic eruptions, seismic activities, and typhoons. Nevertheless, floods, landslides, smog, droughts, and tsunamis often impact it. Flooding is the most common type of disaster, accounting for 48% of all documented incidents (Abdul Shukor et al., 2020). Cong and Feng (2022) studied the age-related patterns of financial readiness for unexpected emergencies from hazards, specifically emphasizing the vulnerabilities of individuals and communities. Findings indicated that those aged 18 to 44 were less likely to have emergency savings accounts among white people and those with insurance, but more likely among Hispanics, minorities, and areas with higher rates of poverty and no cars than those aged 65 to 74. Setiadi and Frederika (2022) revealed that family literacy in financial planning for disaster

preparedness is important. Currently, only a small number of families implemented financial planning and explicitly considered it for preparing for floods. Moreover, digital money may serve as an individual remedy for disaster readiness within families and a collective remedy for financial catastrophe preparedness within communities.

Shao et al. (2022) studied the impact of floods on people's flood insurance purchase decisions, revealing a short-lived, 1-year effect on ecological levels. The findings demonstrate that socioeconomic characteristics such as age, education, and the density of insurance agents influence insurance purchases. Furthermore, there is a direct correlation between the level of objective risk exposure and flood perception. According to Despard et al. (2020) subjective financial knowledge, financial confidence, and ownership of a savings account were important factors in predicting the presence of an emergency fund. Holding a savings account was the most influential factor, resulting in a 25% to 29% higher likelihood of having an emergency fund. Financial literacy initiatives and initiatives to broaden access to short-term savings options are two important ways to encourage emergency savings.

In addition to identifying high-risk zones for natural disasters, Oktora et al. (2024) evaluated the number of households that may purchase natural disaster insurance and examined the connection between the disaster risk index and participation in the program. The findings indicated that there are two classifications of disaster risk in Indonesia: "medium" and "high." Districts in Aceh Province, including Simeuleu, Pidie Jaya, and Banda Aceh City, have a significant number of families that are potentially eligible for insurance participation, whereas districts in Jawa Tengah provinces show lower levels. In an attempt to encourage a "soft" cultural shift toward disaster preparedness, Appleby-Arnold et al. (2021) suggested three strategies: arranging preparedness-related activities for daily life, supporting actions that build on ingrained cultural values and routines, and enhancing perceived self-efficacy by showcasing how individuals can use their unique skills in emergencies. Mabuku et al. (2018) suggested that education and training prioritize altering beliefs that affect preparation behavior, enhancing families' responses to floods, developing flood plans, and increasing preparedness knowledge. This would eventually result in greater awareness of flood threats.

Nikkanen et al. (2021) found that education level and employment status do not significantly influence individuals' preparedness or storm impact in Finland. The study suggested that socio-demographic factors have a marginal influence on preparedness and storm impacts. The study by Lian et al. (2021) indicated that participation in disaster prevention and mitigation training significantly increased the likelihood of farmers adopting earthquake disaster-preparedness behaviors by 21.39% compared to non-participants. In addition, the training program significantly enhanced the level of seismic disaster avoidance preparatory behaviors among farmers, resulting in a 0.75 increase in the number of these behaviors compared to those who did not participate in the training. For the people's earthquake preparedness for urban areas in Bangladesh, Rahman et al. (2023) found that 92% of the population has experienced an earthquake and over 65% lack experience with any preparedness program. Over 50% of those who experienced earthquakes acquired knowledge, but 30% lack immediate financial support in crises. And approximately 50% lack earthquake insurance. Mariam et al. (2021) emphasized the importance of short-term mitigation training as a systematic and organized educational process. This training helps individuals gain practical knowledge and skills for dealing with disasters, thereby increasing their knowledge about disasters and enhancing their ability to respond effectively.

Table 1. Comparison of flood insurance practices in Europe and the United States

Country	Principles and practices	Responsibility
France, Belgium and Spain	✓ The Constitution guarantees solidarity for natural disasters ✓ Preamble to 1946 The Constitution declares solidarity and equality ✓ All citizens are responsible for national disasters	✓ Insurance Industry overview ✓ Mandatory premium collection for natural disasters ✓ State acts as re-insurer, guaranteeing payments ✓ Insurance payments made when the state declares a natural catastrophe
Netherlands	✓ Netherlands Flood Insurance Coverage ✓ Calamities Compensation Act (1998) prevents coverage ✓ Flooding is often uninsured	✓ The government is responsible for flood-related damages that are not covered by private insurance coverage
Iceland	✓ A mandatory insurance system is in place to address natural calamities such as floods through a state-owned insurance entity named Iceland Catastrophic Insurance	✓ Iceland Catastrophic Insurance
Germany	✓ Public compensation systems primarily cover major flooding disasters	✓ Public compensation package
USA	✓ The federal National Flood Insurance Program provides insurance for individuals in Special Flood Hazard Areas, requiring communities to adopt mitigation plans to cover catastrophic flooding	✓ Communities and Federal

Source: O'neill, 2012

The disaster management literature has discussed house disaster preparedness behaviour in terms of multiple behavioural and risk-response orientations. Some past research has shown that the preparedness actions are determined by availability of financial resources, disaster knowledge and training and practical preparedness activities that households undertake. The theoretical mechanisms paramount to household disaster preparedness, as discussed in the preceding section, can be systematically reorganized through the lens of Protection Motivation Theory (PMT) as shown in Table 2 (Ansari et al., 2022; Faryabi et al., 2023, p. 2). This transition allows for a more nuanced understanding of how households process risk and determine their capacity to act. By mapping the original behavioral and risk-response orientations onto PMT constructs, we can differentiate between the Threat Appraisal

(evaluating the danger) and the Coping Appraisal (evaluating the response) (Mertens et al., 2018, p. 80; Rogers, 1975).

