

# Assessing Households' Preparedness for Earthquakes in Gbawe, Accra

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## Abstract

Episodic earth tremors occurrence in Gbawe signal looming earthquakes, a major threat to many households, lives and properties. One basic approach to reduce future risk and increase the resilience of communities to earthquake is for communities to create household's preparedness plan for earthquakes. The research explored the basic issue of what preparedness for earthquake means and its relevance to people in Gbawe. The main objective of this paper is to assess the extent of households readiness for earthquake; qualitative research involving collecting and analysing non-numerical data using questionnaires and interviews were used as the basic method. Household preparedness was measured with fourteen (14) earthquake list of items deemed as basic necessities needed during emergency response to earthquake. If an individual acted on 6 of the 14 indicators, they were deemed poorly prepared. Rating was done based on the number of indicators acquired by a household. The study revealed that, no household was very well prepared; 3.3% respondents were well prepared for earthquakes, 10% were moderately prepared, 16.7% were averagely prepared, 20% were below averagely prepared, and 50% were not prepared for earthquake emergencies. About 90% respondents had less than 6 of the emergency necessities and therefore were not well prepared for earthquakes. The study recommends capacity building of households to improve upon their preparedness for earthquakes.

**Keywords:** household, preparedness, earthquakes, Gbawe, mitigation, risk

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## 1. Introduction

Earthquakes continue to be a significant cause for death, injury and disruption of normal life globally. Contributions to the effects of earthquakes include rising populations, poor construction methods, and attendant hazards such as landslides or tsunami, individual demographics, people's behaviour at the time of the earthquake and the effectiveness of emergency response (Petal, 2011; Spence et al., 2011, Rapaport & Ashkenazi, 2019). According to Spence et al., 2011, in developing countries, death from earthquake can be extremely high, and often less in developed countries, primarily due to better construction methods; however, people can still be seriously affected.

The occurrence of a major earthquake without adequate preparation can cause massive destruction of the built environment in terms of loss of human lives and health, property and infrastructure. Disaster preparedness is defined as the activities and measures taken in advance to ensure effective response to the destructive impacts of disasters (Ardalan, A., & Sohrabizadeh, S. (2016). Earthquake preparedness is considered a significant way to reduce the risk of quake (United Nations: ISDR, 2004). It was estimated that natural disasters alone cost over USD 100billion annually worldwide (World Bank, 2010). According to the 2016 Humanitarian Response Plan launched by the WHO, USD 2.21 billion was needed to provide live saving health services to more than 79 million people in more than 30 countries due to protracted emergencies that year. A multicounty study using the Emergency Event Database (EM-DAT) indicated that developing countries natural disasters have a negative impact on GDP approximately 9%. In earthquake prone areas, the accelerated rate of urbanization coupled with increased in urban population is a serious concern in the event of a damaging earthquake. There have been a number of global efforts to reduce the effects of earthquakes and some of these include the Inter-national Decade for Natural Disaster Reduction (IDNDR). The IDNDR committee on Natural Disaster Reduction adopted a multidisciplinary Program that assimilates important elements including, hazards and risks assessments, awareness and education, preparation for emergency response, recovery and renovation among others (Housner, 1989). Similarly, the Sendai Framework for Disaster risk Reduction in 2015, which encompasses the scientific, policy, and practice activities aimed to reduce losses in lives, livelihoods, and health, linked to development and recovery (Maly & Suppasri, 2020). Becker et al., 2013 indicated that, the underlying factor in earthquake preparedness is knowledge about earthquake and how individuals understand and make meaning of earthquake information and how this influences preparedness. It has been realized that preparing one's home for earthquakes is an important step towards household mitigation to earthquakes.

The study of earthquakes have taken a very broad aspect involving, rotational part of ground motions (Igel, et

al., 2007), spatial distributions of earthquake epicentres and hypocentres (Chen, et al., 2013), poroelastic techniques in the study of earthquake (Roeloffs, 1996), and community resilience model that encompasses the performance of all the physical and socio-economic components from immediate impact through the recovery phase of a natural disaster (Koliou, et al., 2020).

Other studies have embraced concepts of socio-economic as an important parameter to measure the social and economic costs on the natural and built environment (Platt et al., (2016), the role of gender in disaster risk management (Enarson, Fothergill and Peek 2018); difference of attitudes and perceptions depending on gender, age, education and casualty awareness on earthquake risks (Murakami et al., 2016), knowledge about seismic-risk perception and the preparedness to take action to reduce seismic risks (Paradise, 2005; Oteng-Ababio, 2012), the effects of earthquakes on building and the dissipation of energy of vibration to the propagation of elastic waves in the ground (Housner, 1941) while Rahman (2019) examined knowledge on seismic-risk perception and awareness which revealed that risk communication can influence communities to become aware of risks and has a powerful influence on people's risk decision-making and behavior. In a similar study, Fernandez et al. (2018), investigated the factors that influence earthquakes-risk perception in Yangon, Myanmar and revealed that knowledge of earthquake-mitigation actions is positively related to gender where females are likely to have more knowledge of earthquake-mitigation actions than males (Fernandez et al., 2018).

## 2. Study Area and Methods

### 2.1 Location of study Area

The study area, Gbawe, located at latitude 5.57692 and longitude -0.31038 north of the equator, administratively falls under Weija-Gbawe Municipal Assembly. It is found about six kilometers west of Accra and shares boundaries with Mallam and Weija and Accra Metropolitan Assembly in the South-East, Akwapim South to the North-east, Ga west to the East, West Akim to the North, Awutu- Effutu Senya to the West, Gomoa to the South-West and the Gulf of Guinea to the South (Ghana. Statistical Service, 2013); it has a population of 74,403 people and 16,742 households (Ghana. Statistical Service, 2013). The selected study area covered the central part of Gbawe and is characterised as moderately high risk zone by the Ghana Geological Survey Authority (GGSA).

### 2.2 Geology

About two thirds of the land surface of Ghana is covered by Birimian rocks of paleoproterozoic age. These rocks form the easternmost component of the Man Shield of West African craton that has remained stable since 1.7 Ga. The eastern portion of the country is predominantly underlain by middle to late Proterozoic rock units that are differently named as Dahomeyan, Togo, Buem and Voltaian belts (Leube, et al., 1990, Amponsah, 2002). Gbawe is underlain by shale and interbedded shales and sandstones and clay. These geological formations are the most unstable in the event of earthquake (Ayetey and Andoh, 1988).

In 1939, Ghana experienced its severest earthquake with a local magnitude of 6.5. It resulted in the death of 17 people and caused significant damage to property. The most active seismic area is generally characterized by a major active fault line which stretches from the McCarthy Hill area in Accra westwards towards Kasoa-Nyanyanu in the Central Region and eastwards (Amponsah, Opoku-Ntim and Nortey, G., 2020).

Work done by Bacon and Quaah (1981) indicates that most of the earthquakes in Ghana occur in the western part of Accra between the two major fault lines namely, the Coastal boundary fault and Akwapim fault zone. According to them most of the epicentres and seismic activities are located south of Weija and Gbawe and little activity north-eastward along the Akwapim range and westward along the Coastal boundary fault (figure 1); the epicentres of the located earthquakes are related to the level of activity of the faults due to the existence of an old thrust zone, which has been reactivated (Bacon and Quaah, 1981).

