



Earthquake risk in Accra, Ghana: Household perceptions, awareness, and preparedness in a rapidly urbanising metropolis

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Abstract

This century has experienced a rapid surge in environmental disasters globally. In many countries, the response to these disasters has largely been limited to providing relief supplies to victims. This approach is reactive rather than proactive and is undertaken in the aftermath of the disaster. The need for proactive approaches has been articulated. Drawing on a mixed-methods approach through a pragmatic research philosophy, this study aims to assess households' earthquake risk perceptions, awareness, and preparedness in Ghana's Greater Accra Metropolitan Area (GAMA). Surveys, semi-structured interviews, and a binary logistic regression model were utilised to ascertain the key predictors of earthquake preparedness. The study revealed that while nearly half of the surveyed households acknowledged awareness of potential earthquake threats, their preparedness for imminent emergencies remained critically low. The study further showed that only 32.9% of the surveyed households were familiar with the conventional protocol '*drop, cover and hold on during the shaking, moving to safety afterwards and preparing for aftershocks*'. Also, only 5.5% had contingency plans for post-earthquake emergency recovery. Prior tremor experience showed a significant positive effect on preparedness [$B = 0.56$, $p = .022$, $\text{Exp}(B) = 1.75$]. The findings provide empirical evidence to support household-level earthquake preparedness, public risk communication, and urban disaster risk reduction in Accra and comparable rapidly urbanising cities.

Keywords: Earthquake preparedness; earthquake risk perception; household preparedness; earthquake awareness; urban seismic risk; disaster risk reduction; Greater Accra Metropolitan Area; Ghana

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1 Introduction

The 21st century has witnessed a rapid surge in environmental disasters globally. Between 2000 and 2019, about 8,000 major disaster events plagued the planet, causing at least 1.23 million deaths (UNDRR, 2020) and a global economic cost exceeding \$3.3 trillion (Fang et al., 2019; Khan et al., 2022). Among various natural hazards, earthquakes are ranked among the deadliest. According to the WHO (2023), these accounted for more than half of all natural-disaster-related mortalities between 1998 and 2017. Studies have observed a rapidly growing global socio-economic impact of earthquakes (Zhang et al., 2026; Isah et al., 2026), with developing regions bearing the brunt (Dhakal, 2025; Yuan et al., 2018). This mounting socio-economic impact stems from a plethora of cascading factors—unplanned urban development, rapid population growth and rising urban seismic vulnerability, especially in countries where develop-

ment precedes planning. While earthquake risk remains a menace, preparedness plays a fundamental role in mitigating casualties and economic losses (Ao et al., 2021). In this regard, much disaster risk reduction (DRR) research shows that awareness and risk perceptions are crucial to motivating disaster readiness and preparedness (Toker et al., 2026; Kiymis and Kaya, 2025; Altanlar et al., 2025).

Ghana is historically recognized as vulnerable to earthquakes, with the earliest documented event dating to the 17th century (Somiah et al., 2026; Klu et al., 2024). Archival records from the Ghana Geological Survey (the country's institution tasked with monitoring earthquakes) spanning 1636 to 2023 have revealed that the country has been hit by at least three devastating earthquakes over the last four centuries (Table 1). According to the literature, the severest earthquake event occurred in 1939 (Klu et al., 2024; Kadiri and Kijko, 2021), killing 22 people, injuring about

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Table 1. Selected history of earthquake activities in Ghana.

Date	Location	Magnitude (M _L)	Description
Dec 1636	Axim	5.7	Buried 3 workers in a gold mine
Jul 1862	Accra	6.3	Damaged the Christianborg castle
June 1939	Offshore, near Nyanyano-Accra	6.5	Killed 22 people, injured over 140, and damaged property worth £1 million
1969	Tema-Harbour	4.7	Felt around the surroundings
Mar 1997	Accra	4.8	Cracks in some buildings around ministries.
Jan 2000	Weija-Accra	2.7	Felt but no visible damage
Mar 2019	Weija-Accra	3.9	Felt but no visible damage
Jun 2020	Dansoman-Accra	4.8	Felt but no visible damage
Feb 2022	SE from Shai Hills	1.2	Not felt and no visible damage
Oct 2021	Accra	3.7	Felt around Accra, Westland, Ashaley Botwe and Dome areas
Feb 2023	Offshore-Atlantic Ocean	3.9	Felt around the coast of Dansoman and James Town

Source: [Ghana Geological Survey Authority \(2023\)](#).

140 others ([Amponsah et al., 2020](#); [Campbell et al., 2018](#)) and causing an estimated economic damage of \$67.3 million ([Citi Newsroom, 2018](#)). Although Ghana is situated at a considerable distance from the world's active tectonic zones, research indicates that the country's seismic activity is attributable to the thrusting of two major fault lines along its coastal region ([Klu et al., 2024](#); [Asare-Bediako et al., 2024](#)). To that end, Ghana's geographical position within the southern sector of the West African Craton (WAC) renders the country moderately seismic ([Somiah et al., 2026](#); [Mohammadigheymasi et al., 2026](#)), thereby accounting for the recent occurrences of earth tremors in the Greater Accra Metropolitan Area (GAMA)—more commonly referred to as Accra, the nation's capital. From the year 2000s onwards, earth tremors in Accra have been frequent, typically ranging from 3.0 to 4.8 on the Richter scale ([Amponsah et al., 2020](#); [Asare-Bediako et al., 2024](#)). This series of tremors is primarily clustered around the national capital, which sits on the crossroads of two converging fault lines. According to [Adu-Boahen et al. \(2020\)](#), the increasing frequency of recent tremors in Ghana is attributable to the region's increasing geological volatility.