Table 2. Theoretical mapping of study variables based on Protection Motivation Theory (PMT)

PMT dimension	Theoretical construct	Application to disaster preparedness	Study variables
Coping appraisal	Response efficacy	The belief that specific preparatory actions are effective in reducing disaster impact	Family Disaster Discussion, Emergency Supplies, House Safety Assurance
	Self-efficacy	The perceived internal capacity and confidence of the individual to execute protective behaviors	First Aid/CPR Training, DRR Course Participation
Coping resources	Resource facilitators	The availability of external financial and material assets required to implement protection	Savings for Hazards, Recovery Savings, Property/Life Insurance
Threat appraisal	Perceived vulnerability	The assessment of personal risk and the potential severity of disaster consequences	Insurance Coverage (as a risk-transfer measure), Disaster Knowledge

In line with the theoretical perspectives mentioned in Table 2, the most prominent determinants of household disaster preparedness can be grouped around three broad dimensions, which include financial preparedness, disaster training and knowledge, and household preparedness measures. These dimensions encompass the resource potential and the behavioural facet that affect the way houses make preparations to possible natural hazards. Using these insights the current study is able to create the conceptual understanding of how these factors relate to household disaster preparedness. As shown in the framework (Figure 1), financial preparedness, disaster education and training, and practical preparedness measures help in increasing the chances of disaster preparedness in households.

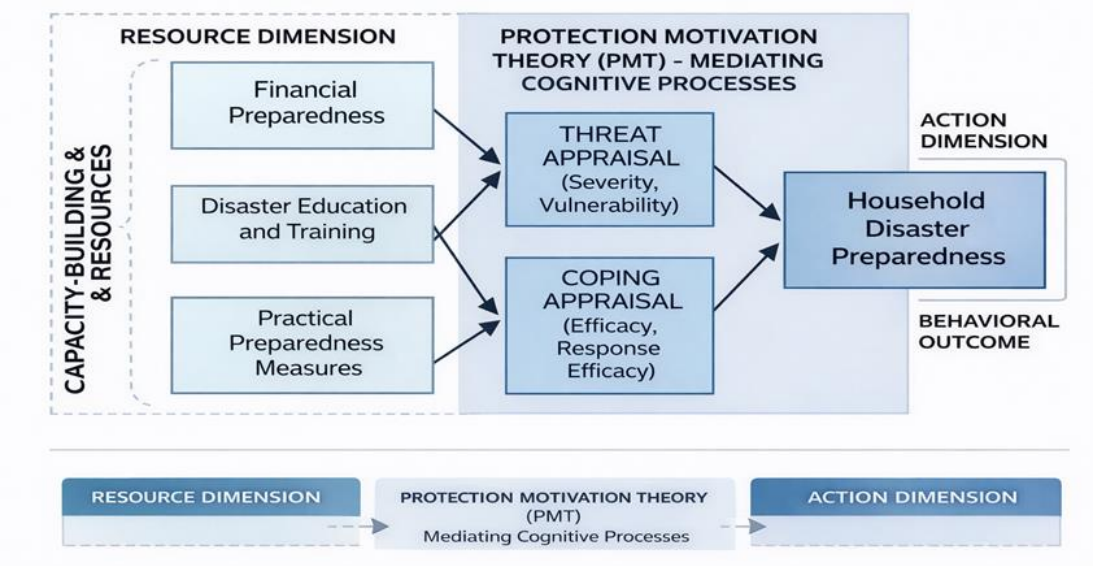


Figure 1. Conceptual framework of household disaster preparedness

Informed by the theoretical dimensions presented in Table 2, this study designed a conceptual framework (Figure 1) to illustrate the disaster preparedness pathways. The framework is structured into three distinct stages: (1) Capacity-Building and Resources, which are the major determinants; (2) the PMT-based cognitive mediators (Threat and Coping Appraisals); and (3) final behavioral outcome, in this case, Household Disaster Preparedness. The given structure makes it possible to analyze such a subtle resemblance between tangible resources and the psychological preparedness, and, finally, the practical action.