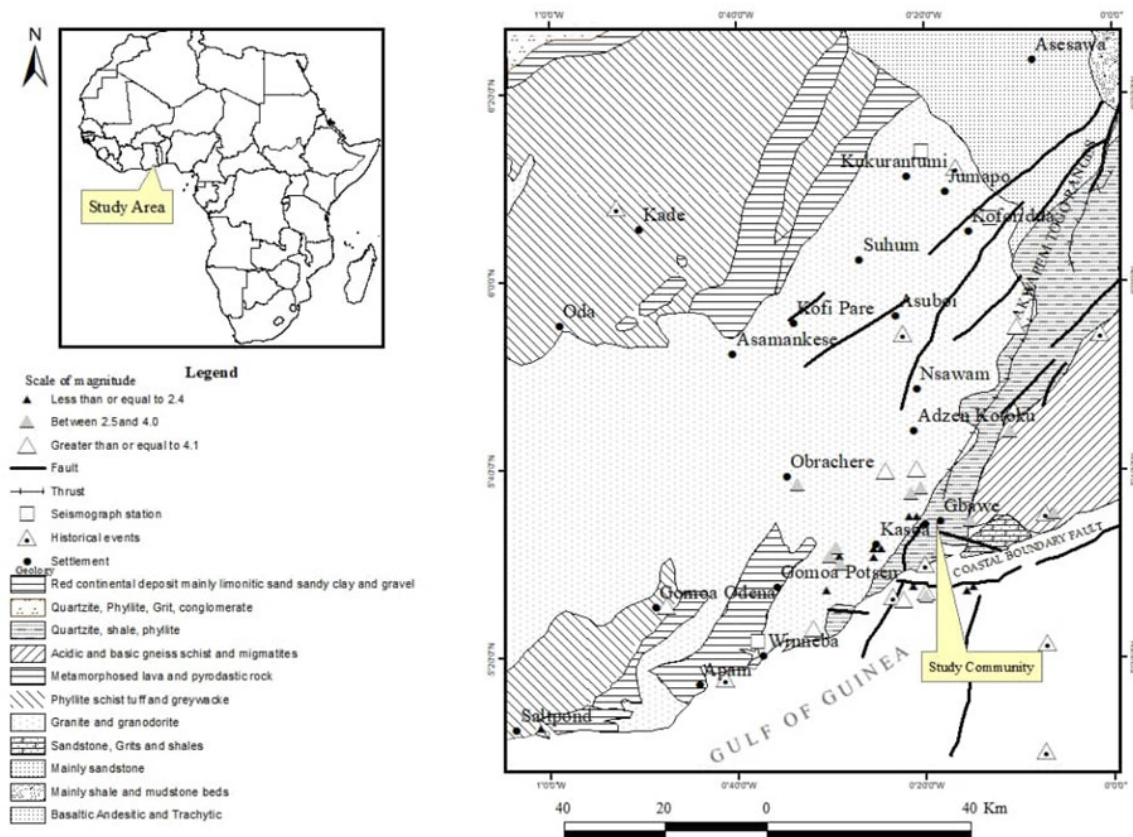


Figure 1. Map of Seismic Activity in Ghana and study location (Source: Amponsah, 2002)

### 2.3 Methods

The study adopted the qualitative approach of investigation using stratified random and purposive sampling to obtain a sample population that best represents the population being studied and making sure that key households groups are represented fairly. This was followed by simple random sampling technique to select households based on assigned numbers. Out of the 16,742 households (Ghana. Statistical Service, 2013), one hundred and fifty households (150) were selected from the study. The study area was divided into 10 localities comprising McCarthy Hill, Mallam, Old Gbawe, Gbawe Telecom, Gbawe CP, Gbawe Methodist church, Gbawe International Montessori, Bulemi-Top Base, C-Connie-Baley and Abbose Okai. Each locality in turn was divided into three making a total of 30-unit areas. All these areas were considered homogeneous since they all fall within the same active fault line and seismically they are of moderately high magnitude. Random sampling was used in order to give all quake prone areas an equal chance to be selected for the surveying, as well as generalization of the findings. Five households were selected from each unit bringing the total households selected to one hundred and fifty (150). Since the study adopted the case study approach which does not require a large sample size (Bryman, 2012, Creswell, 2014), 150 or more respondents could be considered appropriate for the study analysis. 70 (47%) of the respondents were males and 80 (53%) female. The research procedure was in two stages. The first stage involved review of the literature on household preparedness of earthquakes, the second comprised field survey followed by field data collection. Primary data was collected on the field through questionnaires and in-depth household interviews; in addition, two focus group discussions evolving opened meetings were organised. Each group and comprised nine participants and were purposively selected from the household list. The rationale for the focus group discussion was to throw more light on households' preparedness for earthquakes. The interactions provided feedback to those who participated in the interviews and other community members who had a stake in the research themes. The questionnaires covered four key aspects, namely demographic characteristics of respondents, household preparedness of earthquake, perception of earthquake, and institutional response to earthquake preparedness. In each household, one person, preferably the owner of the property was interviewed. In the absence of the owner, the most senior person or a recommended person in the household who could answer the questions was interviewed. Information was also obtained through the use of interviews from targeted institutions: Ghana Geological Survey Authority (GGSA) and National Disaster Management Organization (NADMO).

Household preparedness was measured with fourteen (14) earthquake preparedness checklist items (Spittal et

al., 2006), tapping into the supply of nine emergency necessities (food and water, extra batteries, battery-powered radio, battery-operated torch, first-aid kit, gas mask, fire extinguisher, escape ropes, whistle), coverage of accident insurance, knowledge of local emergency response systems (emergency numbers, exit routes and shelters) and availability of a household evacuation plan. A list of emergency items was prioritized in accordance with the National Disaster Management Organization, Ghana. The emergency supply items for earthquake preparedness were grouped into five and ranked based on the number of emergency items acquired by a respondent; securing all 14 indicators mean a household is prepared; with any 6 emergency necessities, household is rated poorly prepared and with 2 indicators, household is considered unprepared. Both qualitative and quantitative data were analysed using Microsoft Excel Software and the result was presented in the form of frequency tables, and graphs making presentation of data simple and eliminates the potential for bias within the data collected. For the responses of the open-ended questions of the questionnaire and the qualitative data collected, analysis was done manually by systematically searching, arranging and organizing data into manageable themes.

### 3. Results and discussions

#### 3.1 General characteristics of respondents

##### 3.1.1 Age of respondents

The age distribution of the respondents shows that, 10% fell within the range of 20-30 years, 38.7% were in the range of 31-40 years, 30% fell between 41-50 and 21.3% were 51 years and above (figure 2). The distribution shows that most participants were in their youthful and middle age and less in the old age which reflects the demographic nature of the sampled population in the study area (Ghana Statistical Service, 2012) and which needs to be taken into consideration when preparing any disaster mitigation plan. Involving the youth in disaster planning and recovery can increase the awareness of disaster that may occur in their neighbourhood and teach them how to respond in various types of emergencies.