With the notable rise of earthquake risk in Ghana, studies on the problem have gained momentum over the decades (e.g., see [Amponsah, 2022](#); [Amponsah et al., 2012](#); [Oteng-Ababio, 2012](#); [Kutu et al., 2013](#); [Ahulu et al., 2018](#); [Amponsah et al., 2020](#); [Kadiri and Kijko, 2021](#); [Kadiri and Amponsah, 2021](#); [Awere and Addai, 2022](#); [Mohammadigheymasi et al., 2023](#); [Klu et al., 2024](#); [Somiah et al., 2026](#); [Mohammadigheymasi et al., 2026](#)). These studies have broadly assessed earthquakes in varied research areas, including predictive seismic hazard assessment (e.g., [Ahulu et al., 2018](#); [Kadiri and Kijko, 2021](#); [Mohammadigheymasi et al., 2023](#)), area characteristics of earthquake parameters (e.g., [Kadiri and Amponsah, 2021](#); [Nortey et al., 2018](#); [Somiah et al., 2026](#)), and challenges of earthquake national data centre ([Amponsah and Serfor-Armah, 2012](#); [Ahulu and Danuor, 2015](#)). Previous studies (e.g. [Awere and Addai, 2022](#); [Allotey et al., 2010](#); [Kwang et al., 2025](#)) have also examined earthquake risk perceptions and preparedness in many parts of Accra. However, these studies have been insufficient to directly investigate the interplay between household risk perception, awareness, and prepared-

ness in the context of GAMA. Also, a comprehensive search of Web of Science, Scopus, and Google Scholar, employing the keywords “earthquake risk perceptions,” “awareness,” “socio-demographic predictors of earthquake preparedness”, and “preparedness in Accra,” did not yield any empirical studies addressing this research gap. This study addresses this gap by assessing households' earthquake risk perceptions, awareness, and predictors of preparedness in GAMA. This study, therefore, seeks to find answers to the following research questions: (1) How do households perceive earthquake risk in GAMA? (2) To what extent are households aware of earthquake risk? (3) Do socio-demographics and prior earthquake experiences influence preparedness behaviours?

2 Materials and Methods

2.1 Study Area

The study area, GAMA, is in the Greater Accra Region (GAR) of Ghana and hosts the national capital, Accra. GAMA lies between Latitude 5°05'27" N and 5°32'02" N and Longitude 0°04'58" E and 0°37'02" W. It is geographically bounded to the South by the Gulf of Guinea, to the North by the Eastern Region, to the West by the Central Region, and to the East by other Metropolitan, Municipal and District Assemblies (MMDAs) within the GAR ([Fig. 1](#)). GAMA is approximately 1585 km² and is Ghana's most populous administrative area among all MMDAs. The 2021 census statistics from the Ghana Statistical Service ([GSS, 2021](#)) estimated the area's population at 4.7 million and projected it to become a megacity by 2040. According to the [World Bank \(2017\)](#), GAMA is Ghana's socio-economic development engine. The area represents about one-third of Ghana's GDP, with services accounting for about 63% of total output ([Arendse et al., 2023](#)). Climatically, GAMA lies in the dry equatorial climatic belt, with yearly mean temperatures averaging 25°C ([Otoo and Kusimi, 2023](#)) and a bimodal rainfall pattern, with annual rainfall averaging 700 mm and 1300 mm ([Gyimah et al., 2023](#)). Geologically, the area lies within the West African Craton (WAC) ([Nortey et al., 2018](#)), known for low-to-moderate seismicity due to a series of fault zones, including the Akuapem and Coastal boundary faults of Ghana. The Akuapem fault intersects