Methodology

This research used quantitative survey data to evaluate the degree of readiness within society, particularly in households, by concentrating on aspects related to the effects of natural hazards in Paya Terubong and Datuk Keramat, Penang, on 400 participants. This research focuses on assessing the level of readiness and the factors linked to the occurrence of natural disasters within the community, namely among households. This study aims to provide a thorough overview of the readiness levels implemented by households analysing their demographic aspects and residential area characteristics. This includes issues related to household characteristics, preparedness for hazards, and financial readiness, such as the viability of hazard insurance, life insurance, and property insurance. Moreover, it covers involvement in training sessions and initiatives to spread knowledge about reducing hazards. Additionally, it outlines specific actions for household preparedness, including having emergency supplies, family preparedness towards disaster, ensuring home safety, having vehicle emergency supply kits, and having a solid foundation in first aid. The study also used a binary logistic regression model to examine the impact of financial readiness, training, and specific measures on the hazard preparedness of the households. The model ws used to determine the most significant determinants of preparedness and to examine the effects of a unit shift in the independent variable on the probability of household preparedness. The results were analyzed using the B-coefficient, odds ratio, and significance level. The results provide valuable insights into the importance of these factors on disaster preparedness levels and the enhancement of preparedness capabilities.

This study hypothesizes to propose the analytical framework that connects financial preparedness, training, and disaster knowledge, and practical preparedness to the outcome of

household disaster preparedness. The structure is built based on the disaster preparedness literature, which emphasizes the potential of financial capacity and risk-related knowledge and behaviour in preparing households for natural hazards. Financial preparedness denotes the economic capability of the households to manage the risks associated with disasters such as insurance coverage or savings. Training and disaster knowledge encompasses the informational ability and skill based capacities that allows households to identify dangers and act efficiently. Preparedness measures are concrete household activities, like having disaster supplies and talking about the disaster plans in the family. These dimensions, as shown in Figure 2, have the collective effect on the preparation of a household in the event of a disasters.

Figure 2. Analytical framework of household disaster preparedness determinants

Results and discussion

Socio-demographic analysis

The social demographic analysis has been presented in table 3. The age of the respondents ranged from 18 to 65 years and above. There were 219 (54.7%) male and 181 (45.3%) female respondents. Among them, 227 (56.8%) were Malay, 130 (32.5%) were Chinese, 38 (9.5%) were Indian, and 5 (1.3%) belonged to other ethnic groups. The surveyed population resides in different types of housing: 274 (68.5%) of the respondents live in flat-type housing, 69 (17.3%) in landed houses, 22 (5.5%) in terrace houses, 21 (5.3%) in condominiums, and 1 (0.3%) and 2 (0.5%) live in bungalows and shophouses, respectively. Furthermore, households were asked about the presence of a supply kit in case of an incident or hazard to assess whether they are well-prepared. A well-prepared family disaster supplies kit includes essential items like food, water, flashlights, batteries, and first aid, which demonstrate a household's concrete steps for survival and comfort during a hazard. Of the respondents, 249 (62.3%) answered yes and considered it a vital instrument for their survival. However, 151 (37.8%) reported not having any of these supplies, indicating that a significant number of households are still not adequately prepared and remain vulnerable to hazards

Table 3. Demographic characteristics of the households

Variable	Category	Frequency	(%)
Gender	Man	219	54.8
	Women	181	45.2
Age	18 - 20 years	8	2
	21 - 34 years	73	18.3
	35 - 49 years	122	30.5
	50 - 64 years	102	25.5
	65 years/ and above	95	23.8
Race	Malay	227	56.8
	Chinese	130	32.5
	Indian	38	9.5
	Other	5	1.3
Education	PhD	1	0.3
	Master	7	1.8
	Degree	30	7.5
	Diploma STPM/STAM/Matric	65	16.3
	SPM/SPVM	158	39.5
	UPSR	72	18
	None	12	3
Income group	No income	123	30.8
	2,560MYR and below	172	43
	2,561MYR – 3,439 MYR	38	9.5
	3,440MYR – 4,309 MYR	24	6
	4,310MYR – 5,249MYR	18	4.5
	5,250MYR – 6,339MYR	6	1.5
	6,340MYR – 7,689MYR	8	2
	7,690MYR – 9,449MYR	5	1.3
	9,450MYR – 11,819MYR	5	1.3
	15,870MYR and above	1	0.3
Type of house	Flats	274	68.5
	Condominium	21	5.3
	Landed house	69	17.3
	Shophouse	2	0.5
	Terrace	22	5.5
	Bungalow	1	0.3
	Apartment	11	2.8
Family disaster supply kit	Yes	249	62.3
	No	151	37

Correlation analysis of household preparedness factors

Table 4 shows descriptive statistics and correlation coefficient between financial preparedness and training participation with household preparedness measures. The results of the analysis indicate that there are a number of statistically significant relationships that bring out behavioural and structural predictors of disaster preparedness. The variables of financial preparedness depict moderate positive connections with disaster preparedness behaviours. The correlation between savings invested into natural hazards and disaster preparedness is (.25 and.01), which means that the households that actively save up some financial means tend to

do some disaster preparedness activities (Hoffmann & Muttarak, 2017). Likewise, the variable of savings towards post-disaster recovery (r =.20, p <.01) also shows a positive relationship, which reveals the value of financial strength in disaster risk management (Vinnell et al., 2020). The variables of training and knowledge also exhibit a positive association. First aid/CPR training is correlated with the level of preparedness significantly (r =.18, p= <.01) indicating that practical training on disaster response improves the readiness behaviour of households (Sudo et al., 2019). There is a statistically reliable positive correlation between family discussions and preparedness behavior, but the actual magnitude of that relationship is weak (r = .12, p <.05), which is consistent with the evidence of educational attenuation of the action gap (Muttarak & Lutz, 2014). Information sharing during meetings also correlates with disaster preparedness, though minimally and insignificantly (r =.42, p <.01). This observation suggests that domestic communication and decision-making that is facilitated is a key factor in enhancing preparedness (Becker et al., 2017). Likewise, the emergency supply preparation in at least 72 hours is also significantly correlated with the behavioural frameworks of disaster preparedness which would indicate that preparedness cannot be affected only by the economic materials but also by the level of awareness, knowledge intake, and within-household communication (Lindell, 2018).