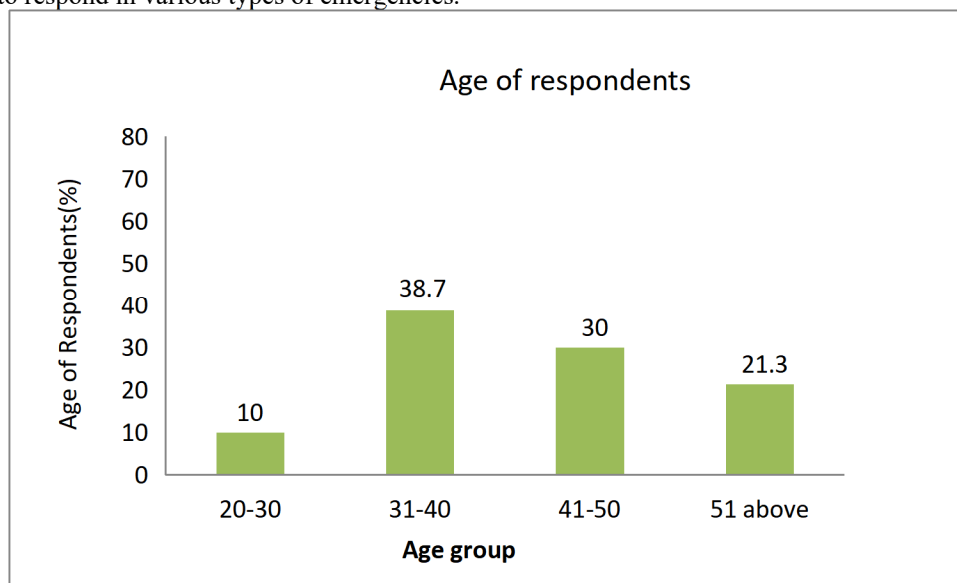


Figure 2. Age of respondents. Source: Field data, 2019

##### 3.1.2 Education of respondents

The educational level of respondents varied; 14% obtained primary education, 19% completed junior high school, 37% finished secondary education, 20% completed tertiary education and 10% had no formal education (figure 3). Education is considered as one basic factor that can be used to measure the level of respondents' knowledge and understanding of earthquake and also for effective household preparedness plan. It was observed that 20% of the respondents who attained tertiary education have a better access to information (41.5%) and have a good knowledge about earthquake as compared to those who completed only basic education: primary, 12%, JHS, 15.5% and SHS 28%, and those without education, 3%, (figure 3). Those with tertiary education defined earthquake as 'the sudden movement of the earth by tectonics; whiles 54.6% who completed basic education, described earthquake as the 'natural occurrence of shaking of the earth, 11.4% believed it is the result of mining and dam operation), and 4% attributed earthquake to God's intervention. The result shows that majority of respondents have a general understanding of earthquake irrespective of the differences in their level of education, income and number of years experiencing earthquakes. However, according to Gillani, et al., 2020, people understanding of earthquakes and their response to earthquake preparedness greatly correlates with their knowledge, attitude, and readiness to preparedness and not only by education. However, disaster training or household preparedness for earthquake is likely to be more effective if people are more knowledgeable about

earthquakes hence higher education plays a key role (Qureshi et al., 2021). Thus, the role of education in household preparedness for earthquake needs to be considered broadly taking into account other factors such as readiness and attitude.

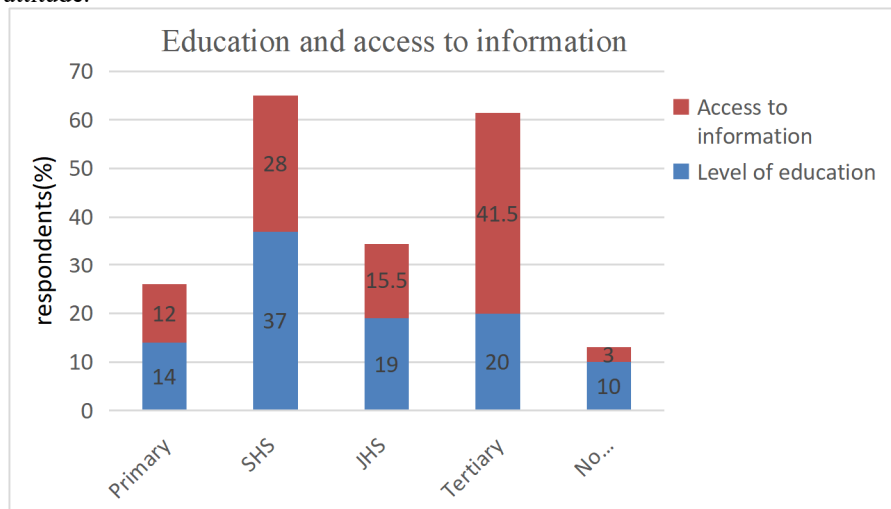


Figure 3. Level Educational and access to information of respondents. Source: Field work, 2019

### 3.1.3 Respondents' duration of stay in the community, experience and awareness about earthquake.

This section relates knowledge about earthquake, which includes information sharing, exposure to earthquake events, and participation in emergency training activities, to duration of stay of respondents in the study area. Duration provides timely assessment of the extent of respondents' exposure to or experience in earthquakes which are likely to influence their perception about disasters and how these contribute to their preparedness for earthquake. Experience plays a critical role in the development of human behaviours which is also influenced by duration of exposure to the events of occurrence. A summed score was calculated for each respondent for the duration of stay and expressed as a percentage. Results indicated that out of the 150 respondents, 43 representing 28.7% respondents have lived at Gbawe for 5-10 years and they have 25.5% level of awareness, 13.9% in training and 60.5% in information sharing about earthquake. 32.7% have lived for 10-15 years and showed they have 55.1% level of awareness, 18.3 in % training experience and 83.6% in information sharing about earthquake whiles respondents with duration ranging from 15-20 years exhibited 50% level of awareness, 60 in% training experience and 70% in information sharing about earthquake; respondents with duration range of 20-25 years showed 64.7%, in the area of information sharing, and 47.6% in training. Duration of 25 years and above rather revealed very low level of awareness, training and information sharing on earthquake as shown in figure 4 below.

It was anticipated that with long duration of stay in a community, households would have gained high awareness, training and information sharing in earthquakes while their behavioral patterns and response to earthquake would benefit households in earthquake preparedness; however it was the reverse case, duration range of 5-20 years rather depicted high values whereas duration of 20-25 years showed a decline in values for the same observed factors (figure 4). On the other hand, respondents of duration period 10-15 years and 15-20 years showed high level of awareness and information sharing about earthquake as compared to the period 20-25 years. The study revealed that people who have had long duration of stay were found to be either less concerned or have low preparedness for earthquake; this was more related to the older people who are more likely to avoid the negative psychological aspect of natural disaster as noted by Phifer et al, 1989. The implication of this is that such people are likely to become more vulnerable to earthquake incidence; besides, their attitudes are not likely to augur well for social awareness of the youth on earthquake mitigations. Even though the result showed concerned about earthquake vulnerability through information sharing, such awareness has very limited knowledge in participant's household preparedness. Awareness was found to be higher among educated people and those who are engaged in social interactions as shown in figure 3 and figure 4).



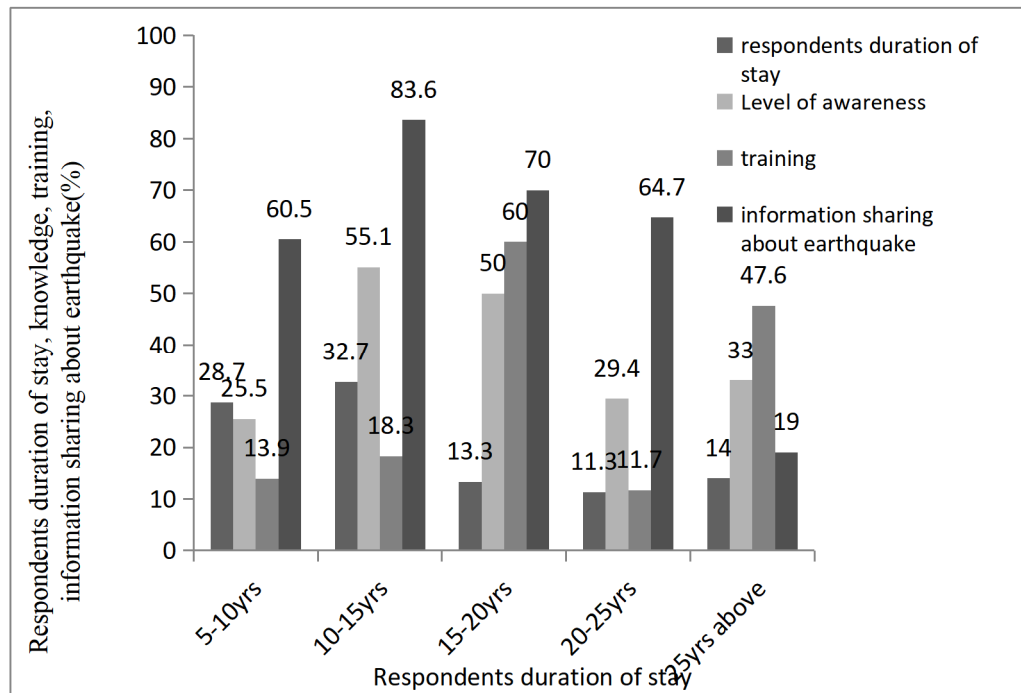


Figure 4. Respondents duration of stay and preparedness in earthquake preparedness. Source: Field data, 2019