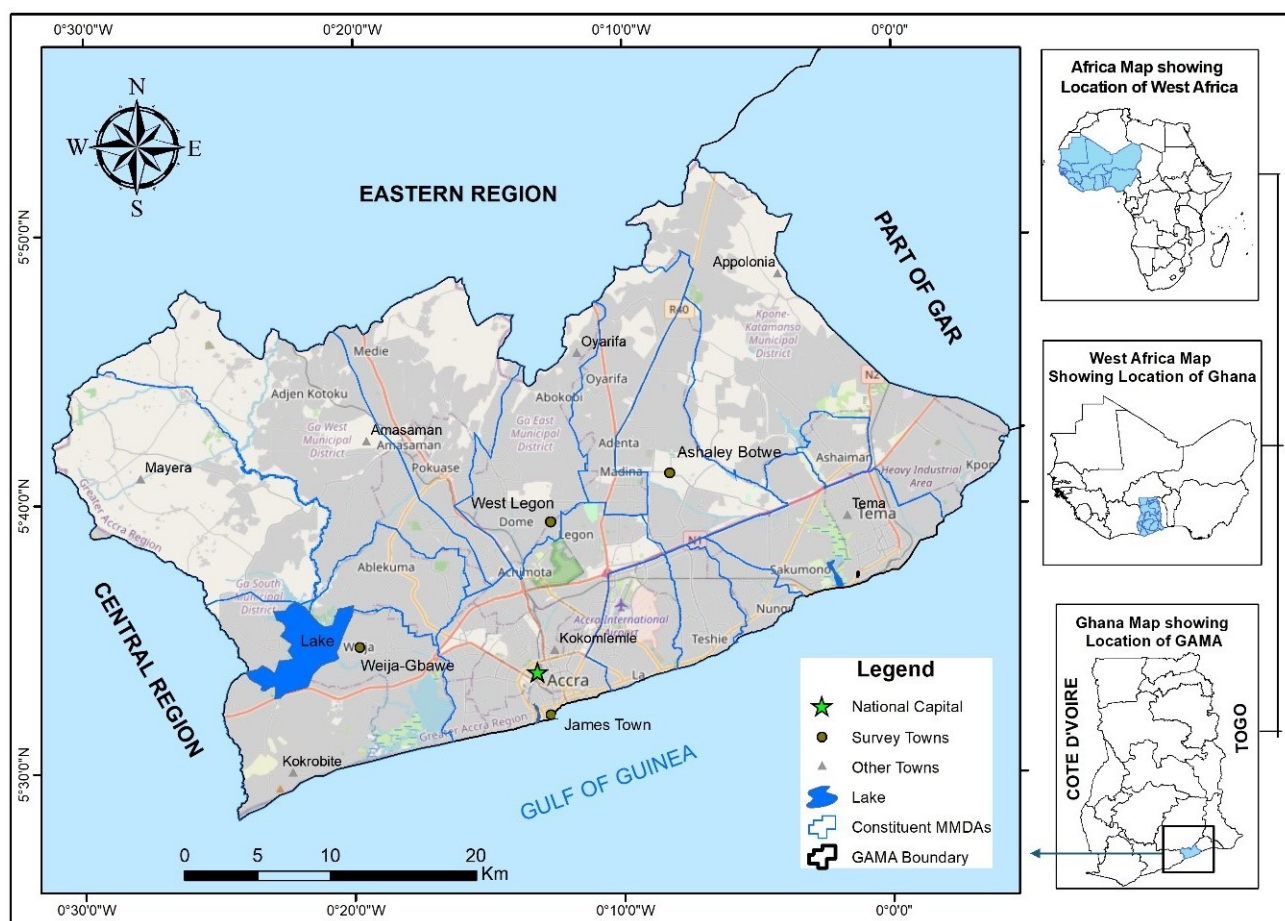


Fig. 1. Map of the study area (GAMA). Source: Author created.

the coastal boundary fault in Accra, creating a junction (thrust fault) epicentre for earthquakes and earth tremors. This thrust fault stretches about 200 km West to East along Ghana's coast and marks the southeastern boundary of the WAC (Klu et al., 2024). The choice of GAMA for this study is primarily due to the mounting physical seismic vulnerability, amid repeated episodes of earth tremors in recent years. This underscores the urgent need to assess earthquake risk perceptions, awareness and preparedness in the area.

2.2 Research Design

Grounded in the pragmatic research philosophy, this study adopted a mixed-methods case study design, thereby triangulating qualitative and quantitative approaches. Case study design was employed because it facilitates a nuanced understanding of subjects under study (Clark et al., 2023; Cook and Kamalodeen, 2020). Mixed methods were employed to integrate quantitative and qualitative approaches, enabling comprehensive data collection and analysis. According to Teye (2012), the increasing adoption of mixed methods in social scientific research is due to the loopholes associated with the monomethod. Other researchers, such as Bryman (2016) and Denzin (2012), have emphatically argued that mixed methods enhance theory testing and theory building. Employing mixed methods in research allows the strategic integration of qualitative and quantitative methods to draw on the strengths of each.

2.3 Data, Data Collection Instruments and Procedure

A semi-structured questionnaire was developed to solicit a primary quantitative home-based survey. The survey was hosted on Google Form, an online survey platform. The survey was appropriate as it enabled extensive data collection within a short period of time. According to Story and Tait (2019), a good survey provides a basis for reliable, valid measurement of study subjects. A pilot test was conducted in one of the study communities (Ashaley Botwe) to improve the clarity, relevance, and consistency of the questions. The semi-structured questionnaire assessed households' earthquake risk perceptions, awareness and preparedness interventions. For qualitative data, semi-structured interviews were conducted. According to Osborne and Grant-Smith (2021), engaging in semi-structured interviews with study participants enables inquiry to uncover new insights, especially for issues that would otherwise not have been properly addressed through surveys alone. Before both the surveys and the semi-structured interviews, participants were debriefed on the study's intended purpose. Participation in the data collection process was strictly voluntary with no reward. The entire data collection procedure was conducted between April and June 2023. Secondary data were obtained and reviewed from published and unpublished sources. These included peer-reviewed journal articles, official government reports and credible online news outlets. The review of the secondary data helped compare,

support or refute the findings of this study in relation to existing literature. Peer-reviewed journals published between 2016 and 2025 were purposively selected to ensure currency and to establish a robust, empirically grounded foundation for the present study.

2.4 Study Population, Sample Size and Technique

The study's target population includes all household heads aged ≥ 25 years who have lived in the study area for at least five years. This selection criterion was adopted to sample respondents with probable exposure to earthquakes and earth tremor experiences over the past decades. The data were purposively collected in four communities: Ashaley Botwe, James Town, Weiija-Gbawe and West Legon-Haatso. These communities were purposively selected for the survey because they have experienced recurring earth tremors in recent years and have received extensive media coverage (e.g., [Graphic Online, 2022](#); [Citi Newsroom, 2022](#); [Ghanaian Times, 2019](#)).

Regarding sample size, [Olvera et al. \(2015\)](#) suggest that larger survey sample sizes ensure greater accuracy and nearness to reality. Nevertheless, [Ahmed \(2024\)](#) contends this notion and argues that larger sample sizes do not protect surveys from non-probability sampling errors. With this notion in mind, and given time limitations, a sample size of 383 survey responses, with an error margin of 0.05, was considered ideal. The sample size was statistically determined using [Yamane's \(1967\)](#) sample size determination equation (Eq. 1).

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

where, n is the sample size required, N is the total number of households (8825), e is the margin of error (0.05).

Substituting the values:

$$n = \frac{8825}{1 + 8825(0.05)^2} = n = \frac{8825}{23.0625} = n = 382.65 \approx 383. \quad (2)$$

Due to household population variations in the study communities ([Table 2](#)), the survey distribution was based on a proportional representation using Eq. (3).

$$n = \frac{H}{\Sigma H} * S. \quad (3)$$

where, n is the sample size for each community, H is the number of households in each community, ΣH is the household sum for all communities (8825), S is the study's sample size (383).

Table 2. Population distribution and sample size.

Sample Community	Household population	Sample size	%
Ashaley Botwe	3628	157	41
James Town	1027	44	11.5
Weiija-Gbawe	3598	156	40.7
West Legon	572	26	6.8
Total	8,825	383	100

Source: Computed with data from [GSS \(2021\)](#).