Table 4. Analysis of disaster preparedness factors: Descriptive statistics and correlation matrix

		M	SD	1	2	3	4	5	6	7	8	9	10	11	12
1	Disaster Preparedness Level	1.33	0.47	1											
2	Savings for Natural Hazards	2.82	1.49	.25**	1										
3	Savings for Recovery	3.18	1.50	.20**	.74**	1									
4	Property Insurance Coverage	3.39	1.69	.09	.32**	.30**	1								
5	Life Insurance Coverage	3.49	1.75	.08	.31**	.32**	.59**	1							
6	Willingness to Take DRR Course	2.49	1.37	.07	.16**	.14**	.09	.12*	1						
7	Disaster Knowledge (Meetings/Information)	1.71	0.46	.12*	.06	.11*	-.03	.04	.15**	1					
8	First Aid/CPR Training	1.62	0.49	.18**	.11*	0.1	.11*	.11*	.06	.11*	1				
9	Emergency Supplies (72-hour minimum)	1.32	0.47	.30**	.10*	.10*	.11*	.02	.10	.07	.07	1			
10	Family Disaster Discussion	1.34	0.48	.42**	.14**	.13**	.03	.07	.17**	.18**	.29**	.21**	1		
11	Vehicle Emergency Supplies Kit	1.72	0.45	.13*	.18**	.08	.03	.16**	.16**	-.03	.11*	.15**	.17**	1	
12	House Safety Assurance	1.06	0.24	.21**	.01	.01	-.02	.03	.06	.02	.13**	.05	.20**	-.01	1
13	Basic First Aid Preparedness	2.56	1.51	.22**	.31**	.20**	.19**	.20**	.36**	.08	.30**	-.02	.23**	.21**	.09

*** significance at 0.01 level; *Significance at 0.05 level; M denotes the mean; SD denotes the standard deviation.*

To add to the statistical information in Table 4, a heatmap was created to visually show how different household preparedness factors are related to each other. While Table 4 provides the exact Pearson correlation coefficients, the heatmap (Figure 3) utilizes a color-coded scale to highlight the most significant drivers of disaster readiness, making it easier to identify clusters of high-impact variables.

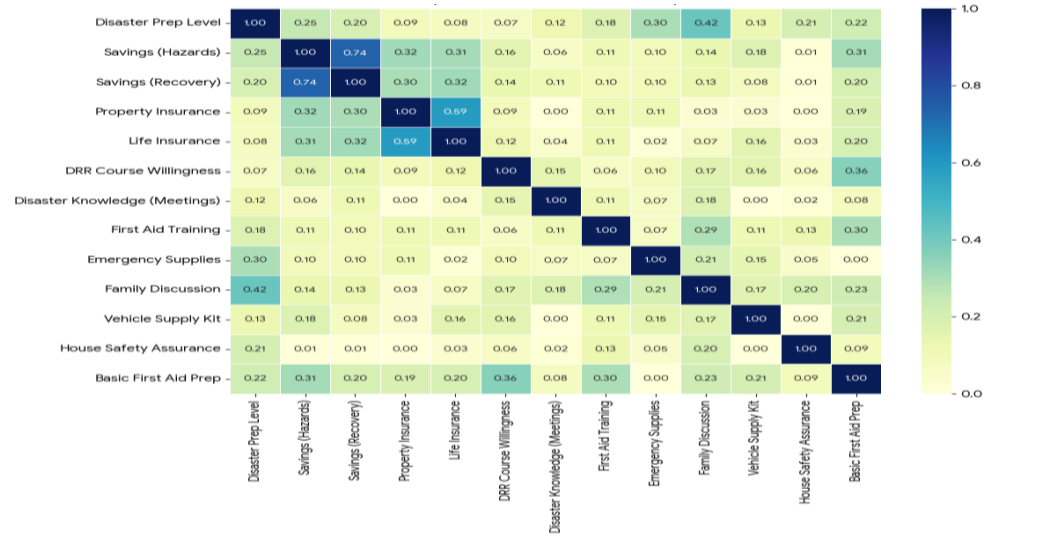


Figure 3. Heatmap of correlation matrix for household preparedness factors

The correlation analysis indicates that key aspects that contribute to increased levels of preparation include engaging in discussions with family members and being financially prepared, which involves saving money and having insurance coverage. A significant link is shown by the relationship between property insurance coverage and financial reserves for natural catastrophes and the recovery (post-disaster). This further emphasizes the relationship between insurance and financial readiness. Residents who own property insurance and life insurance have a modest association, meaning that their chances of owning both insurance types are statistically higher. Engagement in disaster risk reduction (DRR) activities is associated with few other factors, indicating that it is rather apart from other preventive measures. Acquiring knowledge about disasters, whether via meetings or information, has a modest but meaningful association with taking preparation measures, especially when it comes to engaging in family disaster discussions. First Aid/CPR training has a moderate connection with family disaster discussion, indicating that it promotes a wider range of preparation behaviours among families. Having emergency supplies for a 72-hour period is marginally associated with other readiness behaviours, suggesting that it is a component of a wider preparedness attitude. Family disaster discussions have a reasonable correlation with different preparation measures, highlighting their significance in total preparedness for hazards.

