Unveiling the Recipe for Disaster Vulnerability: A Multidimensional Analysis in Dumaguete City, Philippines

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ABSTRACT. Disaster vulnerability is not just a condition but a consequence of the interactions of natural and social factors. From this viewpoint, it is imperative to consider both natural and social factors when planning effective disaster risk reduction strategies. This study sought to determine factors that predict disaster vulnerability. Specifically, this research determined the associations between several socio-ecological dimensions (e.g., environmental, social, and economic profile), coping capacity, disaster preparedness, and disaster vulnerability of selected households in Dumaguete city. Using snowball sampling, a descriptive correlational design was used to collect data from self-report surveys of non-probable samples of 150 households from different disaster-prone barangays. Frequency count, weighted mean, and standard deviation were used to describe the data, and a multiple linear regression analysis was done to test the study's hypotheses. Findings show that the respondents manifested moderate levels of coping capacity and disaster preparedness while having high levels of disaster vulnerability. The study revealed that disaster preparedness and coping capacity were negatively correlated to disaster vulnerability. Aside from coping capacity and disaster preparedness, environmental, social, and economic profiles were also noted to predict disaster vulnerability significantly. Environmental profile was the most vital determinant of the participants' perceived disaster vulnerability. To better prepare for disasters, it is suggested that city disaster risk reduction strategies focus on helping vulnerable barangays develop better adaptive capacities and manage environmental hazards. This could include providing training on essential hazard management and creating income-generating opportunities to offset the adverse effects of disasters.

1.0. Introduction

Disasters have been affecting millions of lives and have claimed thousands annually worldwide. An annual disaster statistical review by Guha-Sapir et al. (2016) revealed that in 2014 alone, disasters claimed an estimated 22,765 lives and affected 110.3 million people worldwide. Data from 2005 to 2014 were taken to estimate the annual deaths and victims of disasters, and it was found that disasters can take 76,416 lives and affect 199.2 million people worldwide each year. Economic damages from disasters were also estimated from the data to have been 70.3 billion US dollars.

In the Philippines, natural disasters are common primarily because of its geographical proximity to the "Ring of Fire," where earthquakes and volcanic eruptions usually occur in varying degrees. About 90% of Earth's earthquakes occur in this area (Connors, 2016). Other factors, such as climate change, rapid urbanization, and industrialization,

caused the country to experience approximately 900 earthquakes and typhoons in 2015 (CFE-DMHA, 2015). In 2013, typhoon Yolanda made its landfall in the country with an estimated wind speed of 230 kilometers per hour, devastated many Filipinos and claimed at least 6,300 lives. It was considered one of the deadliest typhoons in Philippine history (BBC, 2013). According to a study by the United Nations Office for Disaster Risk Reduction (UNISDR), the Philippines is the world's third most disaster-prone country. They have a World Risk Index of 52.46 %, putting behind countries such as Japan (no.4), Chile (no. 11), and Cambodia (no. 15), to mention a few (Schuengel, 2016). Because of the country's high preponderance to disasters, research efforts were channeled into understanding the effects of disasters and how to reduce and mitigate risks.

In its national research agenda, the Commission on Higher Education (CHED) included disaster risk management as one of its priority themes for multidisciplinary/multi-sectoral research. Several disaster-related researches have already been conducted and published by higher education institutions (HEIs), which use some of the famous

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disaster frameworks such as the Hyogo Framework for Action (HFA) and Sendai Framework for Disaster Risk Reduction (SF-DRR). One emphasis from these frameworks is the importance of the concept of vulnerability, in which the HFA suggested that one effective disaster risk reduction strategy is to develop indicators in assessing vulnerability at the national and local levels (International Strategy for Disaster Reduction, 2005). The unpredictability of the occurrence of disasters has turned many researchers to focus on areas that can be controlled. Hence, identifying vulnerabilities in the social sphere can ultimately reduce disaster risk (Gillespie, 2008).