Due to a large and extensive household population, the multistage sampling technique was employed in choosing respondents in each study community for the survey. According to [Rahman et al. \(2022\)](#), larger populations are divided into smaller clusters in multistage cluster sampling to enable effective data collection. Here, each study community was divided into four imaginary quadrants using the roads or pathways of the study communities as boundaries. Following this, household heads in every fifth house in a quadrant, counting from a random starting point, were chosen for the survey. This strategy was adopted to avoid crowding respondents and to minimise biases. Using the same stratified approach, 20 semi-structured interviews were conducted after reaching data saturation from the 12th interview onward. According to [Hennink and Kaiser \(2022\)](#), an interview population sample between 9–17 is suitable for data saturation. The interviews were audio-recorded with the consent of the participants. [Table 3](#) shows the demographic characteristics of interview participants.

Table 3. Participants' profiles by community and gender (semi-structured interviews).

Community	Male	Female	Total
Ashaley Botwe	3	2	5
James Town	1	3	4
Weiija-Gbawe	2	4	6
West Legon	1	4	5
Total	7	13	20

Source: Field data of 2023.

[Table 4](#) illustrates the socio-demographic characteristics of the surveyed population. The dominant demography was female (51.2%), suggesting a likely gendered aspect of household leadership. Most of the respondents were within the active age group, with 12.5% being between ages 25–33, 35% between 34–42, and 31.3% between 43–51. Also, most of the respondents were highly educated, with only 9.4% not having any formal education. While the mean, minimum and maximum number of years lived in the community were 12.1, 5 and 40 years, respectively, the majority (59.5%) of respondents were third-party occupants of their residences ([Table 4](#))—either occupying through rent or as caretakers. Socio-demographic data help contextualize respondent characteristics and examine associations with study variables ([Asiedu and Agyei-Mensah, 2008](#)).

2.5 Modelled Earthquake Preparedness Indicator Checklist

In this paper, the study modelled an earthquake emergency readiness checklist indicator assessment with reference to the '72 hr golden rule', which highlights the relevant pre-packed emergency kits that can sustain victims of a disaster emergency for up to three days. This was done by reviewing existing literature with similar assessments (e.g., [Cai et al., 2018](#); [Dasgupta et al., 2020](#); [Ilo et al., 2018](#); [Spital et al., 2006](#); [Awere and Addai, 2022](#)). Given the broad nature of these indicator assessments, which cover a wide array of disaster events, the kits were narrowed to cover earthquakes, with particular emphasis on their availability

Table 4. Socio-demographic characteristics of surveyed respondents.

Demographic	Variable	n (383)	Percent
Sex	Male	187	48.8
	Female	196	51.2
Age	25–33	48	12.5
	34–42	134	35.0
	43–51	120	31.3
	>51	81	21.1
Education	None	36	9.4
	Basic Education	103	26.9
	Middle/SHS/Voc/Tec	146	38.1
	Tertiary	98	25.6
Residential ownership	Owned Outrightly	155	40.5
	Third-party Ownership	228	59.5
Years lived in community	$\bar{x}$ = 12.1, min = 5, max = 40		

Source: Field data of 2023.

in the context of Ghana. In this paper, the 72-hr kit consists of 17 non-ordered item indicators as a measure of household readiness for earthquake emergencies, where the availability of 0–1 item in a household means unprepared, 2–4 means poorly prepared, 5–10 means moderately prepared, 11–14 means highly prepared, and 15–17 means fully prepared. The checklist indicators are provided in Table 5.

Table 5. Earthquake preparedness checklist indicators.

1. Household food and water availability for up to 72 hours during emergencies,
2. Extra battery,
3. Workable Radio(s),
4. Torchlight(s),
5. A good first aid kit,
6. Gas mask(s),
7. Functional Fire extinguisher(s),
8. House escape route(s),
9. Whistle,
10. Emergency contact number(s),
11. Household evacuation plan,
12. Property and life insurance,
13. Heavy objects on the floor,
14. Accessible electrical main switch(s),
15. Ability to rescue trapped people,
16. Hazardous substances safely stored, and
17. Ability to douse fires.

Source: Author's construct.

2.6 Predictors of Earthquake Preparedness—Binary logistic Regression Model

The Binary Logistic Regression Model was employed to determine the factors influencing preparedness interventions. This model is purposively employed because, according to Tasnuva et al. (2023), the model is the most widely used for assessing dichotomous dependent variables against several independent variables. The Maximum Likelihood Estimation approach was employed to conduct parameter estimation because it yields unbiased output, unlike the linear probability model, as indicated by Pindyck and Rubin-

feld (1991). In the analysis of the binary logistic regression, only variables found to be statistically significant were analysed. The regression model can be expressed as:

$$\text{Log} \left[\frac{P_i}{1 - P_i} \right] = \alpha + \beta_o + \beta_1 * x_i + \dots \beta_n * x_n. \quad (4)$$

Also, Chi-square (χ^2) tests were conducted. Computation of the regression model and the Chi-square (χ^2) tests were conducted using the IBM Statistical Package for Social Sciences (SPSS) version 27.

2.7 Statistical Analysis and Presentation of Findings

The data analysis was computed using IBM SPSS. The survey data were first cleaned and coded to convert responses into numerical values for easy understanding of the patterns and trend relationships. The data were then statistically transformed into tables and charts and inferentially analysed. Non-parametric tests, particularly Chi-square (χ^2) tests, were conducted. The Binary Logistic regression model was computed to assess the key predictors of earthquake preparedness. The semi-structured interviews were thematically coded and transcribed using NVivo 12. The transcribed data were exported to Microsoft Word and presented alongside the quantitative data for analysis. The triangulation of the quantitative and qualitative data provided a robust and all-round analysis.