Multivariate analysis: Determinants of household preparedness

To evaluate the relative contribution of financial readiness, training, and specific disaster actions toward overall household preparedness, a Multiple Linear Regression (MLR) analysis was performed. Prior to the regression, diagnostic tests were conducted to ensure the data met the assumptions of linearity, normality, and absence of multicollinearity.

The Variance Inflation Factor (VIF) was calculated for all thirteen independent variables. As shown in Table 5, VIF values ranged from 1.056 to 2.422, which are well below the conservative threshold of 5.0. These results confirm that multicollinearity does not bias the model and that the independent variables represent distinct constructs. The results of the MLR analysis are summarized in Table 5. The model was found to be statistically significant, $F(12,387) = 12.83$, $p<0.001$, accounting for approximately 28.5% of the variance in perceived household disaster preparedness (R^2=0.285; Adjusted R^2=0.262).

Table 5. Multiple linear regression results for predictors of household preparedness

Predictor Variables	β	SE	t	p-value	VIF
(Constant)	-0.098	0.106	-0.932	0.352	--
Financial Readiness					
1. Savings for Recovery	0.002	0.020	0.074	0.941	2.304
2. Savings for Hazards	0.048	0.021	2.286	**0.023***	2.422
3. Property Insurance	-0.001	0.015	-0.062	0.951	1.666
4. Life Insurance	-0.002	0.015	-0.150	0.881	1.666
Training & Knowledge					
5. DRR Course Willingness	-0.027	0.016	-1.671	0.096	1.205
6. Disaster Knowledge	0.040	0.046	0.863	0.389	1.078
7. First Aid Training	0.014	0.045	0.317	0.751	1.193
Disaster-Specific Actions					
8. 72-Hour Supply Kits	0.219	0.045	4.831	**0.000****	1.109
9. Family Preparedness Discussion	0.303	0.047	6.406	**0.000****	1.240
10. Vehicle Emergency Kit	0.006	0.048	0.122	0.903	1.147
11. House Safety Assurance	0.249	0.087	2.853	**0.005****	1.057
12. Basic First Aid Competency	0.034	0.016	2.153	**0.032***	1.427

Note: $R^2 = 0.285$. Significant at: *p < 0.05, **p < 0.01

The regression coefficients indicate that Family Preparedness Discussion (β = 0.303, p < 0.00) is the most potent predictor of disaster readiness. This suggests that the social capital and communication within a household unit are primary drivers of safety behaviours. Furthermore, House Safety Assurance (β = 0.249, p = 0.005) and the maintenance of 72-Hour Supply Kits (β = 0.219, p < 0.001) significantly contribute to the model, highlighting that physical and structural mitigations are prioritized by prepared households.

Among the financial variables, only Savings for Hazards (β = 0.048, p = 0.023) maintained significance in the multivariate environment. Interestingly, insurance take-up (Property and Life) did not emerge as a significant predictor when controlled for household actions. This implies that while financial liquidity provides a baseline for recovery, it does not necessarily translate into active preparedness behaviors without the presence of disaster-specific planning and physical resource accumulation.

Regression analysis: Effect of financial preparedness on household hazard preparedness

The findings of Table 6 show logistic regression of the gender, age, and education variables on household disaster preparedness: the conclusion is that the specific savings used to prepare against natural challenges have significant effects, which are statistically significant on disaster preparedness (B = 0.328, p = 0.003). The odds ratio (Exp (B) = 1.388) shows that, as the savings allocation to disaster risks increases by one unit, there is a 38.8 percent increase in the likelihood of preparedness. This result emphasizes the importance of financial planning in

disaster preparedness measures, which is consistent with recently discovered information according to which liquid assets set aside to handle disasters are more useful at encouraging physical preparedness than having a general wealth (Vinnell et al., 2020). On the other hand, other financial measures, including savings to recover, property insurance coverage, and life insurance coverage did not find any statistically significant correlation with preparedness. This finding indicates the possibility of having a stronger effect over the hazard contingent financial planning than the generic financial safeguard systems. Theoretically, the current studies confirm that insurance tends to serve as a buffer, which, in fact, results in a reduction of physical preparedness, a process named as an insurance-induced moral hazard in the context of disaster preparedness (Kuhlicke et al., 2020). The households that choose specific investments to be made in the event of disasters will tend to define a higher degree of control over the effects of disasters, which inspires practical preparedness measures (Patel et al., 2023; Wai et al., 2023).