Although vulnerability was acknowledged as the main emphasis in reducing losses from disasters in the early 1980s, it started to decline in the succeeding years as it was criticized for oversimplifying the nature of disasters. For instance, early work on disaster vulnerability was measured by proximity to hazards. While there is the re-emergence of vulnerability studies in the early 21st century, most of the research conducted still identified vulnerability through geographic location, linking the presence of hazards in places to increased losses from disasters and hazard quantification (Borden et al., 2007; Cutter et al., 2003). Current works in vulnerability are shifting away from the plain hazard quantification. They are geared towards social work values and practices, recognizing the intricacies of disaster in the context of the dynamic nature of society (Cutter et al., 2003). While vulnerability is recognized as a social phenomenon, the literature remains almost silent regarding what factors significantly determine disaster vulnerability.

This study aimed to determine disaster vulnerability and its determinants at the local level using the household as the primary unit of analysis, particularly in the City of Dumaguete. Specifically, this paper intends to seek the households' profile in terms of their social, economic, and environmental status, as well as their level of coping capacity and disaster preparedness. It also seeks to determine whether these variables significantly predict the households' disaster vulnerability.

2.0. Framework of the Study

This study is anchored on the Bogardi, Birkmann, and Cardona conceptual model of disaster vulnerability. The BBC framework emphasizes that vulnerability analysis goes further from estimations and assessment of disaster impacts from the past and considers vulnerability to be dynamic and interacting simultaneously with the exposed element's (e.g., households) coping capacities and intervention tools in reducing vulnerabilities. According to the Birkmann, Bogardi, Cardona (BBC) model, vulnerability should

not be seen as an independent feature but rather necessitates focusing on the three sustainability dimensions: environmental, social, and economic. These three themes of sustainability development define the structure in which vulnerability is measured (Cardona, 2004).

Based on the preceding theoretical model, this study argues that the interaction of several vital indicators best explains household disaster vulnerability. It is important to note that the respondents' household profile, such as household respondents' average age, average monthly income, and educational level, may reflect their coping capacity. This refers to the capability of disaster-exposed elements (e.g., households) to handle challenging circumstances, dangers, or tragedies by utilizing existing talents and resources. This includes infrastructure, institutions, human expertise, social connections, leadership, and administration (Wang &Yang et al., 2020). Their strength in resisting the damaging effects of hazards thus would mean reduced vulnerability.

Disaster vulnerability is multi-dimensional, encompassing the environmental, social, and economic dimensions. These dimensions are interlinked, and understanding their interdependency is crucial to comprehend the complexity of disasters (Oliver-Smith, 2004). An example of this mutuality is seen in how human beings can shape their environment and how this built environment, in turn, shapes their economic activities and social norms (Birkmann, 2006). It is seen that the household's built environment, especially the physical components of the exposed elements, increases the risk posed by hazards, thus making them more vulnerable to the adverse effects of disaster. A household's disaster vulnerability is affected by physical components such as residence and construction type, exposure to hazards, and quality of dwelling. Social networks also play a crucial role, with poor social networks increasing vulnerability. Disaster vulnerability also operates in the economic sphere. The economic aspect of vulnerability is well documented in the literature, as poor and socially marginalized families tend to be more affected by disasters than highly well-off families. It is also observed that poor economic systems result in higher casualties (Zakour, 2010) and higher disaster risk (Zheng et al., 2024). The statement implies that households are less equipped to handle unexpected events when economic and social systems are unstable. As a result, they become more vulnerable to disasters and have a more challenging time recovering from them. This underscores the importance of building resilient systems that can withstand economic and social shocks and the need to support households in developing coping mechanisms to mitigate the impact of disasters.
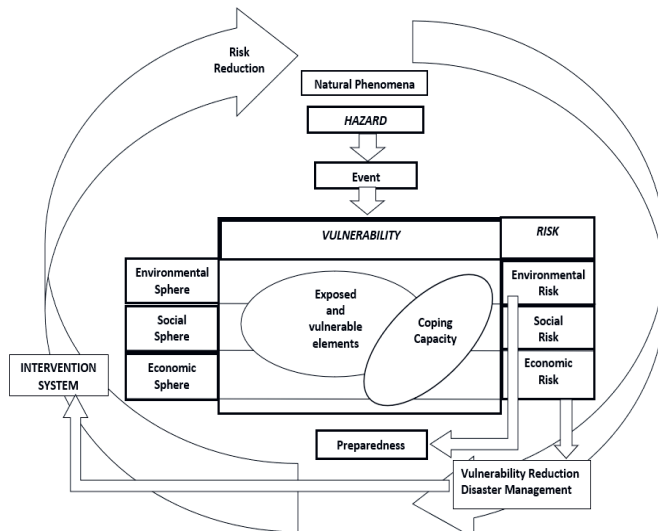
The last important determinant of the household's disaster vulnerability is their level of disaster preparedness, which would serve as an intervention tool to reduce disaster risk. According to Nojang and Jensen (2020), individual and household preparedness involves a constantly evolving readiness. This preparedness depends on various factors, including the specific context in which one finds themselves, various social processes, and the completion of specific activities designed to save lives and minimize the effects of disasters. Essentially, being prepared requires a multifaceted approach that takes into account a variety of different factors and variables. Disaster preparedness reduces disaster risk by identifying issues and difficulties in existing emergency management systems, which tend to create new vulnerabilities in the community, specifically in rural areas (Kapuku et al., 2014). This increases vulnerable groups' capacity to cope with disasters. Coping capacities, disaster preparedness, and environmental, social, and economic factors predict household disaster vulnerability.