Apparently, the findings did not establish any direct relationship between duration, awareness, training and information sharing on household preparedness for earthquakes, it however reflects previous conclusions made by Becker, et al., 2017 on household preparedness who indicated that factors influencing household preparedness for earthquakes can be difficult to assess, especially given the infrequent and varying nature of major events within time; however if people can recount their experiences based on earthquake event, it becomes much easier to assess their experiences and preparedness since people's experiences contribute to their beliefs about whether, and how, they should prepare for earthquakes. Gbawe has not experienced major earthquakes for the past decades and coupled with respondents short duration of stay this might have not given them sufficient experience, knowledge, and awareness about earthquake that could prompt community interaction on disaster issues. In conclusion, the findings of this study should be considered to design awareness raising and capacity building programs to improve community-based disaster management in the study area taking into consideration elements of duration, awareness, training and information sharing on household preparedness for earthquakes.

#### 3.1.4 Effects of earthquake on households

An assessment of the effects of earthquake indicated that no death was reported by respondents during past earthquake events. From the total sampled, only 13.4% had some effects ranging from injuries, damage to buildings and personal items to psychological disturbances; the remaining 86.6% had no effect. The threats of earthquakes, however, have raised public concern about mitigation measures to reduce future risks. Most of the respondents (59.3%) were slightly concerned about the effects of earthquake, 7.3% were moderately concerned and 25.3% were extremely concerned- respondents who had experienced earthquake effects, and 8% were not concerned at all; this last group comprised more of the 20-30 years age group. The percentage of respondents who are either moderately concerned (14%) or extremely concerned (18.6%) about earthquake fell in the age category of 40-50, and 50 years and above respectively. Thus, the issue of concerned appears variable across the age groups and this might be the results of respondent perception about earthquake.

#### 3.1.5 Understanding households preparedness and responsibilities for earthquakes.

The understanding of earthquake preparedness by communities is fundamental in deciding on the appropriate strategy to reduce risks and loss of lives and human suffering (Christoplos, et al, 2001; Jamshidi, et al., 2016). The preparedness discusses ways for households to prepare for an earthquake by developing an emergency response plan involving equipping household with information and emergency supply kits, knowing where to go, the hazards to be aware of, training, and implementing preparedness plans among others.

In an attempt to find out about respondents understanding of household preparedness plan for earthquakes and their responsibilities, respondents were asked to explain the term *preparedness* and whose responsibility is it to create one. Majority perceive earthquake preparedness as a way of putting measures in place to reduce risk in the event of earthquake but most of them have little idea what measures are needed or what has to be done; this can be supported from a 63 years old focus group participant at old Gbawe who was of the view that "*preparedness for earthquake means to avoid being caught unaware; it is safer to know where to hide when things starts falling*". In

similar situation, a focus group participant at MarCathy Hill expressed that *“preparedness would require measures to be taken at the individuals and societal level to minimize the effect of earthquake”*.

One participant from Gbawe-C-Connie informed that “preparedness involves measures taken by individuals to minimize the effect of earthquake”; while a female focus group participant of Gbawe Zero said “earthquake preparedness is about sharing information to help decide what has to be done” and went on to say “but how do we get this information?”

Household preparedness is considered by some focus groups as the responsibility of the state; 41% of participants believed that it is the obligation of the government to enact laws and provide the public with accurate information about earthquake and seismic safety guidelines for planning and household preparedness in risk mitigation; 27% were of the view that state media needs to furnish public with accurate information on earthquakes, 22% believed it is the responsibility of the state agency, National Disaster Management Organization (NADMO) to educate households about earthquake preparedness and 10% felt preparation should involve private institutions.

For protecting and providing personal safety of households, about 51% perceived it to be the duty of the government “because it is the state that has adequate knowledge and personnel to do that”; as echoed by a 54-year-old respondent of Agape,

On the other hand, 23% respondents thought that household preparedness of earthquake should be the responsibility of individuals and their immediate families. About 12% indicated earthquake preparedness is God’s intervention, 11% thought preparedness is either a probability or luck, 3% thought it is the responsibility of friends and relatives, and 50.7% believed it should be state responsibility (Figure 5).

On the question of whose responsibility it is for household earthquake preparedness and protect personal safely, a focus group participant at old Gbawe echoed *“the state is in charge of finance and security therefore the state should have the means to protect the people; besides, it is the responsibility of the government to see to it that all citizens are safe”*

In a similar development, a focus group participant candidly expressed that *“It is the responsibility of NADMO to help communities in earthquake preparedness and disaster management and so if there is excessive damage of buildings the state, through NADMO can help relocate to a temporary place,”* ( from a respondent, Gbawe)

However, a second opinion from a focus group participant of C-Connie Round About in Gbawe remarked that *“it’s up to us to put in place measures to prepare ourselves for any future occurrences of earthquakes because we shall be hurt and we can’t wait for someone else to save us”*; while another participant, Mr. Aryeh, emphasized that “we must provide immediate items to protect ourselves in the event of earthquake”. From the ensuing, the result from the focus group discussion presents not only mixed feedback and underscores households’ perception and preparedness of earthquake; it also identifies the state as a major role player in disaster management. While majority of participants were of the view that preparedness for earthquake risk prevention and management is the responsibility of the state, some participants felt that individuals have potential role to play in household preparedness of earthquake.

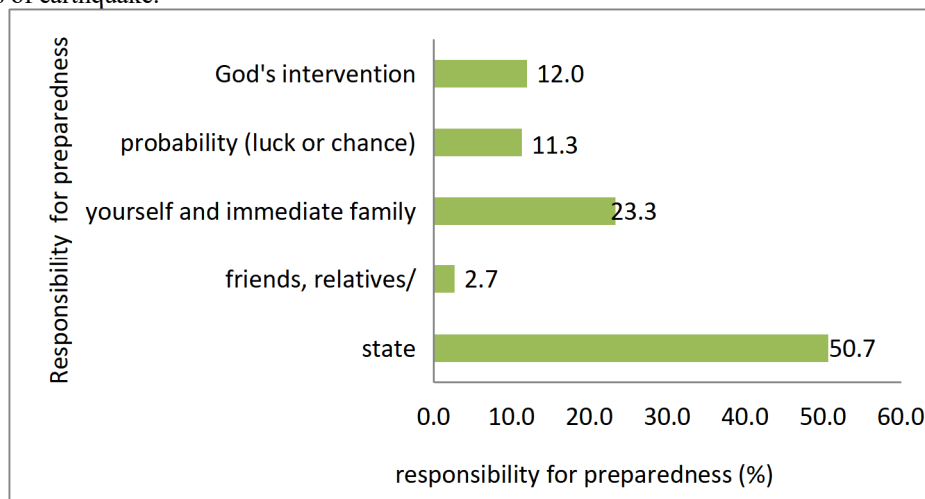


Figure 5. Responsibility for earthquake preparedness. Source: Field data, 2020.

