Earthquake Disaster Preparedness among Selected Households Living Within Earthquake Fault Line Areas in Biñan City, Laguna, Philippines

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Abstract

This descriptive research looked into the level of earthquake disaster preparedness of selected households in Binan City, Laguna whose place of residence lies in earthquake fault line areas. It covered the respondents' profile including number of family members and house structure type. It also looked into their level of preparedness before, during, and after earthquake. Results revealed that less than half of the respondents have 5-8 members of family and their house structure type was mostly wood. Moreover, the respondents have high level of preparedness before, during and after earthquake. However, the results imply that the respondents' have the same level of preparedness during and after earthquake regardless of the number of family members. Meanwhile, those with 5-8 members are more prepared before the earthquake compared to families with 1-4 members and 9 above members. On the other hand, those whose houses were made of mostly concrete were more prepared than those with houses which are mostly made of wood or combination of wood and concrete before and after earthquake. Research findings implicate that determining the disaster preparedness of residents within earthquake fault line areas should help mitigate the massive impact of earthquake to vulnerable residents through proper education and awareness campaign.

Keywords: *earthquake, disaster preparedness, fault line areas, households, Philippines*

Introduction

Disaster preparedness refers to measures taken to prepare for and reduce the effects of disasters like floods, earthquake, and volcanic eruption. Its main goal is, to predict and, where possible, prevent disasters, mitigate their impact on vulnerable populations, and respond to and effectively cope with their consequences (International Federation of Red Cross, 2018).

Disaster preparedness provides a platform to design effective, realistic and coordinated planning, reduces duplication of efforts and increase the overall effectiveness of various societies, household and community members disaster preparedness and response efforts. Disaster preparedness activities embedded with risk reduction measures can prevent disaster situations and also result in saving maximum lives and livelihoods during any disaster situation, enabling the affected population to get back to normalcy within a short time period.

Disaster preparedness should be a continuous and integrated process resulting from a wide range of risk reduction activities and resources rather than from a distinct sectoral activity by itself. It requires the contributions of many different areas—ranging from training and logistics, to health care, recovery, livelihood to institutional development.

One of the most damaging natural disasters in the world is earthquake which is a sudden and violent shaking of the ground, sometimes causing great destruction, as a result of movements within the earth's crust or volcanic action. The Philippines is situated in the Pacific Ring of Fire making it an earthquake-prone country. The Ring of Fire is a major area in the basin of the Pacific Ocean where many earthquakes and volcanic eruptions occur. In a 40,000 km (25,000 mi) horseshoe shape, it is associated with a nearly continuous series of oceanic trenches, volcanic arcs, and volcanic belts and plate movements. It has 452 volcanoes (more than 75% of the world's active and dormant volcanoes). The Ring of Fire is sometimes called the circum-Pacific belt.

Literature Review

Historically speaking, the Philippines has experienced major earthquakes including the magnitude 8.0 earthquake in Mindanao (August 17, 1976), magnitude 7.8 earthquake in Northern and Central Luzon (July 16, 1990), magnitude 7.5 earthquake in Luzon (November 30, 1645), magnitude 7.3 earthquake in Casiguran (August 2, 1968), magnitude 7.2 earthquake in Bohol (October 15, 2013), magnitude 7.1 earthquake in Mindoro (November 15, 1994), magnitude 6.9

earthquake in Central Visayas (February 6, 2012), magnitude 7.5 earthquake in Central and Southern Mindanao (March 5, 2002), magnitude 6.5 quake in Ilocos Norte (August 17, 1983), and magnitude 7.6 earthquake which happened near Guiuan, Eastern Samar (August 31, 2012). All of these brought massive damage to infrastructure, properties and lives of many Filipinos (Sabornido, 2015).

At present, the efforts of many Filipinos led by various agencies of the Philippines like the Philippine Institute of Volcanology and Seismology (PHIVOLCS) are focused on preparing for "The Big One", a magnitude 7.2 magnitude earthquake from the West Valley Fault which is expected to hit Metro Manila and Quezon City and other neighboring areas. The West Valley Fault, a 100-kilometer fault, is one of the segments of an active fault, the Valley Fault System.The West Valley Fault transects portions of Quezon City, Marikina, Makati, Pasig, Taguig, Muntinlupa, Bulacan (Doña Remedios Trinidad, Norzgaray, San Jose Del Monte City), Rizal (Rodriguez), Laguna (San Pedro City, Biñan, Sta Rosa, Cabuyao, Calamba) and Cavite (Carmona, General Mariano Alvarez, Silang).