3 Results and Discussion

3.1 Awareness and Perceptions of Earthquake Risk

Table 6 summarises respondents' awareness and perceptions of earthquake risk. On the topic of earth tremor experiences, the study found that over half of the respondents (56.1%) had encountered a tremor at least once, indicating substantial awareness of the recurring tremor events in GAMA ($\chi^2 = 5.768$, $p = .016$). This finding is consistent with the comparative study by Norman et al. (2012), which, through the “cry wolf hypothesis,” determined that 54.3% of respondents in Accra had personally experienced an earth tremor. Although the prevailing view among respondents

Table 6. Earthquake risk awareness and perceptions.

Variable	Groups	n (383)	Percent
Have you ever experienced an earthquake/tremor in your community? [χ^2 , 5.76 ; df, 1; p, .016]	Yes	215	56.1
	No	168	43.9
Do you consider your community to be earthquake-prone?	Yes	165	43.0
	No	68	17.8
	Not certain	150	39.2
What earthquake risk level do you perceive your community to be? [χ^2 = 198, df = 3, p = <.001]	Low	193	50.4
	Medium	128	33.4
	High	38	9.9
	Very high	24	6.3
A major earthquake is likely to occur in GAMA? [χ^2 = 60.38, df = 2, p = <.001]	Unlikely	182	47.5
	Partially likely	141	36.8
	Absolutely possible	60	15.7
How will you rate your concern for imminent earthquakes in future? [χ^2 = 166, df = 3, p = <.001]	Unconcerned	194	50.6
	Slightly concerned	101	26.4
	Highly concerned	65	17.0
	Extremely concerned	23	6.0
Your home is likely to get damaged when an earthquake occurs. [χ^2 = 44.27, df = 2, p = <.001]	Yes	68	17.8
	No	145	37.9
	Uncertain	170	44.3

Source: Field data of 2023.

was one of concurrence, many respondents offered further experiential insights. Illustratively, a female head of household residing in Weija remarked: “*I experienced the recent tremor that occurred in May 2023. It shook my building, and I really felt it. It lasted for just a few seconds...If I am right, I have experienced about 5 tremors in the last 20 years or so.*” This substantial awareness of the risk situation underscores a high level of self-awareness of earthquake risk in GAMA. A potential contributing factor to the elevated response rates regarding tremor experiences may be the recurrent nature of such events across the densely populated metropolitan area, particularly given the most recent occurrence in March 2023.

An analysis of the survey responses (Table 6) revealed that while only 17.8% of respondents disagreed that their community was earthquake-prone, 39.2% were uncertain. However, a substantial 43% agreed, pointing to a generally high level of awareness regarding GAMA’s earthquake vulnerability. In view of this, several interviewees articulated their perceptions on the problem. One male respondent, for example, contended that “*I think James Town is also earthquake prone. History has it that this town was affected by an earthquake during the colonial era. ... and yes, I think we reside in an earthquake-prone area because we experience slight ground shaking intermittently.*” This study reaffirms the widely held geoscientific position—supported by both contemporary research and historical datasets—that the south-eastern corridor of Ghana, with Accra as a focal point, is inherently susceptible to earthquakes (Klu et al., 2024; Asare-Bediako et al., 2024; Somiah et al., 2026; Ghana Geological Survey Authority, 2023). A significant concentration of respondents within the ‘disagree’ category may indicate a potential gap in critical knowledge regarding earthquake disaster risk in Accra.

Despite 56.1% of respondents reporting prior experience with earth tremors, just 6.3% classified GAMA as a very high earthquake risk zone. Conversely, the overwhelming majority (50.4%) held a strong perception of GAMA as a low-risk area, revealing a significant disconnect between lived experience and risk assessment (χ^2 = 198.232, p <.001).

The data reveal a clear preponderance of lower-risk perceptions, with 83.8% of respondents placing GAMA within the low-to-medium risk band, against just 16.2% who categorised it as high-to-very high risk (Table 6). These findings are at odds with the existing earthquake hazard assessments for Accra, including those of Ahulu et al. (2018) and Kutu et al. (2013). Indeed, the latter’s assertion that Accra constitutes a high-to-very-high risk zone is contrary to the prevailing sentiments reflected in the responses of this study’s participants. Generally, the prevailing perception of GAMA as a low earthquake-risk area, as reflected in the high response rate, may be attributed to either a shortfall in risk literacy among participants or the significant quiescent period that has elapsed between major earthquake occurrences in Accra.

Additionally, this study examined respondent perceptions of the probability of a major earthquake against the backdrop of recent tremors. As detailed in Table 6, the data revealed that a substantial proportion of respondents (47.5%) exhibited a strong perception that a major earthquake was unlikely in the near future. This underscores a pronounced lack of awareness among respondents, given that tremors are widely recognised in the literature (e.g., Rhoades, 2020; Christophersen et al., 2017; Konishi, 2025) as potential harbingers of imminent major earthquakes. Methodological triangulation with in-depth interviews yields a critical insight into local risk perception.

This is exemplified by a participant in Ashaley Botwe who indicated that: “Yes, earth tremors are happening. But I do not see any major earthquake happening anytime soon. I think our country does not lie in a high earthquake zone, unlike many countries in Europe”. On the contrary, only 15.7% of the surveyed population reported that earthquakes were absolutely possible, whereas 36.8% noted they were partially possible. Adding to this, a female participant in Weija noted that: “I personally think the whole of Ghana should be prepared for an imminent earthquake. The truth is that, once tremors start occurring, it is usually followed by a major earthquake someday. Let us just prepare for the worst-case scenario”.

While nearly a majority of respondents reject the notion of imminent earthquakes, this public perception is contradicted by both expert analysis and current peer-reviewed research. Klu et al. (2024), for instance, project that major earthquakes in Ghana are imminent, leveraging Gutenberg–Richter estimations derived from Ghana’s seismic data. Similarly, the perspectives shared by numerous geological experts during public interviews (e.g., [Graphic Online, 2018](#); [Chronicle, 2023](#); [Ghanaian Times, 2020](#)) have frequently converged on the imminence of a major earthquake in Accra, with some projecting its occurrence within the next half-century.