The results also revealed the level of perception and misconceptions of respondents on whose responsibility is it in risk mitigation measures. The high reliance on state support for household preparation of earthquakes is not surprising because NADMO, a state institution, is the focal point for disaster management in the country. Respondents however, noted that state institutions responsible for disaster management have little or no coordination with the grass roots on household preparedness for earthquakes. In a statement by the Gbawe-Weija Municipal Assembly, NADMO is to improve human and institutional capacity building, promote disaster risk

reduction with stakeholders but this is hampered by inadequate resources (Weija-Gbawe Municipal Assembly, 2021); in such a state, household reliance on government for earthquake risk reduction could lead to poor household preparedness, a factor which can lead to an increase in household risk to earthquakes effects in the future. To minimise these effects, operative household earthquake preparedness requires effective planning, coordination, building synergies between public and private institutions as well as providing adequate funds and logistics to manage future risk and suffering.

*3.1.6 Respondents concern about earthquake preparedness*

Knowing the concerns of respondents in household preparedness for earthquake is important in determining their capacity in risk mitigation at the community level. When respondents were asked to list their concerns in preparing for household emergencies, the following concerns were raised.

*i) Cost of developing household preparedness plan*

Developing a household emergency plan always entails prioritizing the needs and cost involved in preparedness (McConnell, A., & Drennan, L. 2006, Marlyono & Nandi, 2018). From the data collected, 108, representing 72%, respondents do not have earthquake emergency plans because they thought developing a household plan will cost a lot of money, 30,(20%) respondents were uncertain if preparedness will cost a lot of money than their income level or not, and 8% considered that cost of preparedness would be moderate (figure 6). Respondents were of the view that people with low socioeconomic status are less likely to invest and act on risk prevention and risk management activities.

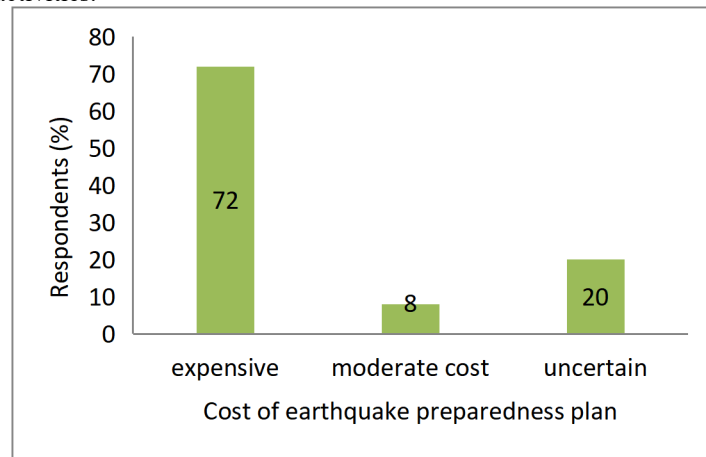


Figure 6. Cost of developing household emergency plan  
 Source: field survey (2020)

*ii) The need for specialized skills*

The need for specialized skills is necessary to ensure effective and reliable household plan for hazard mitigation. About 63% of the respondents believed that developing household emergency plan will require specialized knowledge and skills; 15% thought it does not require specialized knowledge and skills and 22% were unsure if it would need special skills (figure 7)

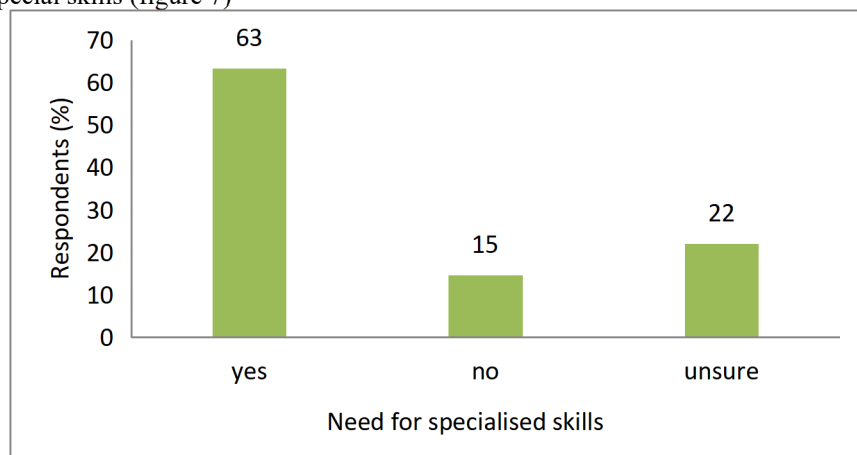


Fig. 7 Demand for specialized skills for preparedness plan  
 Source: field survey (2020)

*iii) Level of interest in preparing households emergency plan.*

The level of interest is a necessary concern in determining respondents' willingness and misconceptions about



household preparedness. It was revealed that 39% expressed self-interest to develop a household emergency plan for safety reasons, 47% of the respondents were not likely to develop an emergency plan and 14% were uncertain of developing a household emergency plan (figure 8). As indicated by respondents, the levels of interest are in diverse ways, related to availability of resources.

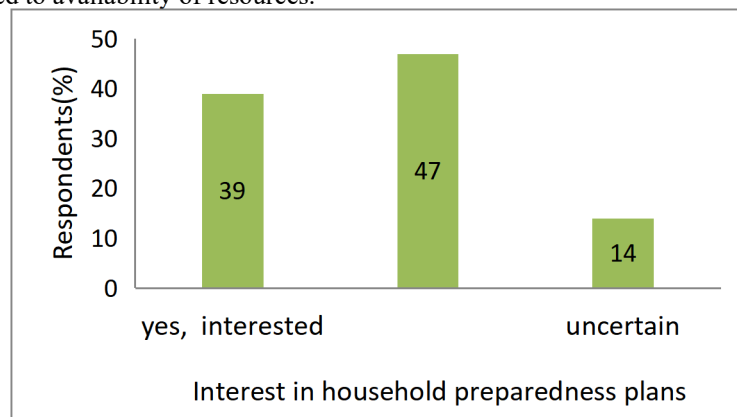


Figure 8. Interest in developing household emergency plan.

Source: field survey, (2020)

The study revealed the financial difficulty of respondents, the need for specialized skills and low level of interest in household preparedness for earthquake; all these point to the economic and social constraint of respondents. Besides, the study found people with low incomes and low education to be less prepared for disasters. Some preparedness actions are costly, and possibly too costly for people in poverty to afford. A similar study conducted by Mulilis & Duval, 1995 indicated that, resources as sufficient in quantity and quality to obviate or minimize the negative consequences of a threatening earthquake would increase levels of earthquake preparedness to a greater extent than would other factors do.

Disaster preparedness and early warnings are important factors in reducing the vulnerability of people and property (Songlar et al., 2019). Most people believe they are safe until an earthquake disaster occurs (Devi et al., 2015). Studies have indicated that the geographical location of one's home, age group, sex and education are factors that can influence the perception, knowledge and attitudes of people towards the practice of earthquake preparedness and to reduce their vulnerability (Songlar et al, 2019). In addressing the critical vulnerabilities, the World Health Organization (WHO) identifies the aged group as more vulnerable to earthquake disasters since they experience more impacts and are at a greater risk to high morbidity rates than the rest of the population (World Health Organization, 2008, Zhu and Sun, 2017). Also, less educated people are at a risk and vulnerable to earthquake disasters as compared to the educated people. Less knowledge results in less preparedness due to lack of information and materials (Rahman, 2019). The recognition of the above factors and perceptions of people about earthquake preparedness may help policy makers and institutions to develop a better plan to change their perceptions (Mehdi et al, 2018).