the observed variables may be complex as it only observed the phenomenon of interest as it naturally occurs without any manipulation.

Research environment. The data used in this study came from self-report surveys from non-probability samples of 150 households coming from the different disaster-prone barangays that were identified by the Local Disaster Risk Reduction Management Council (LDRRMC) in Dumaguete City, Negros Oriental. These disaster-prone areas were also validated by a flood risk assessment study by Montenegro (2019) and LiDAR survey results by Paringit and Otadoy (2017). Household samples that were selected from 9 barangays that are relatively close to different sections of the Ocoy and Banica rivers came from Camanjac(15), Looc(15), Candau-ay (8), Bagacay (15), Tinago (15), Bantayan (15), Junob (22), Taclobo (15) and Batinguel (15).

Respondents and sampling technique. The researcher decided to have a total of 150 respondents to ensure the assumption of normality was achieved, as Field (2009) suggested that sampling distribution of samples thirty (30) or more tends to be normally distributed. Furthermore, sample size was determined using Green's formula (1991) cited in Field's book (2009) to determine the minimum acceptable sample size for a regression analysis. Green (1991) recommends that in testing the overall fit of the regression model, a sample size of 50 plus 8 multiplied by the number of predictors should be calculated (50 + 8k), where k is the number of predictors. This study was anticipated to have ten predictors; hence, the study would need a minimum sample size of 150. A snowball sampling was used to identify the respondents. Households were picked purposively from the identified disaster-prone barangays by selecting people who would meet the inclusion criteria and would be asked to refer qualified households nearby.

Research instrument. A researcher-developed survey questionnaire adopted from the BBC conceptual model of disaster vulnerability was used to measure the dependent and as well as independent variables of the study. Part I involves the household respondent's profile. The variables included are

Figure 1
Conceptual model of vulnerability (BBC conceptual framework) by Birkmann and Bogardi (2004) and Cardona (2001)

3.0. Methodology

Research design. The study employed a descriptive-correlational research design. The descriptive design was used to describe the households' profile, level of disaster vulnerability, coping capacity, and extent of disaster preparedness. The correlational aspect examines relationships between two or more variables without necessarily concluding causation (Trochim & Donnelly, 2006). Inferring causation of

attributes of all household members living in their homes during data collection. This means that of the 150 sampled households, there were 563 household members. Gender represents the frequency of male and female of all of the household members; Age represents the frequency of household members which falls under a specific age group; level of education represents the frequency of household members which falls under a specific level of education, while average monthly income represents the mean income of a household when all of its earning members income are combined. Other attributes included are the source of income and perceived health status. Part II comprises the disaster vulnerability assessment, including dependent and independent variable measures. The level of disaster vulnerability was measured with a 10-item Likert scale having questions such as "What is the probability of death or injury in times of landslides?" and "What is the probability of your household to cope with a disaster such as an earthquake?" The responses were always sure, certain, almost certain, and uncertain, with assigned weights of 4, 3, 2, and 1, respectively.