The Office of Civil Defense (OCD) in coordination with the Bureau of Fire Protection (BFP) and other government agencies has been conducting series of earthquake drills. This is to prepare the people for the estimated impacts projected in the 2004 Metro Manila Earthquake Impact Reduction Study (MMEIRS). According to MMEIRS, "The Big One" could destroy about 40% of residential buildings and damage 35 percent of public buildings. It could also result to 34,000 casualties, 114,000 individuals will be seriously injured, and the possible fire incidents that would follow could add another 18,000 deaths. With the drills and information campaigns conducted, the authorities are hoping that those numbers would be lessened.

Moreover, PHIVOLCS, in collaboration with the Association of Structural Engineers of the Philippines and other partners, came up with a 12-point "Self-Check for Earthquake Safety" questionnaire. Answers to the questions will indicate "whether a house (especially if it is built with concrete hollow blocks) was properly built and followed appropriate construction procedures and recommended measures or if it would require necessary strengthening.

Considering the foregoing premises, this study was brought to fore to determine the disaster preparedness of selected residents in Brgy. Poblacion and Brgy. Sto. Domingo, Biñan City Laguna that lies within fault line areas of West Valley Fault. The study is deemed significant because disaster preparedness is very crucial in mitigating the impact of natural disasters like earthquake through proper education and disaster assessment of national and local government.

According to Kangabam (2012), a critical component of disaster preparedness is the knowledge of available local resource information and how to response at the time of disaster. Impacts of natural disasters can be reduced through pre-disaster activities for mitigating risks and such activities are among the most crucial aspects of disaster risk reduction to consider in forming a coordinated strategy or plan. Mobilising resources raises the awareness level within the community and aids in assessing local knowledge and resources. He conducted a pilot study on awareness level among the different community of Rajiv Gandhi University which is located in one of the high seismic zone in the North eastern part of India.

The study concluded that disaster awareness among the community varies with the educational background, origin and age and the level can be strengthened through a combination of appropriate community based disaster preparedness, information technology and collaborative relationships between government, non- government organizations and community-based organizations.

Theoretical Framework

According to the Disaster Management Training Programme (UNDP, 1992: 22) disasters can be viewed as a series of phases on a time continuum. UNESCO (2010:30) states that natural 21 disaster preparedness is an essential component of any disaster management planning because it minimizes the adverse effects of a hazard, and that disaster preparedness must be seen as an active, ongoing process. Disaster management therefore involves the response to or anticipation of a hazardous event through a set of policy and administrative decisions and operational activities which pertain to the various stages of a disaster at all levels as reported by UNESCO (2010:31) and Disaster Management Training Programme (UNDP, 1992).

Khan (2008) maintains that education and awareness are prerequisites for preparedness, and that disaster preparedness education should be provided through formal and non-formal means by both governments and NGO programmes. Formal education in disaster preparedness is provided at the primary school level, where the topics focus mainly on general awareness about different types of disasters and at the post graduate level where degrees, certificate, diploma and master in disaster management are offered to prepare professionals for this task.

Methods

This study used descriptive method of research to determine the difference in the respondents' level of disaster preparedness before, during and after earthquake when grouped according to their profile variables. Descriptive research was deemed appropriate to describe characteristics of the population or phenomenon being studied, i.e. residents whose place of residence lies within earthquake fault line areas.

The respondents were fifty-nine (59) households who were represented by the heads of the family in Brgy. Poblacion and Brgy.Dela Paz Binan Laguna. Purposive sampling was used and only those living within fault line areas were included.

The survey questionnaire was considered as the most appropriate data gathering instrument for this descriptive research study about the respondents' level of disaster preparedness before, during and after earthquake. A self-made questionnaire with two parts was utilized in the study. Part 1 covered the respondents' profile along number of family members and house structure type. Part 2 dwelt on their level of disaster preparedness before, during and after earthquake. Items on the questionnaire were based on literature review particularly from the infographics released by the Department of Science and Technology (DOST). To test the validity of the questionnaire, the researcher presented it to the panel of experts in environmental science, research and statistics. It was also subjected to internal consistency reliability and yielded a Cronbach's alpha value of 0.879 which was considered excellent.

In preparation for data gathering, the researcher presented a letter addressed to the Barangay Captain of the covered areas to obtain permission to conduct the study. Before personally conducting the survey to the selected respondents, the researcher mentioned the instructions and explained the importance of the study to the respondents. After which, the answered questionnaires were retrieved, tallied, tabulated, and subjected to statistical treatment for analysis and interpretation.