### 3.2 Earthquake preparedness and responsibilities

#### 3.2.1. Disaster, Institutional and social responsibilities

Institutional responsibility is crucial in ensuring sustainable disaster management through enacted policies, guidelines and standards settings, monitoring and reporting (Waddock, et al., 2002). The Government of Ghana, in acknowledgment of disaster risk reduction, established an organization known as the National Disaster Management Organization (NADMO), through an Act of Parliament Act 517 of 1996 to coordinate disaster management among governmental and non-government actors and build the capacity of communities to respond effectively to disasters (Allotey, et al. (2010). A few mitigation measures and policies were put in place and a committee was formed to develop framework for National earthquake preparedness and response within the country; one major task was to identify and outline key measures that must be undertaken by important agencies to empower communities to be well prepared for reduction of seismic risk, outline response measures required in the event of an earthquake and also to determine the kind of international support that may be required (Allotey, et al. (2010).

NADMO in collaboration with the United Nations Country Team, Ghana Red Cross Society, Government, Non-governmental agencies and other key stakeholders have also developed the National Contingency Plan (NCP); one of its major objective is to undertake educational campaign to bring awareness to all sections of society with respect to what to do before, during and after a major earthquake while public schools should be made aware of environmental and other practices that could increase the effects of any major earthquake event.

The government of Ghana, developing Ghana Plan of Action for Disaster Risk Reduction, was another step to

engage institutions and strengthen their capacity in disaster management. This plan involved policy change, advocacy and awareness creation, functional investments in infrastructure and the development and implementation of strategies to change systems and to prevent disasters from happening, with United Nations Development Programme (UNDP) as the implementation body in partnership with the National Disaster Management Organization; some key achievements of this project were the production of a comprehensive manual on disaster risk management to help practitioners update their knowledge and enable effective mainstreaming of disaster risk reduction in policy making and development (Mafimisebi, et. al. 2018). Institutional capacity building included innovative short course in disaster risk management for practitioners to build the capacity of government practitioners in disaster management, first-hand information on household safety tips for earthquake, adult education programmes on disaster management, simulation exercises conducted at national and district levels to improve emergency preparedness (Mafimisebi, et. al. 2018).

The Ghana Institution of Engineering (GhIE) and the Federation of African Engineering Organization (FAEO), for example, recommended that the country needs a cautious plan to ensure that all public structures are retrofitted to be able to withstand earthquake and tremors (Ghana Institute of Engineering, 2019). FAEO continued to advice the public on the steps to take during earthquake. There have been a number of programs concerning earthquake preparedness and various suggestions and mitigation measures have been made. According to Weija-Gbawe Municipal Assembly, NADMO office core function is to improve human and institutional capacity building and promote disaster risk reduction and climate change management with stakeholders, strengthen disaster prevention and response mechanisms and to link disaster prevention and management programmes to promote poverty reduction (Weija Municipal Assembly, 2021). In spite of the above institutional coordinated action plan in risk management, there a number of factors that impede their implementation; firstly, the vicious cycle of rural-urban migration with the overall result of sprawl, lack of livelihood opportunities and redundancy, substandard development and congestion create a condition of acute poverty and human insecurities even before the event of earthquake and its impact (Özerdem, et al., 2006, Wamsler, 2014); secondly, due to lack of enforcement and improvements in construction regulation, people continue to live in housing unsuited to earthquake-active environments hence households are not persuaded or committed to reduce their levels of hazard exposure. Apparently, non-compliance of building codes by developers, poses high risk to hazard vulnerability (Agbosu, et al. 2007, Oteng-Ababio, 2012, Boateng, 2020). Currently, most earthquake prone areas, by land use status, are built up areas. The safety of these structures and the risk that they pose in the event of earthquake is a great concern for public safety. Mitigating earthquake hazards in urban areas of Gbawe appears quiet challenging requiring trade-offs among competing interest groups in land use and risks assessments that are hampered by a lack of information and preparedness; this situation is likely to be exacerbated by rapid urbanization and the growth of informal urban settlements most of which lack appropriate development guidelines hence increasing the rate of risk.

### *3.2.2 Household preparedness for Earthquake*

The study assessed the number of emergency items that households have acquired as their preparedness for earthquake (figure 9). The upshot indicated that out of the 150 respondents, 43% have access to battery powered radio, extra batteries, battery operated torch; 29% have first aid kit and emergency numbers, 15% have perishable food items and exits routes; and 8% knowing and having evacuation plan, exist routes, and whistle blow, whiles none (0%) had no gas mask and fire extinguishers. It was also noted that, less than a quarter of households was averagely prepared in terms of earthquake items. In overall, households in Gbawe can be rated as poorly unprepared for emergency response in earthquake or that respondents have poor knowledge of what constitute emergency response necessity for earthquake. The marked variations in terms of choice for earthquake emergency items by respondents indicated that households require awareness creation that would promote effective and adequate earthquake preparedness by households to reduce risk.

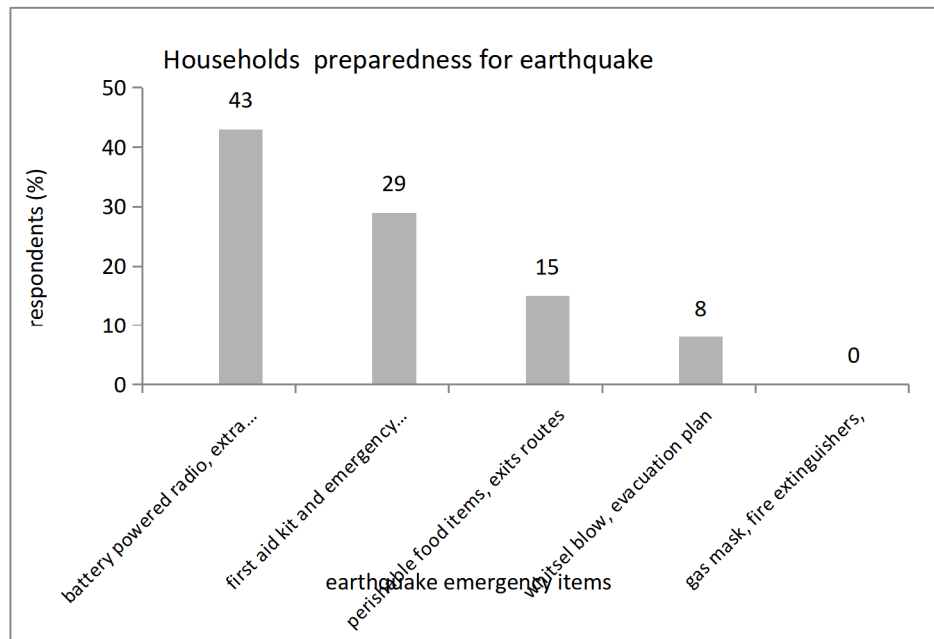


Figure 9. Households preparedness for earthquake.

Households preparedness for earthquake is a key dependent variable in many studies examining people's responses to disasters such as earthquakes the assessment of which is based on the ranking of emergency supply items as presented in figure 10. Preparedness

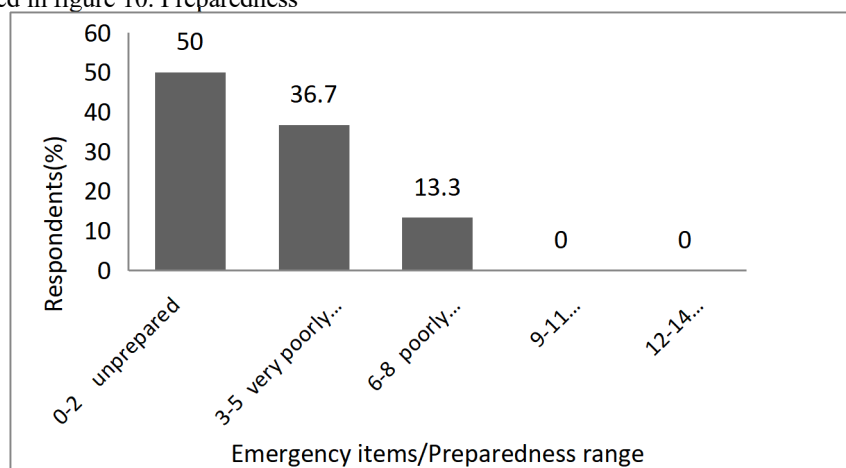


Figure10. Level of household preparedness for earthquake.