The questionnaire was validated by both the head of the city and province disaster risk reduction office using a rubric for scoring, evaluating length, clarity of questions, understandability relevance, and appropriateness of terms used. The instrument was considered valid, and it yielded a score of 4.31. The instrument was also subjected to a pilot study involving 30 households not coming from Dumaguete city. Reliability testing from the results yielded a Cronbach's alpha of 0.783, considered reliable.

Data collection and analysis. Before data gathering, an ethics clearance from the Silliman University Research Ethics Committee was acquired. Several letters of communication were given to the different disaster-prone barangays asking permission to conduct the research study. During data gathering, the sampled respondents were thoroughly explained the risks and benefits of the study and were asked for their informed consent. Confidentiality and anonymity were ensured by assigning number identifiers as replacements for their names, and the data were kept in a hard drive accessible only by the researcher and deleted right after data analysis.

A multiple regression analysis was conducted

to test how the interaction between disaster preparedness, coping capacity, and environmental and socioeconomic profile significantly affect disaster vulnerability. A (blockwise) hierarchical regression method was used to enter variables into the model, where predictors are selected based on past work, and the researcher decides in which order to enter the predictors (Field, 2013, p. 401). Since the environmental and socioeconomic profiles of the participants were categorical variables, which violates the assumption of a regression analysis, dummy coded variables are created to enter these categorical variables into the regression analysis (Trochim, 2011). Beta coefficients with corresponding bootstrap confidence intervals (BCa CIs) are reported for count variables. Bootstrap confidence intervals serve as robust population parameter estimates since they are not affected by the biases introduced in the dataset (Field, 2009). F statistic from ANOVA of each categorical variable rather than the beta coefficients of each dummy coded variable would be reported to determine whether these categorical variables significantly predict disaster vulnerability. SPSS version 21 was used in the analysis.

4.0. Results

The characteristics of the sample are depicted in the household profile. Environmental and socioeconomic profiles are also illustrated, as Cardona (2004) has emphasized that these reflect the main themes by which disaster vulnerability is measured. The household respondents' profile provides comprehensive information about a household's composition, demographics, and financial status. It includes detailed data on the age, gender, and

Table 1
Profile of the Household Respondents

Variable	n	%
Age of householdmembers		
20 and below	151	26.8
21 - 40 years old	196	34.8
41-60 years old	154	27.4
61 and above	62	11
Sex		
Male	285	50.6
Female	278	49.4
Educational Attainment		
None	43	7.6
Elementary level	57	10.1
Elementary graduate	97	17.2
High school level	65	11.5
High school graduate	148	26.3
College level	87	15.5
College graduate	65	11.5
Graduate studies	1	0.2
Average Monthly Income		
Less than 10,000	73	48.7
10,001 to 20,000	74	49.3

educational background of each member, along with their collective average monthly income. Table 1 shows that household members are primarily middle-aged males and high school graduates. The average monthly income ranges from Php 10,000 to Php20,000 pesos.

The environmental profile of the households includes variables such as residence, construction type, and presence of hazards. This is essential as it provides insight into people's physical safety. For example, a flood will be less risky to those living in a multi-story building than an earthquake. The majority of the respondents have separate houses built of a combination of stiff and light materials. It also shows that flooding is the primary hazard present. Several households are reported to be exposed to storm surge hazards since they reside in different coastal areas. Several households claim to be exposed to toxic waste hazards near dumpsite areas.

Variables included in the socioeconomic profile are the strength of the social network, access to loans, access to health services, and allocation for disaster preparedness. Participants rely on their families as a social support source during a disaster. A small

Table 2
Environmental Profile

Variable	n	%
Residence type		
Single detached	115	76.7
Duplex	9	6.0
Bungalow	8	5.3
Others	6	4.0
Single detached	6	4.0
Construction type		
Semi-concrete	105	70.0
Wood	27	18.0
Concrete	16	10.7
Others	2	1.4
Presence of Hazards		
Floods	99	66.0
Storm surge	20	13.3
Toxic waste	12	8.0
Sinkhole	4	2.7
Drought	4	2.7
Epidemics	3	2.0
Others	8	5.2

portion of the sample availed of insurance plans and did not rely much on the local government. Almost half of the participants have access to loans with their relatives, while two-thirds do not have access at all. Most households have access to health care services via health care insurance. Finally, more than half of the respondents allocated 1-3 % of their monthly income to disaster preparedness; on the contrary, almost half did not allocate it.