The following statistical tools were utilized in the study: frequency and percentage distribution were used to describe the respondents' profile in terms of number of family members and house structure type. Weighted mean was used to describe the respondents' level of disaster preparedness a) before b) during and c) after earthquake. Kruskal-Wallis H Test was used to determine the significant difference in the respondents' level of disaster preparedness before, during and after earthquake when grouped according to a) number of family members and b) house structure type.

Stages of communication were strictly considered in this paper by sending letter of request to Barangay officials who have jurisdiction over the selected residents who served as respondents. Confidentiality of the respondents' identity and responses was strictly maintained as they were informed that the pieces of information that they provided were used for research purposes only.

Analysis

This descriptive study determined the disaster preparedness of selected residents in Brgy. Poblacion and Brgy. Dela Paz, Biñan City Laguna that lies within fault line areas of West Valley Fault. Specifically, it looked into their profile along number of family members and house structure type as well as the level of their disaster preparedness before, during and after earthquake. Significant difference in their level of disaster preparedness before, during and after earthquake in terms of number of family members and house structure type was also determined.

Table 1 Respondent's Profile

Profile	Frequency	Percentage
Number of Family Members		
1-4 members	20	33.90
5-8 members	32	54.20
9 members and above	7	11.90
House Structure Type		
Mostly Wood	37	62.7
Mostly Concrete	8	13.6
Combination of Wood and Concrete	14	23.7
Total number of Respondents: 59		

Table 2 Respondents' Level of Disaster Preparedness Before Earthquake

Before an earthquake, I make sure that…	Weighted Mean	Verbal Interpretation	Rank
1.my family has a first aid kit, a battery-powered radio, a flashlight, and extra batteries at home.	2.98	High	7
2. I know how to perform first aid.	3.31	High	1
3. I know how to turn off the gas, water and electricity.	3.29	High	2
4. I have a plan of where to meet my family after an earthquake.	3.24	High	4
5. I don't leave heavy objects on shelves because they may fall during a quake.	3.19	High	5
6. I anchor heavy furniture and/or appliances to the walls or floor.	3.02	High	6
7. I learn the earthquake plan at my school or workplace.	3.27	High	3
Average Weighted Mean	**3.18**	**High**	

Table 3 Respondents' Level of Disaster Preparedness During Earthquake

During an earthquake, I know that I have to…	Weighted Mean	Verbal Interpretation	Rank
1. stay calm.	3.41	High	4
2. Stay away from windows and outside doors.	3.32	High	5
3. stay in the open away from power lines or anything that might fall	3.61	Very High	2
4. Stay away from buildings (stuff might fall off the building or the building could fall on me).	3.63	Very High	1
5. duck, cover and hold.	3.59	Very High	3
Average Weighted Mean	**3.47**	**High**	

Table 4 Respondents' Level of Disaster Preparedness After Earthquake

After an earthquake, I can…	Weighted Mean	Verbal Interpretation	Rank
1. check myself and others for injuries.	3.31	High	5
2. provide first aid for anyone who needs it.	3.20	High	7
3. check water, gas, and electric lines for damage	3.22	High	6
4. stay away from damaged areas.	3.34	High	3
5. follow the emergency plan or the instructions of the person in charge	3.39	High	1
6. expect aftershocks.	3.32	High	4
7. be careful around broken glass and debris.	3.37	High	2
Average Weighted Mean	**3.31**	**High**	

Table 5 Difference in the Respondents' Level of Disaster Preparedness Before, During and After Earthquake When grouped according to Number of Family Members

Profile		Mean	Test Statistics (Kruskall-Wallis)	p-value	Decision	Interpretation
Before	1-4 Members	3.10	X^2=7.470	.024	Null Hypothesis Rejected	Significant
	5-8 Members	3.31				
	9-above Members	2.79				
During	1-4 Members	3.51	X^2=.848	.655	Null Hypothesis Not Rejected	Not Significant
	5-8 Members	3.51				
	9-above Members	3.17				
After	1-4 Members	3.16	X^2=4.678	.096	Null Hypothesis Not Rejected	Not Significant
	5-8 Members	3.41				
	9-above Members	3.24				
Significant@0.05						

Table 6 Difference in the Respondents' Level of Disaster Preparedness Before, during and After Earthquake When grouped according to House Structure Type

Profile		Mean	Test Statistics (Kruskall-Wallis)	p-value	Decision	Interpretation
Before	Mostly Wood	2.98	X^2=21.16	.000	Null Hypothesis Rejected	Significant
	Mostly Concrete	3.76				
	Wood and Concrete	3.36				
During	Mostly Wood	3.40	X^2=5.13	.077	Null Hypothesis Not Rejected	Not Significant
	Mostly Concrete	3.75				
	Wood and Concrete	3.47				
After	Mostly Wood	3.11	X^2=22.17	.000	Null Hypothesis Rejected	Significant
	Mostly Concrete	3.84				
	Wood and Concrete	3.51				
Significant@0.05						