Source: Field data, 2020

Households earthquake preparedness was measured using the household readiness scale which assesses the preparedness level of households towards earthquake risk reduction and mitigation. From figure 10, the distribution showed that no household was fully equipped with all the required earthquake emergency items necessary for earthquake risk reduction. Out of the 150 respondents, none (0%) was prepared by the criteria for earthquake response; only 13.3% had 6-8 emergency items, 36.7% had 3-5 emergency items, and 50% respondents had only 2 emergency items. Thus all 150 respondents did not have all the 14 emergency items needed for household's preparedness for earthquake and therefore were considered as unprepared for earthquake emergencies. However, it was noted that those who envisaged some benefits from earthquake risk reduction were ready to act within their limit to increase their level of preparedness; these outcomes need to be taken into consideration when designing and implementing related future risk interventions for communities since it identifies those who are willing to make impact on risk reduction measures. The poor household preparedness of earthquake, according to respondents, is due to the perception that developing a household preparedness plan and acquiring the needed emergency earthquake items involves huge financial cost and specialized knowledge and skills which communities lack; even though this may be a contributing factor to low preparedness, little is being done at the national scale to

#### 3.2.4. The role of gender

Gender plays a very important role in earthquake preparedness so far as information and knowledge sharing is concerned. However, the result indicated that women placed more emphasis on their traditional responsibilities;

most female respondents spend more time engaging in housekeeping responsibilities and child care, fuel, water, food, and on, medication and little on earthquake preparedness, safe exit routes and social contact for help. There were however exceptional cases where, in some households, women were mainly responsible for the preparation of their earthquake plans; this was found to be much common in households ownership is by women and constituted 27.4% (41) of total respondents. On the other hand, household earthquake preparedness fell more on men (73.6%). Men, by custom, are head-family and as such are responsible for providing security to their families hence they are compelled to spearhead earthquake preparedness by spending more time in acquiring information and money as compared to women who are all deeply engulfed in housekeeping and have less time for earthquake preparedness. According to Paradise (2005), the traditional role play by women as housekeepers gives women little time for earthquake preparedness as compared to men who by custom are head of families and therefore are responsible for providing security.

The results of the household preparedness of earthquakes have several implications on risk prevention; based on the results, it can be projected that, should there be an earthquake, over 50% respondents would be severely affected because they do not have household preparation plans in place to mitigate the effects of earthquakes while the remaining less 50% would be affected by earthquake at different degree; the incidence may also lead to an increase in government expenditure on health care and rehabilitation of the affected population.

#### **4. Conclusions**

The study examined household preparedness of earthquake in Gbawe, Greater Accra region using questionnaires and indicator-based assessment. The study focused on the background of respondents, their understanding and extent of household preparedness of earthquakes, and institutional responsibilities in earthquake management.

Household earthquake preparedness was seen as an important mitigation measure to prevent emerging risks. The study revealed that households were not prepared for earthquake; all 150 respondents stand at risk should a devastating earthquake occurs. The poor household preparedness of earthquake also indicates a weak social and national mitigation response to disasters; while households lacked the necessary data, resources, knowledge and skills for earthquake preparedness, there was little coordination between disaster management institutions and communities to help improve upon households' capacity on earthquake mitigation.

The perception of respondents about earthquake is requisite to determine their concerns and level of earthquake preparedness. From the sociodemographic characteristics studied, income, education, gender, ownership of property and experiencing earthquake occurrences appeared to be the most consistent factors that influence respondents behaviour in household preparedness for earthquakes.

The role of gender was clear from respondents involvement in household preparedness for earthquake; women role was substantially low as compared with men but this is because men by tradition are heads of families and as such have greater access to information and are responsible for security hence take the lead role in household preparedness for earthquake. However, the factor of ownership is gradually making women to become actively involved in earthquake response measures. Generally, the possibility of people being more prepared is increased when they are aware of and understand the benefits of being prepared for earthquakes and other disasters.

Household earthquake preparedness falls short of basic household risk requirements. Based on analysis of the results, converting the knowledge and level of household earthquake preparedness into practice may be one of the most critical challenges in earthquake risk reduction. Even though the current approach evaluated both knowledge and practice regarding certain aspects of household preparedness, for example, the content of the prepared emergency kit, followed up questions that asked them to bring and present the kits revealed that some participants had inaccurately reported their preparedness and the results were below expectation; thus this follow-up system allowed for understanding these inconsistencies and how they can be addressed in the future. Consequently, further research is necessary to identify effective plans to improve preparedness behavior. Finally, lack of a disaster prevention philosophy in Ghana poses a challenge for any preparedness initiative, as impact assessment and prevention methods are often not taken seriously. To achieve substantial risk reduction and losses in lives, livelihoods and health, there should be the need not only to strengthen and support household preparedness plans on earthquake mitigations but that there should be a clear state policy and strategy, strong institutions, sufficient financial commitment, and monitoring to ensure efficient management and disaster risk.

#### **5. Recommendations**

Based on the findings, the following recommendations are proposed to enhance household preparedness towards earthquake in Gbawe.

Create awareness and capacity building of communities through training and practices that would enhance knowledge and skills of communities in disaster risk management, provide communities with affordable earthquake emergency kit items for household preparedness plan.

Government institutions responsible for earthquakes should strengthen their coordination with communities in earthquake prone areas on mitigation measures, ensure strict compliance to development guidelines as a mitigation

measure to reduce risk, and engage the private sector for investments opportunities in disaster management.

