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Assessment of Preparedness Level of Community towards Earthquake Disaster in Hawassa City, Ethiopia

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Abstract

The evaluation of earthquake preparedness in Hawassa City, Ethiopia, centers on assessing the community's ability to respond to seismic disasters, considering its position within the East African Rift System. This region is known for its significant geological activity, which increases the risk of earthquakes and necessitates effective preparedness strategies. Hawassa's vulnerability, coupled with its historical experience with damaging earthquakes, highlights the critical need for community readiness to mitigate potential impacts and enhance resilience. This study aims to evaluate the community's readiness for earthquake disasters through a qualitative research framework. Utilizing a community-based cluster sampling method, 200 questionnaires were distributed across Hawassa, resulting in 179 completed responses. Data analysis revealed several significant insights: 72.10% of respondents were male, 38.5% possessed a bachelor's degree or higher and 49.7% had lived in Hawassa for more than ten years. Notably, the majority of respondents had not received any information or training on earthquake preparedness, despite being aware of the risks and hazards associated with seismic events. Alarmingly, while all respondents knew where to seek medical assistance in the event of injuries during an earthquake, a striking 97.2% reported lacking essential first aid supplies. These findings indicate a significant gap in community preparedness. In conclusion, although some households have experienced earthquakes, the majority remain inadequately prepared. There is an urgent need for the implementation of effective pre- and post-earthquake disaster management systems within government agencies responsible for disaster response. Furthermore, comprehensive training programs for community organizations are essential to strengthen disaster preparedness initiatives throughout the city.

Keywords: Disaster Management, Earthquake, Preparedness

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1. Introduction

The geological conditions of a region play a crucial role in determining its seismic activity and the potential impact of earthquakes. In the case of Hawassa city, situated within the East African Rift System, local geological factors significantly influence its susceptibility to seismic hazards. The East African Rift, a classic example of continental rifting, is characterized by extensional deformation and tectonic activity due to the movement of the African and Arabian tectonic plates (Alaneme & Okotete, 2018; Ruch et al., 2021).

The local geology of Hawassa and its surrounding areas affects how seismic waves propagate during an earthquake. Studies have shown that variations in surface geology, such as transitions between soft and hard rock, can lead to significant differences in ground motion amplification, often exacerbating earthquake damage (Marlyono & Nandi, 2018). The East African Rift system, encompassing Hawassa, Ethiopia, stands as one of Sub-Saharan Africa's most seismically active regions, harboring a history of earthquakes surpassing magnitudes of 6.0. Past seismic events in proximity to Hawassa, spanning decades and varied in magnitude, serve as poignant reminders of the persistent threat posed by earthquakes, despite perceptions of moderate to low hazard levels.

Hawassa has experienced various seismic events, attributed to its position along the tectonic plate boundary of the East African Rift. The historical seismicity of Ethiopia, including the region surrounding Hawassa, has seen several damaging earthquakes, influencing civil engineering practices and the establishment of seismic codes(Alaneme & Okotete, 2018). The Ethiopian seismic code, introduced in 1980 and revised subsequently, was designed to address the risks posed by earthquakes and to inform the design of structures in different seismic zone(Alaneme & Okotete, 2018; Ayele et al., 2021).

This historical context underscores the imperative of comprehending Hawassa's earthquake history to anticipate and prepare for future seismic events effectively(Wilks et al., 2017). Beyond understanding historical seismicity, embracing concepts of disaster resilience, community preparedness, and proactive risk mitigation becomes paramount. By integrating

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these broader concepts into the discourse, stakeholders can foster a comprehensive approach to safeguarding Hawassa and its inhabitants from the potential devastation wrought by earthquake disasters, ensuring sustainable development and resilience in the face of adversity.

2. Materials and Methods

The methodology for assessing the preparedness level of the community towards earthquake disasters in Hawassa city was structured using a community-based cluster sampling method. The total sample size is determined to be 200 respondents. With the city divided into eight sub-cities (Addis Ketema, Hayk Dar, Bahil Adarash, Misrak, Menahreya, Tabor, Mehal Ketema, and Tula Sub cities), three sub-cities are randomly selected for inclusion in the study. Within the selected sub-cities, 200 questionnaires are randomly distributed among residents. In total, 179 completed questionnaires are collected back for analysis.

2.1 Study Subject

This research focuses on assessing the level of community preparedness towards earthquake disasters in Hawassa City, Ethiopia. Given the geographical location of Hawassa within the seismic-prone Great Rift Valley, the city is vulnerable to the potential devastation caused by earthquakes. This study seeks to comprehensively evaluate various aspects of community preparedness, including awareness levels, emergency response plans, disaster warning systems, and resource mobilization mechanisms. By conducting a detailed examination of these factors, the research aims to identify existing gaps and challenges in community preparedness and provide actionable insights to enhance resilience and mitigate the impact of future earthquake disasters. Through this study, we endeavor to contribute valuable knowledge that can inform policy formulation, urban planning, and disaster management strategies aimed at safeguarding lives and livelihoods in earthquake-prone regions like Hawassa City.