Discussion

As shown in Table 1, more than half of the respondents' family had 5-8 members representing 54.20 percent of the sample population, twenty of them had 1-4 members while only 7 had 9 members and above constituting 33.90 and 11.90 percent respectively. As to house structure type, thirty-seven (37) or 62.7 percent had mostly wood house type, fourteen (14) or 23.7 percent had a combination of wood and concrete and eight (8) or 13.6 percent had mostly concrete.

As reflected in table 2, it is worth noting that the respondents know how to perform first aid, turn off the gas, water and electricity. They also learned the earthquake plan at their school or workplace and have a plan where to meet their families after earthquake. It is observed that all indicators are interpreted as "high" with weighted means ranging from 3.02 to 3.31 except for the indicator that includes first aid kit, a battery-powered radio, a flashlight, and extra batteries at home with the lowest weighted mean of 2.98 though interpreted as high. To sum up, an overall weighted mean of 3.18 shows that the respondents have high level of disaster preparedness before earthquake.

Table 3 shows that the respondents have very high level of disaster preparedness during earthquake particularly in staying away from buildings (WM=3.63), staying in the open away from power lines or anything that might fall (WM=3.61), ducking, covering and holding (WM=3.59). Meanwhile, they have high level of preparedness for staying calm (WM=3.41) and staying away from windows and outside doors (WM=3.32). As a whole, the respondents have high level of disaster preparedness during earthquake. This can be attributed to the intensified information campaign by the national government and local authorities to make people aware of what to do in case of emergencies and natural disasters.

As table 4 shows, the respondents have high level of disaster preparedness after earthquake. Specifically, their preparedness was high for following emergency plan or the instructions of the person in charge (WM=3.39), being careful around broken glass and debris (WM=3.37), staying away from damaged areas (WM=3.34), expecting aftershocks (WM=3.32), checking oneself and others for injuries (WM=3.31), checking water, gas and electric lines for damage (WM=3.22) and providing first aid for anyone who needs it (WM=3.20). As to the respondents' level of disaster preparedness during and after earthquake, table 5 shows that no significant differences were noted as shown by the p-values .655 and .096 respectively. On the other hand, a p-value of .024 was observed in terms of respondents' preparedness before earthquake which shows a significant difference. Against 0.05 test of statistical significance, the results imply that the respondents' have the same level of preparedness during and after earthquake regardless of the number of family members. Meanwhile, those with 5-8 members are more prepared before the earthquake compared to families with 1-4 members and 9 above members. This can be explained by the ideal number of family members that is usually composed of 4-8 members in the Philippine context.

As to the respondents' level of disaster preparedness before and after earthquake when grouped according to their house structure type, significant differences were noted as shown in table 6 by both p-value 0.000. On the other hand, a p-value of .077 was observed in terms of respondents' preparedness during earthquake which shows no significant difference. Against 0.05 test of statistical significance, the results imply that the respondents' have the same level of preparedness during earthquake regardless of their house structure type.

Meanwhile, those whose houses were made of mostly concrete were more prepared than those with houses which are mostly made of wood or combination of wood and concrete before and after earthquake. This is so because families with houses that have concrete structure can be more confident and prepared that they will be safe in case of natural calamities like earthquake.

Conclusions

Less than half of the respondents have 5-8 members of family and their house structure type was mostly wood. Moreover, the respondents have high level of preparedness before, during and after earthquake. Likewise, the respondents have the same level of preparedness during and after earthquake regardless of the number of family members. Meanwhile, those with 5-8 members are more prepared before the earthquake compared to families with 1-4 members and 9 above members. On the other hand, those whose houses were made of mostly concrete were more prepared than those with houses which are mostly made of wood or combination of wood and concrete before and after earthquake.

Research findings implicate that determining the disaster preparedness of residents within earthquake fault line areas should help mitigate the massive impact of earthquake to vulnerable residents through proper education and awareness campaign. Although the national and local government have been aggressive in terms of educating the people about the damage that a strong earthquake may bring, house to house monitoring should still be done to check whether all family members are knowledgeable on what should they prepare for before, during and after earthquake especially first aid kit, a battery-powered radio, a flashlight, and extra batteries at home which are basic to responding to disasters like earthquake. Future studies covering multiple fault line sites may be conducted for better generalization.

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