Level of Disaster Vulnerability

Results reveal that the participants perceived they are primarily vulnerable to solid typhoons, as evidenced by having the highest mean score, followed by floods, resource insufficiency, and household fire. Participants also tend to perceive that they can likely evacuate safely should a need arise. Data also reveal their perceived difficulty in coping with a disaster, suggesting that barriers are in place that make the necessary mobilization of resources difficult. Epidemics are perceived to be non-threatening to the households, as manifested by having the lowest mean score since the occurrence of epidemics in the area is uncommon.

Level of Coping Capacity

Table 5 reveals mean scores of coping capacity in terms of information engagement, economic capital, social capital, and infrastructure. Mean levels

Table 3
Socioeconomic Profile

Variable	n	%
Strength of Social Network		
Family	115	76.7
Local government	20	13.3
Friends	7	4.7
Insurance company	4	2.7
People in the community	4	2.7
Access to loans		
Relatives	41	27.3
Friends	12	8.0
Rural coop	9	6.0
Gov't bank	4	2.7
Others	73	48.7
Cooperative	11	7.3
Access to health care services		
Philhealth	130	86.7
Access to municipal health Center	10	6.7
Medical competition	4	2.7
Extension services	3	2.0
Traditional medicine	3	2.0
Allocation for Disaster Preparedness		
No allocation	62	41.3
1-3%	83	55.3
4-6%	3	2.0
7% or more	2	1.4

Table 4
 Level of Disaster Vulnerability of Households

Variables	Mean	SD	Interpretation
1.Likelihoodthat the household could not withstand a strong typhoon such as Typhoon Yolanda.	3.39	.826	Moderate high
2.Likelihood that the house would be destroyed in a flood.	3.37	.798	Moderate high
3.Probability that the household would have insufficient financial and food resources during a disaster.	3.33	.774	Moderate high
4.Probability that the house could not withstand household fire.	3.33	.894	Moderate high
5.Likelihood of evacuating the house in times of flood.	3.23	.956	Moderate high
6.Probability of getting the household safely in an armed conflict.	3.13	1.028	Moderate high
7.Probability of death or injury in times of landslides.	3.09	1.099	Moderate high
8Probability the household can cope with a disaster such as an earthquake.	2.94	.582	Moderate high
9.Likelihoodthat the household would get sick during an epidemic.	2.78	.694	Moderate high

Per item level of Disaster vulnerability: very low (1.00 – 1.74), moderately low (1.75 –2.49), moderate-high(2.50 – 3.24), very high(3.25 – 4.00)

from the coping capacity variable revealed that households in disaster-prone areas tend to have lower coping capacity on the economic and social capital indicators. Furthermore, households may have acquired capabilities to apply disaster-related tips and gather information necessary to prevent damage to life and property. It emphasizes the essential role of multimedia in disseminating important information is expensive to maintain, considering the economic capacity of the respondents. Based on mean scores, respondents do not usually develop a family disaster plan. These respondents probably have not made their disaster plans yet since most of these families lack the necessary disaster management knowledge to evaluate the urgency of making one.

Table 5
 Level of Coping Capacityof Households

Indicators	Mean	SD	Interpretation
Information and engagement			
Appliedlessons learned on television or radio in reducing disaster risk (e.g., Prepared evacuation plan, Stored batteries and staple foods, etc.)	2.23	1.205	Moderate low
Accessed the television, radio, or any devices to give appropriate and timely information (emergency early warning system, etc.)	2.33	1.294	Moderate low
Economic Capital			
Acquired money from different sources other than your income	1.82	.970	Moderate low
Set aside funds (emergency funds) that would be readily available in case of disasters.	1.78	.968	Moderate low
Community Capital			
Accessed to health care like membership of Philhealth	2.06	1.154	Moderate low
Took advantage of the assistance offered by non-governmental organizations (NGOs) and local government units (LGU) (e.g., Government loans, rehabilitation programs,Medical missions, etc.)	1.99	1.074	Moderate low
Strengthened membership inrural cooperatives	1.79	.980	Moderate low
Infrastructure and Planning			
Participated in Barangay and City assemblies for Disaster Management	2.09	1.206	Moderate low
Improved quality of dwelling to make it more disaster resistant (e.g., earthquake resistant, storm surge resistant, etc.)	1.96	1.104	Moderate low