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2.2 Study Design

The research adopts a mixed-methods approach, combining both qualitative and quantitative methodologies to comprehensively assess the level of community preparedness towards earthquake disasters in Hawassa City, Ethiopia.

A structured questionnaire is developed to collect quantitative data from a representative sample of residents within Hawassa City. The questionnaire includes items designed to measure various aspects of community preparedness, such as awareness levels, emergency response plans, disaster warning system awareness, and availability of resources. Sampling is conducted using a stratified random sampling technique to ensure representation across different demographic groups within the city. Data collected through the questionnaire are analyzed using SPSS V 27 statistical software to generate descriptive statistics and identify patterns and trends in community preparedness.

In-depth interviews are conducted with key stakeholders involved in disaster management and community resilience within Hawassa City. Participants include local government officials, emergency responders, community leaders, and representatives from non-governmental organizations. Semi-structured interview guides are used to facilitate discussions around perceptions of earthquake risks, challenges in disaster preparedness, and opportunities for improvement. Thematic analysis is employed to analyze qualitative data, identifying key themes and insights that emerge from the interviews and focus group discussions.

2.3 Data Analysis

Quantitative data collected from the questionnaires are analyzed using SPSS V27 statistical software to generate descriptive statistics, including frequencies and percentages. Chi-square tests may be employed to assess associations between demographic variables and levels of community preparedness. Qualitative data from open-ended questions are thematically analyzed to identify recurring themes and patterns related to community preparedness. The

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integration of quantitative and qualitative findings provides a comprehensive understanding of the level of community preparedness towards earthquake disasters in Hawassa City

3. Result and discussion

The analysis of data collected from the questionnaire is conducted using SPSS version 27. Out of the 200 questionnaires distributed among respondents, a total of 179 valid responses were received and included in the analysis. This subset of respondents represents the sample population from which insights and conclusions are drawn regarding the level of community preparedness towards earthquake disasters in Hawassa City, Ethiopia. The utilization of SPSS facilitates the computation of descriptive statistics, such as means, standard deviations, and variances, for demographic variables including age, gender, role in the family, job status, education level, and length of residence in Hawassa City. By analyzing the valid responses, the research aims to provide a comprehensive understanding of the demographic characteristics and their relationship with the level of community preparedness for earthquake disasters in the study area.

3.1 Demographic Information

The demographic information of the respondents is presented in Table 1 below:

Table 1:Demographic Information Statistics

Statistics

		Age	Your Gender	Role in the family	Job status	Education Level	Length of Residence in Hawassa City
N	Valid	179	179	179	179	179	179
	Missing	0	0	0	0	0	0
Mean		2.83	1.28	1.43	1.96	3.29	2.64
Std. Deviation		1.114	.450	.496	.847	1.211	1.048
Variance		1.241	.202	.247	.717	1.466	1.098

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From the above table, the majority of the respondents, 72.10 % are male and 27.9 % are female. The average gender response is approximately 1.28, which is correspond to Male=1 coding used in the survey. The gender data has a standard deviation of approximately 0.450, suggesting a relatively low variability in gender responses. The variance in gender responses is approximately 0.202

The average age of the respondents is approximately 2.83, age between 25 to 34. The age data has a standard deviation of approximately 1.114, indicating a relatively wide dispersion of ages around the mean. The variance in age is approximately 1.241, further indicating the variability in age among the respondents.

3.2 The level of awareness within the community regarding earthquake risks and preparedness measures

Table 2: Awareness level evaluation Statistics

		Have you ever received information or training on earthquake preparedness	Do you know the potential risks and hazards associated with earthquakes	Can you identify safe locations within your home or workplace to take shelter during an earthquake	Are you aware of the emergency evacuation routes in your neighborhood	Have you participated in any earthquake drills or exercises in the past year	Do you know how to turn off utilities (water, electricity) in your home in the event of an earthquake
N	Valid	179	179	179	179	179	179
	Missing	0	0	0	0	0	0
Mean		1.79	1.27	1.22	1.83	2.00	1.04
Std. Deviation		.410	.444	.414	.375	.000	.194
Variance		.168	.197	.171	.140	.000	.038

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From Table 3, here is the interpretation of the statistics provided for the questions related to earthquake preparedness:

- Have you ever received information or training on earthquake preparedness?
  - ✓ **Mean:** The average response to this question is approximately 1.79, suggesting that a majority of respondents did not receive information or training on earthquake preparedness.
  - ✓ **Standard Deviation:** The data has a standard deviation of approximately 0.410, indicating a moderate variability in responses.
  - ✓ Variance: The variance in responses is approximately 0.168.
- Do you know the potential risks and hazards associated with earthquakes?
  - ✓ **Mean:** The average response to this question is approximately 1.27, indicating that most respondents are aware of the potential risks and hazards associated with earthquakes.
  - ✓ **Standard Deviation:** The data has a standard deviation of approximately 0.444, suggesting a moderate variability in responses.
  - ✓ **Variance**: The variance in responses is approximately 0.197.
- Can you identify safe locations within your home or workplace to take shelter during an earthquake?
  - ✓ **Mean:** The average response to this question is approximately 1.22, suggesting that respondents generally possess knowledge of safe locations to take shelter during earthquakes.
  - ✓ **Standard Deviation:** The data has a standard deviation of approximately 0.414, indicating a moderate variability in responses.
  - ✓ **Variance:** The variance in responses is approximately 0.171.
- Are you aware of the emergency evacuation routes in your neighborhood?
  - ✓ **Mean:** The average response to this question is approximately 1.83, indicating that respondents are generally didn't aware of emergency evacuation routes in their neighborhood.

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- ✓ **Standard Deviation:** The data has a standard deviation of approximately 0.375, suggesting a moderate variability in responses.
- ✓ **Variance:** The variance in responses is approximately 0.140.

- Have you participated in any earthquake drills or exercises in the past year?
  - ✓ **Mean:** The average response to this question is approximately 2.00, suggesting that respondents nobody participated in earthquake drills or exercises in the past year.
  - ✓ **Standard Deviation:** The data has a standard deviation of approximately 0.000, indicating that there is no variability in responses for this question.
  - ✓ **Variance:** The variance in responses is approximately 0.000.
- Do you know how to turn off utilities (water, electricity) in your home in the event of an earthquake?
  - ✓ **Mean:** The average response to this question is approximately 1.04, indicating that most respondents know how to turn off utilities in their homes during an earthquake.
  - ✓ **Standard Deviation:** The data has a standard deviation of approximately 0.194, suggesting a moderate variability in responses.
  - ✓ **Variance:** The variance in responses is approximately 0.038.

These statistics provide insights into the level of earthquake preparedness among respondents, highlighting areas of strength and potential areas for improvement in community readiness for earthquake disasters.

3.3 Earthquake Disaster Prevention Measures

The respondents were asked whether they do take measures to secure heavy furniture or appliances in their homes to prevent injury during an earthquake the result is presented below in Figure 1:

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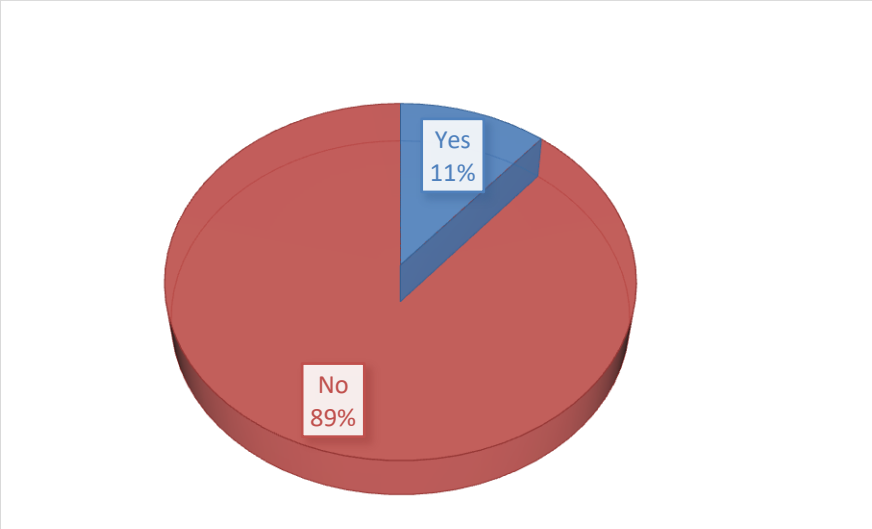

Figure 1:Measures to secure heavy furniture or appliances

From Figure 1, the 89% of respondents no, indicating that a majority of respondents didn't take measures to secure heavy furniture or appliances in their homes to prevent injury during an earthquake.

3.4 Early Warning Systems

All respondents answered negatively when asked about their awareness of any warning systems or alerts for earthquakes in Hawassa City. This indicates a complete lack of awareness among respondents regarding early warning systems or alerts for earthquakes in the area. This underscores a critical need for enhancing earthquake preparedness and public education initiatives in the region.