As shown in [Table 6](#), concern regarding impending earthquakes was distributed across four tiers, with the majority of respondents (50.6%) reporting no concern, 26.4% reporting slight concern, 17.0% reporting high concern, and only 6.0% reporting extreme concern. The findings from the survey were further substantiated through the integration of interview data, which provided invaluable qualitative depth. A case in point is the response from a female participant in West Legon who claimed that: “I am not concerned about earthquakes occurring in Accra. I don’t think it is a possibility. They are not a part of Ghana’s or Africa’s problem. I think it mostly happens in Asia or Europe.... So, it is the least of my worries”. The findings reflect a strong public disregard ($\chi^2 = 166, p < .001$) for the episodes of earth tremors as a legitimate concern and warning for potential earthquakes. The pervasive lack of public apprehension toward potential earthquake threats is largely a function of multiple compounding factors. Predominantly, this stems from the year-round prevalence of more immediate hazards (e.g., floods and fire disasters), the protracted temporal gap between major earthquake events, and the absence of comprehensive, wide-reaching earthquake awareness campaigns by DRR regulatory authorities.

When queried on the potential for their residences to be ravaged by a major earthquake, only 17.8% of respondents perceived such an outcome as likely ([Table 6](#)). A further 44.3% were uncertain in their assessment, whereas about 37.9% absolutely refuted the claim. The findings reveal that nearly a majority of respondents demonstrated a high level of uncertainty regarding the implications of the potential danger, suggesting a pronounced level of uncertainty about the general destructive capacity of earthquakes. In light of this finding, a participant in James Town added that: “I do not think the occurrence of an earthquake will destroy many homes. The earthquakes we experience here are very

small and powerless”. Contrary to the findings of many earlier studies, this finding suggests a different reality. A study by [Oteng-Ababio \(2012\)](#) typifies the existing view, noting that GAMA’s urban footprint has sprawled beyond its administrative boundaries and that construction actors frequently circumvent the nationally prescribed earthquake-resistant provisions. The occurrence of an earthquake will therefore be devastating to human and economic livelihoods ([UN-Habitat, 2010](#); [Asare-Bediako et al., 2024](#)) due to widespread public disregard for Ghana’s building code and inconsistent implementation of seismic safety measures ([Owusu, 2025](#)). This, therefore, underscores the need for awareness and preparedness interventions.

3.2 Earthquake Preparedness and Mitigation

[Table 7](#) summarises respondents’ preparedness towards imminent earthquakes. On the question of whether respondents were prepared for imminent earthquakes, the study discovered that only 35% reported being prepared while the majority of respondents (65%) were not ([Table 7](#)). This highlights a lack of public preparedness for the seemingly possible future earthquakes. The present finding aligns with existing literature, including the works of [Awere and Addai \(2022\)](#) and [Mohammed et al. \(2025\)](#). In their study on Weija-Gbawe, [Awere and Addai \(2022\)](#) observed notably low levels of household earthquake preparedness, which they linked to a broader systemic failure in both local and national DRR strategies. Similarly, [Mohammed et al. \(2025\)](#) examined disaster preparedness within higher education institutions (HEIs) and found that a majority were inadequately prepared to handle disasters, primarily due to the absence of formal mitigation policies. Interestingly, while respondents widely acknowledged the vulnerability of their communities to earthquakes, this awareness did not translate to actionable measures to enhance readiness for impending earthquakes.

Consistent with the overall trend of low readiness, the study further found that a high level of preparedness was limited to a small fraction of the population (14.6%). In contrast, the majority of participants (67.1%) lacked adequate preparedness ([Table 7](#)). These findings necessitate the urgent need for the implementation of robust, community-based earthquake preparedness programs. The findings agree with those of [Awere and Addai \(2022\)](#), who similarly revealed that households in Weija were very poorly prepared for earthquake emergencies, with only a minority reported being moderately prepared and no household fully prepared. Despite the general gap in preparedness and readiness, the majority of respondents (81.2%) agreed that preparedness can help minimise the impact of imminent earthquakes ([Table 7](#)). This suggests that, although respondents acknowledged the fundamental relevance of preparedness, their actual earthquake emergency preparedness and readiness remained critically low ([Table 7](#)).

Furthermore, household prioritisation of earthquake preparedness was notably low; only 9.4% of respondents reported a high level of prioritisation, while the majority (54.3%) indicated that it was not a priority ([Table 7](#)). This indicates a high lack of concern for households’ earthquake

Table 7. Earthquake preparedness.

Variable		n (383)	Per cent
Are you prepared for imminent earthquakes?	Yes	134	35.0
$[\chi^2 = 34.530^a, df = 1, p = <.001]$	No	249	65.0
How prepared are you for earthquake emergencies?	Unprepared	257	67.1
$[\chi^2 = 197.300^a, df = 2, p = <.001]$	Moderately prepared	70	18.3
	Highly prepared	56	14.6
Can earthquake preparedness minimise damage?	I agree	311	81.2
$[\chi^2 = 149.141^a, df = 1, p = <.001]$	I disagree	72	18.8
Rate your level of earthquake preparedness priority	Not a priority	208	54.3
$[\chi^2 = 117.373, df = 2, p = <.001]$	Low priority	139	36.3
	High priority	36	9.4
Have you ever attended any public outreach on earthquake safety?	Yes	128	33.4
$[\chi^2 = 120.692^a, df = 1, p = <.001]$	No	255	66.6
Household familiarity with earthquake response procedures	Yes	126	32.9
$[\chi^2 = 44.807^a, df = 1, p = <.001]$	No	257	67.1
Household contingency plan (n = 200)	No, and not considered	137	68.5
$[\chi^2 = 123.910^a, df = 2, p = <.001]$	No, but considered	52	26.0
	Yes	11	5.5

Source: Field data of 2023.