Table 6. Logistic regression on financial factors to household hazard preparedness

Independent variables	B-coefficient	Odds ratio	P-value
Savings for natural hazards	0.328	1.388	0.003
Savings for recovery	0.043	1.044	0.702
Property insurance coverage	0.008	1.008	0.924
Life insurance coverage	0.002	1.002	0.983

DV: Household preparedness

The assessment of financial preparedness for catastrophic occurrences often focuses on the implementation of emergency savings strategies that are linked to overall financial well-being. Effectively addressing the challenges posed by disasters requires preparation. It helps people apply methods to reduce risks and take protective actions, such as moving to safer locations when a natural disaster is expected or predicted (Cong & Feng, 2022). Saving for natural hazards has a significant effect on the preparedness level of the household. Every unit save for future hazards would significantly increase the probability of being prepared for natural hazards. The logistic regression results indicate that funds allocated to savings specifically for addressing natural catastrophes emerged as the most significant financial factors that define readiness for risks. This significantly enhances the likelihood of being well-prepared, making this category more advantageous. However, the other financial indicators such as family money allocated for recovery, property insurance coverage, and life insurance coverage do not show any significant correlations with hazard preparedness in this estimation.

Effect of training, and knowledge sharing on household hazard preparedness

According to the findings, overall, training and knowledge sharing have a positive impact to the preparedness level of the household's preparedness for hazards. Specifically, results underscored a strong positive relationship of 80 % (B-cofficient=0.80) between taking first aid/CPR training or having a trained household member and hazard preparedness level. Moreover, the likelihood that the household can survive or reduce risks from unexpected hazards is more likely twice (Exp (B)=2.241) when members of the household are trained or educated about the strategies for risk management and a reduction with a statistically significant level of less than 0.001. Additionally, the study found that seminars and education workshops partially improve household hazard preparation, despite first aid or CPR training. The results suggest that families with more disaster awareness are 61.1% more likely to be prepared for risks, with a statistical significance level of 0.063, close to 5%. This suggests that

disaster awareness through presenting hazard knowledge-sharing meetings can enhance family preparation. The result, consistent with the insights of Panpan Lian et al. (2021), depicted that training in disaster risk reduction and mitigation significantly enhances the probability of landowners adopting emergency preparedness behaviours. Instructed individuals are 21.39% more inclined to engage in these behaviours compared to their untrained counterparts. These findings indicate that increasing training programs may be essential for improving disaster preparedness in disaster-prone locations.

Table 7. Analysis for the role of training and knowledge sharing on household preparedness

Independent variables	B-coefficient	Odds ratio	P-value
Willingness to Take DRR Course	0.074	1.077	0.356
Disaster Knowledge (Meetings/Information)	0.477	1.611	0.063
First Aid/CPR Training	0.807	2.241	<.001

DV: Household preparedness

Table 8. Logistic regression specific hazard measures and household hazard preparedness

Independent variables	B-coefficient	Odds ratio	P-value
Emergency supplies (72-hour minimum)	1.249	3.486	<.001
Family disaster discussion	1.545	4.69	<.001
House safety assurance	1.294	3.648	0.014
Vehicle emergency supplies kit	0.141	1.152	0.642
Basic first aid kits	0.244	1.276	0.004

DV: Household preparedness

Moreover, the estimates of binary logistic regression in the specified hazard measures/activities demonstrate a very strong positive correlation with the household hazard preparedness. For instance, measures like storing emergency supplies at least for the first 72 hours of the event and also discussing with family/ household members about hazard risks, and evacuation processes such as discussing which roads are more secure through the event and which are dangerous to mitigate risk effects. The analysis showed that homes with emergency supplies had a 3.5 times higher chance of being well-prepared for catastrophes compared to households without such resources, with a p-value of less than 0.001. The statistical significance of this evidence confirms the claim that having a 72-hour emergency stockpile greatly improves families' preparedness. Furthermore, results reveal a 4.69-fold increase in disaster preparedness among families who engage in conversations about disaster preparedness. This highlights the crucial importance of communication and strategic planning within families in enhancing disaster preparedness. Additionally, assuring the fundamental safety of the houses and preparing some first aid kits significantly enhances the extent of Family readiness towards catastrophes. This involves taking preparedness actions including installing safety devices such as smoke detectors, restructuring heavy items of furniture in the home, and backing some medication to reduce damages and survive during a situation of a catastrophic event.

Theoretical implications and model validation

The integration of empirical data with Protection Motivation Theory (PMT) (Rogers, 1975) provides a robust explanation for the behavioral patterns observed in this study. While

traditional disaster management often emphasizes "Threat Appraisal" (the severity of the hazard), our Multiple Linear Regression (MLR) results suggest that for the Malaysian context, Coping Appraisal is the dominant driver of preparedness shown in Table 9.

The significant predictive power of Family Preparedness Discussion ($\beta = 0.303$, $p < 0.001$) and House Safety Assurance ($\beta = 0.249$, $p = 0.005$) validates the "Self-Efficacy" and "Response Efficacy" components of PMT. These results imply that households are more likely to prepare when they perceive they have the social and physical agency to mitigate the threat. Conversely, the lack of significance in insurance variables suggests a "Response Inefficacy," where financial tools are viewed as recovery mechanisms rather than proactive protective behaviors. This finding contributes to PMT literature by suggesting that social interaction (family discussion) acts as a catalyst that transforms passive knowledge into active protection motivation.