Per item level of coping capacity: very low (1.00 – 1.74), moderatelylow (1.75 – 2.49), moderately high(2.50 – 3.24), very high(3.25 – 4.00)

should a disaster happen. On the contrary, low weighted means are observed in the economic and community capital, suggesting that families may lack the capability to mobilize necessary resources to resist the damaging effects of disaster.

Level of Disaster Preparedness

Table 6 shows the different disaster preparedness activities manifested by the participants. It is seen that higher mean scores of disaster preparedness are observed in preparing for secondary sources of energy, such as storing extra batteries, should there be power interruptions caused by a disaster. Back-up systems for energy sources are observed to have lower mean scores since having a generator

Predictors of Disaster Vulnerability

Multiple regression analysis was used to identify the predictors of disaster vulnerability. Results show in Table 7 that coping capacity, disaster preparedness, and environmental and socioeconomic profile significantly predict disaster vulnerability while controlling for age, sex, average monthly income, and highest educational attainment. Disaster preparedness is seen to affect disaster vulnerability negatively. Similarly, it is also seen that higher levels of coping capacity correspond to lower levels of disaster vulnerability. The environmental profile of the participants also shows to be predictive of disaster vulnerability, precisely, residence and construction type, as well as proximity to hazards.

Table 6
Level of Disaster Preparedness of Households

Variables	Mean	SD	Interpretation
Stored extra batteries or other emergency supplies.	2.61	.842	Moderate high
Attended disaster drills or exercises conducted by authorities.	2.49	.817	Moderate low
Actively participated in barangay disaster risk reduction management planning.	2.48	.865	Moderate low
I talked with government officials about what to do in an emergency.	2.48	.849	Moderate low
Developed a Family Disaster Plan.	2.42	.797	Moderate low
Obtained backup systems (improvised source of energy and other related gadgets)	2.39	.801	Moderate low
Purchased earthquake or flood disaster insurance.	2.24	.783	Moderate low

Per item level of coping capacity: very low (1.00 – 1.74), moderatelylow (1.75 – 2.49), moderately high(2.50 – 3.24), very high(3.25 – 4.00)

Additionally, the strength of social networks, allocation to disaster preparedness, and access to loans and healthcare services are also shown to be significant predictors. It is essential to note that all predictors can explain 79.6% of the overall variance in disaster vulnerability when taken together. The environmental profile had the highest contribution (R^2=0.713), followed by coping capacity (R^2=0.611), socioeconomic profile (R^2=0.604), and disaster preparedness (R^2=0.259).

are better suited to civic responsibility and careers after adapting to physical changes for optimal health (Berman et al, 2022). This depicts that the respondents are vulnerable to environmental hazard-bearing young and middle adults as the majority age group would have higher levels of coping capacity as this age group adapts more quickly to stressors and could be able to help several households recover immediately in disaster events (Cardona, 2004). A recent study by Chen and Cong (2023) explored

Table 7
Predictors of Disaster Vulnerability of Households

Variables	β	F	R^2	Df
Block 1: **Household characteristics**				
Disaster Preparedness	-.458*		0.259	(4,145)
	(.058, .529)			
Coping Capacity	-.670*		0.611	(4,145)
	(-.791, -.536)			
After block 1		53.122**	0.648	(5,144)
Block 2: **Environmental Profile**				
Residence type		4.603**		
Construction type		8.561**		
Presence of hazard		7.392**		
After block 2		17.031**	0.713	(19,130)
Block 3: **Socioeconomic Profile**				
Strength of social network		4.983**		
Access to loans		18.669**		
Access to Health care services		32.056**		
Allocation for disaster preparedness		17.145**		
After block 3		12.664**	0.604	(16,133)
After all blocks		11.782**	0.796	(37,112)

*p<0.05, **p<0.01Note. In all models, age, sex, average monthly income, and educational attainment were controlled.