mitigation and safety. This finding is substantiated through triangulation with personal interview data, where numerous respondents supported the observed prioritisation patterns and articulated justifications for their respective responses. For example, a male participant from Ashaley Botwe stated: “*To be sincere, I do not see the need to highly prioritise something that doesn’t have an impact on my family. I mean, we should rather prioritise flood preparedness.*” When combined, the ‘not a priority’ and ‘low priority’ response categories represent 90.6% of the total survey population. This majority stance reflects a low level of public concern for earthquake preparedness—a trend that remains evident even among those who have previously experienced tremors. Studies have unearthed the influence of personal experiences on disaster preparedness (e.g., Bourque, 2013; Becker et al., 2017; Doyle et al., 2018). In summary, these studies collectively suggest that direct exposure to hazards serves as a significant motivational factor for preparedness. Yet, the results of this study offer a contrasting perspective, revealing that even for most respondents with prior tremor experience, that experience did not translate into increased preparedness.

Also, prior participation in public outreach on earthquake safety was minimal, with only about 33.4% reported to have ever participated in an outreach (Table 7). On the contrary, most respondents (66.6%) reported they never participated in or attended any outreach on earthquake safety, indicating a strong lack of community education and awareness on earthquake preparedness and safety campaigns. Triangulation of this result against qualitative interview responses reveals a prevailing consensus among participants, regardless of campaign exposure, who uniformly endorsed the necessity of a nationwide, inclusive, and efficacious earthquake safety education framework. In many

earthquake-prone countries, nationwide programs and campaigns on derisking are a common practice (e.g., see Hosseini and Izadkhah, 2020; Zhang et al., 2021). In Ghana, although disasters of natural causes are a frequent occurrence, according to UNDP (2025), government funding for DRR has remained fragmented, ad hoc and overly dependent on international aid. While Ghana’s Act 927 of the National Disaster Management Organisation (NADMO) Act 2016 mandates NADMO to derisk disasters, the institution lacks the financial, logistical and human resources to carry out its mandate (Anab et al., 2022), which, to some extent, explains the low participation rate among households.

On the question of familiarity with earthquake response procedures, the study discovered that the majority of respondents (67.1%) were unfamiliar with the conventional ‘*drop, cover and hold on during the shaking, moving to safety afterwards and preparing for aftershocks.*’ This indicates a very weak knowledge of safety precautions during and after earthquake emergencies. On the contrary, only 32.9% of respondents were familiar with the conventional procedures, underscoring the need to hasten earthquake safety standard precautions. The findings contradict a similar study by Cvetković and Planić (2022) in Belgrade, who discovered that most respondents were familiar with standard procedures during and after an earthquake. This contradiction perhaps stems from variations in risk awareness and the frequency of major earthquake emergencies across the different study areas.

On household contingency plans for post-earthquake recovery, the study discovered that only 5% of respondents had alternative plans, which include insurance policies and relying on their social capital for post-emergency recovery (Table 7). More than one-fifth indicated they did not have any post-emergency contingency plan, but it is being

considered. On the contrary, most respondents (68.5%) reported they did not have any plan and do not consider having any—indicating a wide public disregard for future post-earthquake disaster recovery. This finding concurs with a similar study by [Cvetković and Planić \(2022\)](#), who also revealed that most households in Belgrade did not have a post-earthquake recovery plan. According to [Zhou et al. \(2018\)](#), emergency decision-making for natural hazards is vital in improving the capacity to respond to disasters. This is true given that planning for emergencies enhances survival and promotes rapid post-disaster recovery.

3.3 Earthquake Preparedness Indicator Checklist

To conduct a nuanced earthquake preparedness assessment, the study conducted a checklist assessment of 17 items as highlighted in the methodology. Here, respondents' degree of preparedness was based on the number of items they own on the checklist. The findings ([Table 8](#)) showed that less than 1% of respondents were completely prepared (thus had items between 15–17), 3.1% were highly prepared (had 11–14 items), and 15.9% were moderately prepared (had 5–10 items). On the contrary, most respondents (50.3%) were poorly prepared (2–4 items), and an additional 29.9% were unprepared (had 1 item). This finding signals a very low household preparedness for earthquake emergency preparedness and safety. Regarding the reasons for the poor preparedness, many participants argued that earthquakes are not a major threat to public safety in Ghana at the moment, unlike other events, including fire outbreaks, perennial floods and road traffic accidents. The findings resonate with those of [Awere and Addai \(2022\)](#), who, in Weija-Gbawe, revealed that most respondents reported being completely unprepared using a similar checklist assessment. Across the continuum of preparedness level based on the indicator checklist, the majority of respondents (80.2%) fall within unprepared-to-poorly prepared. In fact, the neglect of Ghana's earthquake risk is rooted in complex interrelated factors ranging from geological conditions to institutional oversight of the risk situation. According to [Allotey et al. \(2010\)](#), the neglect is largely attributed to factors including the relative stability of the region and poor integration of disaster risk into development. [Somiah et al. \(2026\)](#), on the other hand, attribute the problem to a lack of seismic data and a poor understanding of the risk situation. Although earthquake risk persists, other dominant environmental hazards—perennial flooding and fire disasters may have taken the forefront of national DRR attention.

Table 8. Earthquake emergency preparedness indicator checklist.

Checklist indicator	Preparedness level	n (383)	Per cent
0–1	Unprepared	115	29.9
2–4	Poorly prepared	193	50.3
5–10	Moderately prepared	61	15.9
11–14	Highly prepared	12	3.1
15–17	Fully prepared	2	.5

Source: Field data of 2023.