Table 9. Application of protection motivation theory to survey findings

Significant predictor	Regression weight (β)	PMT construct	Theoretical implication
Family disaster discussion	0.303	Self-efficacy	Collective planning reinforces the belief that the household can successfully navigate a disaster
House safety assurance	0.249	Vulnerability reduction	Structural safety reduces the "perceived severity" of the threat by securing the immediate environment
72-Hour supply kit	0.219	Response efficacy	Physical resources provide tangible evidence that the household's protective response will be effective
Savings for hazards	0.048	Resource availability	Financial liquidity acts as a secondary support for coping capacity but is less influential than social/physical actions

Conclusion

Due to changes in climate, rising expenses, and increasing stress, households and individuals are taking on greater responsibility for disaster preparation. Individual adaptation and preparedness are closely linked, as preparedness involves acquiring the knowledge and skills necessary to manage and recover from catastrophic events. Household preparedness includes proactive actions such as accumulating emergency supplies, formulating response plans, and participating in evacuation exercises. The study reveals that family discussions and preparation towards disaster, financial preparedness including insurance coverage, are key factors in determining the respondent’s preparation for natural disasters. Property insurance coverage significantly correlates with financial reserves for recovery. Respondents with both property and life insurance are more likely to be well prepared. Participation in disaster risk reduction activities is associated with other factors, suggesting that it serves as another important factor for preventive measures. Moreover, this study suggests that financial preparation for disaster management is associated with individual background and community vulnerabilities. Promoting emergency reserves and financial literacy may help families with low savings to mitigate and fast recovery (post disaster occurrence). Education and awareness on natural disaster risks is crucial, as increased community awareness may lead to the adoption of precautionary measures.

Acknowledgement

The research has received funding from the Ministry of Higher Education Malaysia for Transdisciplinary Research Grant Scheme (TRGS) with project code: TRGS/1/2022/USM/02/3/2.

References

Abdul Shukor, S., Imam Supaat, D., Salida Suhaila Nik Saleh, N., Mohamad Ahmad, N., Abdul Ghafar, A., Abd Rahman Shah, H., & Salwani Muda, F. (2020). Natural disaster and vulnerable victims in Malaysia: A preliminary study.

Ansari, Md. S., Warner, J., Sukhwani, V., & Shaw, R. (2022). Protection motivation status and factors influencing risk reduction measures among the flood-prone households in Bangladesh. *International Journal of Environmental Research and Public Health*, *19*(18), 11372.

Appleby-Arnold, S., Brockdorff, N., & Callus, C. (2021). Developing a "culture of disaster preparedness": The citizens' view. *International Journal of Disaster Risk Reduction*, *56*, 102133.

Ashikin, N., Rom, M., Hassan, N. B., Rahman, Z. A., Hassan, N. M., & Rahman, Z. A. (2020). Flood protection: Takaful for small scale agriculture and micro business. *Asian Journal of Research in Business and Management*, *2*(4), 44-53.

Azimi, M. A., Syed Zakaria, S. A., & Majid, T. A. (2019). Disaster risks from economic perspective: Malaysian scenario. *IOP Conference Series: Earth and Environmental Science*, *244*, 012009.

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. W. H. Freeman.

Becker, J. S., Paton, D., Johnston, D. M., & Ronan, K. R. (2017). Salient belief states and their role in disaster preparedness: The revised protection motivation theory model. *International Journal of Disaster Risk Reduction*, *24*, 182–192.

Cong, Z., & Feng, G. (2022). Financial preparedness for emergencies: Age patterns and multilevel vulnerabilities. *Research on Aging*, *44*(3–4), 334–348.

Despard, M. R., Friedline, T., & Martin-West, S. (2020). Why do households lack emergency savings? The role of financial capability. *Journal of Family and Economic Issues*, *41*(3), 542–557.

Faryabi, R., Davarani, F. R., Daneshi, S., & Moran, D. P. (2023). Investigating the effectiveness of protection motivation theory in predicting behaviors relating to natural disasters, in the households of Southern Iran. *Frontiers in Public Health*, *11*, 1201195.

Harvatt, J., Petts, J., & Chilvers, J. (2011). Understanding householder responses to natural hazards: Flooding and sea-level rise comparisons. *Journal of Risk Research*, *14*(1), 63–83.

Heidenstrøm, N., & Kvarnlöf, L. (2018). Coping with blackouts: A practice theory approach to household preparedness. *Journal of Contingencies and Crisis Management*, *26*(2), 272–282.

Hoffmann, R., & Muttarak, R. (2017). Learn from the past, prepare for the future: Impacts of education and experience on disaster preparedness in the Philippines and Thailand. *World Development*, *96*, 32–51.

Kuhlicke, C., Seebauer, S., Hudson, P., & Begg, C. (2020). The many dimensions of resilience: Household-level adaptation in the face of flood risk. *Environmental Science & Policy*, *114*, 215–222.