6.0. Discussion

Recent literature on disaster vulnerability is now shifting away from hazard quantification and is acknowledging disaster vulnerability as a social phenomenon. Although disaster research is flourishing in the Philippines, there is a dearth of evidence suggesting disaster vulnerability as a social process, particularly at the household level. Survey results indicate that most respondents are in the young and middle adulthood stages of human growth and development. Individuals in these stages

psychological distress experienced by different age groups after multiple disaster exposures. Results show that older age groups (65 years and over) reported lower psychological distress compared to people ages 18–34, 35–49, and 50–64. This implies that although younger age groups tend to adapt quickly, they may experience psychological distress when exposed to disasters repeatedly.

In a study conducted by Chan et al. (2016), community health risk perception and household-based preparedness were ascertained based on sociodemographic determinants, and it was found

that a negative relationship exists between disaster risk perception and household disaster preparedness among the elderly (65 years and above) compared with the younger age groups (middle age). In other words, Middle-aged adults pose higher levels of household disaster preparedness and disaster risk perception. On the contrary, Cong et al. (2021) suggest that older adults may have a higher capacity for coping, as they tend to appraise coping barriers less than their younger counterparts. Decreased education can lead to low income levels, forcing families to live within the poverty line. Wisner (2005) also stressed that economic pressure forces families to dwell in unsafe living conditions, contributing to families settling in unsafe areas prone to disasters. With low educational attainment, the respondents may be more susceptible to disaster as it would be difficult for the households to interpret disaster warnings and follow disaster preparedness tips. The magnitude and salience of the situation may be wrongly evaluated and miscalculated, resulting in untimely decision-making should there be a need to evacuate in times of calamities.

The environmental profile also shows that most of the houses by the participants are made of concrete with a combination of light materials. In contrast, second in rank are houses built totally of wood, making them more susceptible to the damaging forces of nature. This finding suggests that construction type is one of the more significant contributors to disaster vulnerability in respondent households. According to a study by Chen et al. (2021), newly built concrete houses are less likely to be situated in hazard-prone areas and have lower risk exposure. On the other hand, poorly built houses tend to be occupied by informal settlers and are more likely to be found in these hazard-prone areas. The socioeconomic profile reveals that respondents mainly rely on their family as a source of social support when a disaster event occurs. A small portion of the sample availed of insurance plans and did not rely much on the local government. Poverty could explain why only a tiny portion of the sample had insurance since their income was only enough to support the daily basic needs of their family. Low-income families are also observed to rely more on the local government since they are helpless and unable to resist the damaging effects of disaster (Gerlitz, 2014). Confirming the results from the previous discussions, some households' low economic profile explains why some respondents reported that they rely on the local government. In addition, low-income levels may affect disaster preparedness practices as low-income households allocate necessary financial resources to disaster preparedness activities less likely. This is confirmed by the study of Lopez et al. (2022), which shows a significant difference in

the disaster preparedness activities of households in coastal communities in Negros Occidental when grouped according to household income.

Obtaining loans in the form of money, food, and non-food items is an essential strategy household use to cope with environmental and socioeconomic shocks brought about by disasters (Pouliotte et al., 2009). Almost half of the respondents have access to loans from their relatives, so it would be easy for them to borrow money without having to deal with high-interest rates as other lending firms do. Having access to loans makes the respondents insured of having readily available financial resources whenever a crisis emerges. Having no access to loans would make a recovery from structural and economic damage brought about by disaster a problem. When faced with a disaster, the respondents may also have to deal with the health costs after the disaster since any household member could be sick or injured. Access to readily available money through loans could address treatment and health costs. This also confirms the previous results that respondents can afford health care when money is borrowed.