3.5 Resources Availability During Earthquakes

Table 3: Resources availability During Earthquake statistics results

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		Do you have access to emergency communication devices (e.g., mobile phone) in case of an earthquake?	Are you aware of designated emergency shelters or safe gathering places in your neighborhood	Do you know where to seek medical assistance in the event of injuries during an earthquake	Are you familiar with the local emergency response procedures in Hawassa City
N	Valid	179	179	179	179
	Missing	0	0	0	0
Mean		1.00	1.91	1.00	1.27
Std. Deviation		.000	.286	.000	.444
Variance		.000	.082	.000	.197

From Table 3 we can understand that

- All respondents reported having access to emergency communication devices such as mobile phones in case of an earthquake.
- Indicate that most respondents are lack aware of designated emergency shelters or safe gathering places in their neighborhood
- All respondents reported knowing where to seek medical assistance in the event of injuries during an earthquake
- Indicate that respondents are moderately familiar with the local emergency response procedures in Hawassa City

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4. Conclusion

The study aimed to assess the level of community preparedness towards earthquake disasters in Hawassa City, Ethiopia. The analysis of data collected from a sample of 179 respondents revealed several key findings. Firstly, the majority of respondents were male (72.10%), with an average age of 2.83 years. The respondents had a moderate level of awareness regarding earthquake risks and preparedness measures, with 63.1% knowing the potential risks and hazards associated with earthquakes, and 57.5% being aware of emergency evacuation routes in their neighborhood. However, there are significant gaps in community preparedness, particularly in terms of early warning systems, emergency communication devices, and designated emergency shelters. Only 11% of respondents reported being aware of any warning systems or alerts for earthquakes in Hawassa City, and 89% did not take measures to secure heavy furniture or appliances in their homes to prevent injury during an earthquake. In terms of resources availability during earthquakes, 100% of respondents reported having access to emergency communication devices such as mobile phones, but only 26.8% were aware of designated emergency shelters or safe gathering places in their neighborhood. Furthermore, all respondents reported knowing where to seek medical assistance in the event of injuries during an earthquake. These findings highlight the need for enhanced earthquake preparedness and public education initiatives in Hawassa City. The Ethiopian government and other stakeholders should prioritize the development of early warning systems, emergency communication devices, and designated emergency shelters to mitigate the impact of earthquakes in the region..

Recommendation for Improvement

Enhancing Community Preparedness

To improve community resilience and preparedness towards earthquake disasters in Hawassa city, it is essential to focus on localized strategies that emphasize community involvement and technology adoption. Investments in early warning systems and community-based emergency preparedness plans should be prioritized, enabling communities to respond effectively to seismic threats(Alaneme & Okotete, 2018; Lamessa et al., 2019a). Implementing training programs and

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exercises tailored to local risks will enhance community members' capabilities to deal with potential disasters (Lamessa et al., 2019b).

Infrastructure Development

Developing adaptable and resilient infrastructure is critical for mitigating the impacts of earthquakes. This includes investing in seismically retrofitted buildings, ensuring that emergency services facilities meet strict safety standards, and employing green infrastructure practices(Alaneme & Okotete, 2018; Lamessa et al., 2019b). Regular assessments and updates of building codes must be conducted to reflect current knowledge about earthquake risks and ensure the safety of structures within the community(Alaneme & Okotete, 2018; Apriyatno et al., 2020).

Strengthening Collaborative Networks

Building strong partnerships between local governments, community-based organizations, and academic institutions is vital. Collaborative efforts should focus on sharing resources, knowledge, and best practices to enhance community resilience (Lamessa et al., 2019b). Establishing a multi-sectoral approach will foster effective communication and coordination among stakeholders, leading to more comprehensive disaster preparedness initiatives (Benouar & Boumediene, 2005; Lamessa et al., 2019b).

Promoting Inclusive Governance

Effective governance and transparent decision-making processes will help cultivate trust between community members and leaders. Local governments should encourage inclusive participation in decision-making, ensuring that the diverse needs and perspectives of community members are taken into account. By fostering a culture of openness and accountability, communities can develop a shared sense of ownership and responsibility towards disaster risk reduction efforts.

Continuous Education and Awareness

Public awareness campaigns should be implemented to educate residents about earthquake preparedness, including safe practices during and after an earthquake. Outreach efforts can also involve community drills and educational workshops that promote preparedness at both

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individual and community levels(Alaneme & Okotete, 2018; Lamessa et al., 2019b). This knowledge-sharing will empower residents to respond effectively during emergencies and support recovery efforts post-disaster.

Evidence-Based Policy Making

Utilizing data and research to inform policy decisions is crucial for enhancing community preparedness. Continuous assessment of local hazards, vulnerabilities, and response capabilities should guide the development of targeted actions to improve resilience against earthquakes(Alaneme & Okotete, 2018; *Database Shows Buildings That Could Pose Safety Risk during Earthquakes | by WA Governor's Office | Washington State Governor's Office | Medium*, 2019). Policymakers should adopt a framework that emphasizes localized, evidence-based approaches to disaster risk reduction, ensuring that strategies are both effective and relevant to the unique context of Hawassa city.

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