3.4 Predicting Factors of Earthquake Preparedness—Binary Logistic Regression model

The question of what factors shape disaster preparedness has long been a central concern within DRR scholarship. This enduring line of inquiry prompts critical reflection on the underlying predictors of earthquake preparedness, particularly in the context of high-impact, low-probability events such as earthquakes, where systemic shortcomings in readiness are persistently observed despite their recurrent and devastating consequences. [Tekeli-Yeşil et al. \(2010\)](#) suggest that social and environmental factors have the most intervening influence on earthquake preparedness. Similarly, [Gillani et al. \(2020\)](#) note that people's understanding of disasters and their preparedness response correlates with their knowledge, attitudes, and readiness to prepare. To that end, the binary logistic regression model was employed to assess the key predictors of earthquake preparedness in Accra. The model identified education and prior earth tremor experiences as statistically significant predictors of earthquake preparedness ([Table 9](#)). In the logistic regression model, educational status emerged as a statistically significant negative predictor of preparedness ($B = -0.89$, $p = .006$), suggesting that respondents with lower formal educational attainments were less likely to adopt earthquake preparedness measures [$\text{Exp}(B) = .40$]. These findings add to the growing body of international evidence highlighting formal education as a critical factor in earthquake preparedness (e.g., [Sözen and Genç, 2025](#); [Barua et al., 2020](#)). Prior experience with earth tremors was a significant positive predictor of preparedness ($B = .56$, $p = .022$), suggesting that respondents with earth tremor experiences were more likely to adopt preparedness measures [$\text{Exp}(B) = 1.753$]. In accordance with existing literature, this finding reaffirms the findings of [Becker et al. \(2017\)](#), [Castañeda et al. \(2020\)](#), and [Kim et al. \(2024\)](#), all of whom identified prior experience as a significant predictor of disaster preparedness in the context of different study areas. The other variables—sex, age, mode of residential ownership, and the fear of imminent major earthquakes did not show statistically significant influence on preparedness. Overall, the model's goodness-of-fit is supported by a -2 Log Likelihood value of 456.312, a Cox & Snell R-squared of .098 and a Nagelkerke R-squared of .135, highlighting that the model explains approximately 13.5% of the variation in household earthquake preparedness and readiness interventions.

4 Limitations of the Study

This study has limitations that should be considered. First, the scope of the study was confined to GAMA. The findings may not fully represent the patterns of perceptions, awareness and preparedness in other parts of Ghana. Second, the assessment of households' risk perceptions and their awareness was based on surveys and interviews. Participants may overestimate or exaggerate their perceptions, awareness and preparedness for social and political reasons, thereby limiting the true reflection of the situation. Also, the concept of 'perception' is subjective and cannot be equated with an objective assessment—as their

Table 9. Binary Logistic regression analysis of factors predicting earthquake preparedness.

Constant	B	S.E	Wald	Sig.	Exp(B)	95% CI for EXP(B)	
						Lower	Upper
Sex	.36	.23	2.40	.121	1.43	.91	2.27 ^b
Age	.63	.34	3.42	.064	1.89	.96	3.71 ^b
Education	-.89	.33	7.56	.006	.40	.22	.77 ^a
Residential ownership	-.23	.25	.89	.344	.79	.49	1.28 ^b
Fear of imminent earthquakes	.001	.13	.000	.994	1.00	.78	1.28 ^b
Prior tremor experiences	.56	.25	5.26	.022	1.753	1.08	2.93 ^a

Note: ^a represents significance at 5%, ^b represents insignificance at 5%. [$\chi^2 = 39.570$, $-2 \text{ Log likelihood} = 456.3$, $\text{Cox \& Snell R Square} = .098$, $\text{Nagelkerke R Square} = .135$].

Source: Field data of 2023.

perspectives can be influenced by many factors including access to information and other socio-economic circumstances.

5 Conclusion, Policy Implications and Directions for Future Research

The Greater Accra Metropolitan Area faces a mounting earthquake risk. The situation is precarious, especially given that the area sits at the crossroads of two converging major fault lines. To curb this growing threat, household-level preparedness must serve as the cornerstone of disaster risk reduction in GAMA, particularly as the city's population continues to grow rapidly. The study concludes that there is a major gap between awareness and preparedness for imminent earthquake emergencies, despite the high awareness rates about earthquake risk among households. Prior tremor experiences are identified as the major predictors of earthquake preparedness in GAMA. Yet many interacting factors hamper household overall earthquake emergency preparedness. By heeding the study's call to assess household earthquake risk perceptions, awareness, and preparedness for disaster emergencies, the application of a mixed-methods research design helps situate the study on a solid scientific footing. The application of the binary logistic regression model provides policymakers with reliable first-hand and predictive data for developing localised earthquake awareness and preparedness interventions. The findings have policy implications. First, this could strengthen the need to enforce the Ghana Building Code (GS 1207:2018), which embraces seismic design provisions—requirements that structural builders have largely ignored with impunity. Resource mobilisation and funding for community-level earthquake preparedness committees at the local unit level, with oversight provided by district assemblies, are fundamental and could also be enacted. Moreover, authorities should also consider the systematic integration of disaster risk reduction into education curricula at the basic levels of education to create awareness and preparedness from an early stage. Further studies on predicting factors influencing changes in risk awareness and perceptions will help assess changes in risk perceptions and how that influences household preparedness interventions. Earthquake risk governance, the role of the state and challenges faced by institutions mandated to manage disasters must be assessed.

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CRedit statement

AMK: Manuscript preparation, Investigation, Visualization, Methodology, Writing – original draft preparation.

Declaration of competing interest

The author declares no competing interests.

Data availability

The data are available from the author upon reasonable request.

AI-Assistance Disclosure

Grammarly and DeepSeek were used to improve grammar, clarity and writing tone. The content of the article is completely the author's own, and he remains responsible for it.

Consent to participate

A consent-to-participate option was provided in the instruments and was strictly followed. Participants were debriefed on the intended purpose of the study.

Ethics statement

The study sought opinions through questionnaires and interviews from household heads. A formal introductory letter was obtained from the Head of Department, which was then shown to respondents and participants prior to the administration of the instruments. All participants were assured of the confidentiality and anonymity of their views, which were intended for academic purposes.

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