The result shows that more than half of the respondents have allocated 1-3 % of their monthly income to disaster preparedness, while almost half have no allocation. This means that through experiences dealing with calamities, people in disaster-prone areas have already learned to increase household resilience by performing disaster preparedness behaviors such as allocating certain funds as a standby resource in an emergency. It is also seen that a considerable number of respondents (41.3%) reported having no allocation at all. This might be explained by the respondents' low to moderate income level being enough for the family's necessities. The respondents' access to loans could explain why they did not need to allocate an amount for disaster preparedness, as they are assured of having enough resources should a disaster strike. Families also tend to react differently to calamities; people often respond to calamities at the last minute since they must ensure that a disaster event occurs before allocating money and mobilizing resources for disaster preparedness (Fernando, 2008).

Multiple regression analysis was performed to test whether the environmental and socioeconomic profile, disaster preparedness, and coping capacity significantly affect the respondents' disaster vulnerability level. It is revealed in the linear models that the environmental profile among the several variables of interest is the best predictor of the level of disaster vulnerability, with a significant improvement in R square followed by coping capacity. It is also shown that all of the associations between the predictors and the outcome variable have p-values less than 0.05, which means that the dimensions (e.g.,

social, economic, and environmental) of disaster vulnerability, level of disaster preparedness and level of coping capacity does significantly influence the level of disaster vulnerability.

7.0. Conclusion

The results show that disaster preparedness, coping capacity, and environmental and socioeconomic profile of households influence their disaster vulnerability. Households that are better prepared for disaster and are readily capable of coping with post-disaster events manifest decreased levels of disaster vulnerability. It is also seen that the environment in which these households are mainly situated contributes to their susceptibility to the damaging effects of disasters. Residence and construction type contribute to vulnerability and access to readily available resources such as money and health care services.

8.0. Limitations of the Findings

Several limitations were identified during the study. First, the respondents were taken from disaster-prone areas of identified disaster-prone barangays, which makes the introduction of bias in their level of disaster vulnerability very likely. Second, the purposive sampling technique employed in the study might not allow households not identified as disaster-prone to be represented. Thus, generalization of the participants' level of disaster vulnerability to the entire city of Dumaguete might prove difficult. Lastly, the study's results reflect the respondents' perceptions; therefore, physical vulnerability to identified environmental and man-made hazards may be obscured.

9.0. Practical Value of the Paper

These findings suggest that there is a need to empower households in disaster-prone barangays in their capacity to resist and recover from disasters by strengthening their means of livelihood. Many of the respondents do not have any secondary source of income and tend to rely on borrowing money. It has been noted that the respondents have low scores on social and economic capital in coping capacity indicators. Thus, LGUs must provide them with alternative means of income. One effective way of strengthening their livelihood is to improve accessibility to skills training and livelihood programs offered by different government and non-government organizations such as DOLE, DOST, and DepEd. These programs should be made more accessible to people in disaster-prone areas, as they are the ones who need them the most. Households in disaster-prone areas are at risk of physical damage during a disaster. Therefore, these households need to have basic skills in disaster management. LGUs must reinforce disaster management skills, including preparedness and participatory planning for relocation. A study by Oracion (2021) shows that although households may perceive their environment as highly predictive of their sense of vulnerability to disasters, they may choose not to relocate due to their perception that the areas of relocation may be challenging to thrive in. Therefore, the planning for relocation sites must be done collectively by the LGU and affected households. A study conducted by Oracion (2015) also showed that riverside communities tend to establish kinship networks, allowing for the transfer of assistance and resources from areas with mild impacts to severely affected areas. Hence, along with community-based relocation planning, LGUs can incorporate disaster risk finance and contingency planning to help households identify risk transfer solutions, thereby strengthening the coping capacities of at-risk communities.

10.0. Directions for Future Research

Validity of the results may be strengthened through future research works geared towards replicating the research and testing the validity and reliability of the research instrument to a broader sample size, perhaps the entire Negros Oriental, to achieve more statistical power and ultimately lead to a more valid and generalizable conclusion. There is also a need to explore the different characteristics of all the barangays in Dumaguete City to determine what makes them more vulnerable to disasters. Lastly, researchers could also look at the actual geophysical characteristics of Dumaguete City to determine the physical aspect of disaster vulnerability rather than relying on the perceptions of the community.

11.0. Declaration of Conflict of Interest

The author declares no conflict of interest in the authorship and publication of this article.

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