## REFERENCES

- Agbosu, L., Awumbila, M., Dowuona-Hammond, C. and Tsikata, D., 2007. Customary and statutory land tenure and land policy in Ghana. *Institute of Statistical, Social & Economic Research, University of Ghana, Legon*. Technical Publication No. 70.
- Allotey, N.K., Arku, G. and Amponsah, P.E., 2010. Earthquake-disaster preparedness: the case of Accra. *International Journal of Disaster Resilience in the Built Environment*.
- Amponsah, P.E., 2002. Seismic activity in relation to fault systems in southern Ghana. *Journal of African Earth Sciences*, 35(2), pp.227-234.
- Amponsah, P., Opoku-Ntim, I. and Nortey, G., 2020. Seismic risk in Ghana: efforts and challenges. *Arabian Journal of Geosciences*, 13(15), pp.1-5.
- Ardalan, A. and Sohrabizadeh, S., 2016. Assessing households preparedness for earthquakes: an exploratory study in the development of a valid and reliable Persian-version tool. *PLoS currents*, 8.
- Ayete, J.K. and Andoh, M.B., 1988. Earthquake site response study of Accra Area, Ghana. *Bulletin of the International Association of Engineering Geology-Bulletin de l'Association Internationale de Géologie de l'Ingénieur*, 38(1), pp.15-25.
- Bacon, M. and Quaah, A.O., 1981. Earthquake activity in southeastern Ghana (1977-1980). *Bulletin of the Seismological Society of America*, 71(3), pp.771-785.
- Becker, J.S., Paton, D., Johnston, D.M. and Ronan, K.R., 2013. A model of household preparedness for earthquakes: how individuals make meaning of earthquake information and how this influences preparedness. *Natural hazards*, 64(1), pp.107-137.
- Becker, J.S., Paton, D., Johnston, D.M., Ronan, K.R. and McClure, J., 2017. The role of prior experience in informing and motivating earthquake preparedness. *International journal of disaster risk reduction*, 22, pp.179-193.
- Boateng, F.G., 2020, December. Exploring the collapse of buildings in urban settings. In *Proceedings of the Institution of Civil Engineers-Municipal Engineer* (Vol. 173, No. 4, pp. 187-195). Thomas Telford Ltd.
- Bryman, A., 2012. Sampling in qualitative research. *Social research methods*, 4, pp.415-429.
- Chen, C.H., Hsu, H.L., Wen, S., Yeh, T.K., Chang, F.Y., Wang, C.H., Liu, J.Y., Sun, Y.Y., Hattori, K., Yen, H.Y. and Han, P., 2013. Evaluation of seismo-electric anomalies using magnetic data in Taiwan. *Natural Hazards and Earth System Sciences*, 13(3), pp.597-604.
- Christoplos, I., Mitchell, J. and Liljelund, A., 2001. Re-framing risk: The changing context of disaster mitigation and preparedness. *Disasters*, 25(3), pp.185-198.
- Creswell, J.W. and Creswell, J.D., 2017. *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Devi, A.W. and Sharma, D., 2015. Awareness on earthquake preparedness: A key to safe life. *International Journal of Nursing Research and Practice*, 2(2), pp.1-6.
- Fernandez, G., Tun, A.M., Okazaki, K., Zaw, S.H. and Kyaw, K., 2018. Factors influencing fire, earthquake, and cyclone risk perception in Yangon, Myanmar. *International journal of disaster risk reduction*, 28, pp.140-149.
- Enarson, E., Fothergill, A. and Peek, L., 2018. Gender and disaster: Foundations and new directions for research and practice. *Handbook of disaster research*, pp.205-223.
- Ghana. Statistical Service, 2013. *2010 population & housing census: National analytical report*. Ghana Statistics Service.
- Housner, G.W., 1941. An investigation of the effects of earthquakes on buildings (Doctoral dissertation, California Institute of Technology).
- Housner, G. W. (1989). *Coping with natural disasters: the international decade for natural disaster*.
- Igel, H., Cochard, A., Wassermann, J., Flaws, A., Schreiber, U., Velikoseltsev, A. and Pham Dinh, N., 2007. Broad-band observations of earthquake-induced rotational ground motions. *Geophysical Journal International*, 168(1), pp.182-196.
- Jamshidi, E., Majdzadeh, R., Namin, M.S., Ardalan, A., Majdzadeh, B. and Seydali, E., 2016. Effectiveness of community participation in earthquake preparedness: a community-based participatory intervention study of Tehran. *Disaster medicine and public health preparedness*, 10(2), pp.211-218.
- Koliou, M., van de Lindt, J. W., McAllister, T. P., Ellingwood, B. R., Dillard, M., & Cutler, H., 2020. State of the research in community resilience: Progress and challenges. *Sustainable and resilient infrastructure*, 5(3), 131-151.
- Leube, A., Hirdes, W., Mauer, R. and Kesse, G.O., 1990. The early Proterozoic Birimian Supergroup of Ghana and some aspects of its associated gold mineralization. *Precambrian research*, 46(1-2), pp.139-165.
- Mafimisebi, O.P. and Thorne, S., 2018. Strategies for disaster risk reduction and management: are lessons from



- past disasters actionable?. In *Handbook of disaster risk reduction & management* (pp. 843-866).
- Maly, E. and Suppasri, A., 2020. The Sendai framework for disaster risk reduction at five: Lessons from the 2011 great East Japan earthquake and tsunami. *International Journal of Disaster Risk Science*, 11(2), pp.167-178.
- Marlyono, S. G., and Nandi, N., 2018. The preparedness level of community in facing disaster in West Java Province. In *IOP Conference Series: Earth and Environmental Science (Vol. 145, No. 1, p. 012103)*. IOP Publishing.
- McConnell, A., & Drennan, L., 2006. Mission impossible? Planning and preparing for crisis 1. *Journal of Contingencies and Crisis management*, 14(2), 59-70.
- Mulilis, J. P., & Duval, T. S., 1995. Negative threat appeals and earthquake preparedness: A person-relative-to-event (PrE) model of coping with threat 1. *Journal of applied social psychology*, 25(15), 1319-1339.
- Murakami, M., Nakatani, J., & Oki, T., 2016. Evaluation of risk perception and risk-comparison information regarding dietary radionuclides after the 2011 Fukushima nuclear power plant accident. *PloS one*, 11(11), e0165594.
- Oteng-Ababio, M., 2012. Neglected vulnerabilities in a rapidly urbanizing city: reflections on earthquake risks in Accra. *Journal of Housing and the Built Environment*, 27(2), 187-205.
- Özerdem, A., & Jacoby, T., 2006. *Disaster management and civil society: Earthquake relief in Japan, Turkey and India* (Vol. 1). London: IB Tauris.
- Paradise, T. R., 2005. Perception of Earthquake Risk in Agadir, Morocco; A Case study from a Muslim Community. *Environ. Hazards*, 6, 5-22.
- Petal, M., 2011. Earthquake casualties research and public education. In *Human Casualties in Earthquakes* (pp. 25-50). Springer, Dordrecht.
- Phifer, J. F., & Norris, F. H., 1989). Psychological symptoms in older adults following natural disaster: Nature, timing, duration, and course. *Journal of Gerontology*, 44(6), S207-S212.
- Platt, S., Brown, D., & Hughes, M., 2016., Measuring resilience and recovery. *International Journal of Disaster Risk Reduction*, 19, 447-460.
- Qureshi, M. I., Khan, S. U., Rana, I. A., Ali, B., & ur Rahman, A., 2021. Determinants of people's seismic risk perception: A case study of Malakand, Pakistan. *International Journal of Disaster Risk Reduction*, 55, 102078.
- Rahman, M.L., 2019. Risk perception and awareness of earthquake: the case of Dhaka. *International journal of disaster resilience in the built environment*.
- Rapaport, C., & Ashkenazi, I., 2019. Drop down or flee out? New official earthquake recommended instructions for schools and kindergartens in Israel. *International Journal of Disaster Resilience in the Built Environment*.
- Roeloffs, E., 1996. Poroelastic techniques in the study of earthquake-related hydrologic phenomena. In *Advances in geophysics* (Vol. 37, pp. 135-195). Elsevier.
- Songlar, T., Pussadee La-or, N.P., Chomchoe, C. and Khunthason, S., 2019. Knowledge, Attitude and Practice (KAP) of Earthquake Preparedness amongst the Elderly in Risk Areas: Chiang Rai, Thailand. *Journal of Health Research*, Vol. 33 No.1, pp 2-13.
- Spence, R., So, E. and Scawthorn, C. eds., 2011. *Human casualties in earthquakes: progress in modelling and mitigation* (Vol. 29). Springer Science & Business Media.
- Spittal, M.J., Walkey, F.H., McClure, J., Siegert, R.J. and Ballantyne, K.E., 2006. The earthquake readiness scale: The development of a valid and reliable unifactorial measure. *Natural Hazards*, 39(1), pp.15-29.
- United Nations: ISDR, 2004. International Strategy for Disaster Reduction, 2004. Living with risk: A global review of disaster reduction initiatives.
- Wamsler, C., 2014. *Cities, disaster risk and adaptation*. Routledge.
- Weija-Gbawe Municipal Assembly., 2021. Composite budget for 2019-2022 Programme based estimate for 2019. Weija-Gbawe Municipal Assembly, page 55.
- World Bank, 2010. Natural hazards, unnatural disasters: the economics of effective prevention, 2010.
- Zhu, X. and Sun, B., 2017. Study on earthquake risk reduction from the perspectives of the elderly. *Safety science*, 91, pp.326-334.