Levac, J., Toal-Sullivan, D., & O'Sullivan, T. L. (2012). Household emergency preparedness: A literature review. *Journal of Community Health*, *37*(3), 725–733.

Lian, P., Zhuo, Z., Qi, Y., Xu, D., & Deng, X. (2021). The impacts of training on farmers' preparedness behaviors of earthquake disaster-evidence from earthquake-prone settlements in rural China. *Agriculture, 11*(8), 726.

Lindell, M. K., & Perry, R. W. (2012). The protective action decision model: Theoretical modifications and additional evidence. *Risk Analysis*, *32*(4), 616–632.

Mabuku, M. P., Senzanje, A., Mudhara, M., Jewitt, G., & Mulwafu, W. (2018). Rural households' flood preparedness and social determinants in Mwandi district of Zambia and Eastern Zambezi region of Namibia. *International Journal of Disaster Risk Reduction*, *28*, 284–297.

Mariam, I., Budhiana, J., Permana, I., Dewi, R., Rahmanishati, W., Noviyanti, L., Novianti Utami, R., Sanjaya, W., Rahman La Ede, A., Frans Unmehopa, Y., & Tinggi Ilmu Kesehatan Sukabumi, S. (2021). Knowledge, attitudes, disaster training and self efficacy on disaster preparedness. *Research Horizon*, *1*(5), 179-188.

Mertens, K., Jacobs, L., Maes, J., Poesen, J., Kervyn, M., & Vranken, L. (2018). Disaster risk reduction among households exposed to landslide hazard: A crucial role for self-efficacy?. *Land Use Policy*, *75*, 77-91.

Michel-Kerjan, E., & Kunreuther, H. (2011). Redesigning flood insurance. *Science, 333*(6041), 408–409.

Muttarak, R., & Pothisiri, W. (2013). The role of education on disaster preparedness: Case study of 2012 Indian Ocean earthquakes on Thailand's Andaman Coast. *Ecology and Society*, *18*(4).

Muzamil, S. A. H. B. S., Zainun, N. Y., Ajman, N. N., Sulaiman, N., Khahro, S. H., Rohani, M. M., Mohd, S. M. B., & Ahmad, H. (2022). Proposed framework for the flood disaster management cycle in Malaysia. *Sustainability, 14*(7), 4088.

Nikkanen, M., Räsänen, A., & Juhola, S. (2021). The influence of socioeconomic factors on storm preparedness and experienced impacts in Finland. *International Journal of Disaster Risk Reduction*, *55*, 102089.

O'neill, J. (n.d.). Social justice and the future of flood insurance. www.jrf.org.uk

Oktora, S. I., Wulansari, I. Y., Siagian, T. H., Laksono, B. C., Sugiandewi, N. N. R., & Anindita, N. (2024). Identifying the potential participation in natural disaster insurance: first attempt based on a national socio-economic survey in Indonesia. *International Journal of Disaster Resilience in the Built Environment*, *15*(2), 177–192.

Patel, R. K., Pamidimukkala, A., Kermanshachi, S., & Etminani-Ghasrodashti, R. (2023). Disaster preparedness and awareness among university students: A structural equation analysis. *International Journal of Environmental Research and Public Health*, *20*(5), 4447.

Paton, D. (2003). Disaster preparedness: A social-cognitive perspective. *Disaster Prevention and Management*, *12*(3), 210–216.

Rahman, M. M., Asikunnaby, Chaity, N. J., Abdo, H. G., Almohamad, H., Al Dughairi, A. A., & Al-Mutiry, M. (2023). Earthquake preparedness in an urban area: the case of Dhaka city, Bangladesh. *Geoscience Letters*, *10*, 27.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *The Journal of Psychology*, *91*(1), 93–114.

Setiadi, R., & Frederika, R. (2022). Family financial planning for disaster preparedness: A case study of North Semarang, Indonesia. *International Journal of Disaster Risk Reduction*, *82*, 103332.

Shao, J., Hoshino, A., & Nakaide, S. (2022). How do floods affect insurance demand? Evidence from flood insurance take-up in Japan. *International Journal of Disaster Risk Reduction*, *83*, 103424.

Sudo, K., Murakami, H., & Yamano, S. (2019). Impact of disaster education on household preparedness: A case study of the 2016 Kumamoto earthquake. *International Journal of Disaster Risk Reduction*, *40*, 101150.

Vinnell, J. S., Hudson-Doyle, E. E., Johnston, D. M., & McClure, J. (2020). Prediction of household preparedness for different disaster hazards: A social cognitive model. *Journal of Environmental Psychology*, *72*, 101521.

Wai, S. T., Lin, Y. N., & Tang, C. H. (2023). The role of response efficacy and self-efficacy in disaster preparedness actions for vulnerable households. *Natural Hazards and Earth System Sciences*, *23*(2), 555-570.

World Bank, & Bank Negara Malaysia. (2024). Managing flood risks: Leveraging finance for business resilience in Malaysia. International Bank for Reconstruction and Development / The World Bank. https://www.worldbank.org/en/country/malaysia/publication/flood-risk-management-leveraging-finance-for-business-resilience-in-malaysia.