

The Correlation Between Mitigation and Community Preparedness in Facing Volcanic Eruption

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ABSTRACT

Turgo area is a disaster-prone area of Mount Merapi activity, and it is at high risk of being affected by Mount Merapi activity. Mitigation carried out by the community greatly influences community preparedness in facing disasters. This study aims to determine the correlation between mitigation and the level of community preparedness in facing the volcanic eruption of Mount Merapi in the Turgo area. This study is a descriptive correlative design using a cross-sectional approach. The total sample was 131 respondents, according to the inclusion and exclusion criteria. The sampling technique used is the purposive sampling technique. Data was collected through valid and reliable disaster mitigation and disaster preparedness questionnaires. Data analysis was conducted using the Chi-Square test to determine the relationship between mitigation and preparedness variables. The study results showed that the level of community mitigation was mainly in the high category (96.9%), and the level of preparedness was primarily in the good category (93.9%). The analysis results using the Chi-Square test demonstrate no significant correlation between mitigation and preparedness in facing volcanic eruption ($p > 0.05$; $r = 2,569$). This means that there is no statistically significant relationship between mitigation and preparedness. This study recommends a more comprehensive approach, including education, disaster simulations, and cross-sector collaboration to improve community preparedness.

Keywords: Community, Disaster, Mitigation, Preparedness

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INTRODUCTION

Several factors influence the impact of a disaster. The main factor is the low level of public knowledge about disasters, dangers, attitudes, and behavior in facing disasters. The lack of community preparedness in facing disasters is influenced by the community's lack of self-awareness in reducing risk factors. The government needs to take steps to mitigate disasters by making policies. In addition, community control is also required as one of the efforts in disaster mitigation steps. Disaster mitigation is a series of activities before or pre-disaster to reduce disaster risk, from physical development to increasing capacity to deal with disaster threats (BPBD DIY, 2021).

The impact of the disaster from the volcanic eruption is a threat to the people living in the surrounding areas. The effects caused by the volcanic eruption have an economic, psychological, and social impact on society. The effect of victims of the volcanic eruption

disaster experienced trauma due to the loss of loved ones and property and the destruction of houses and rice fields that had been their livelihoods so far. The conditions in the evacuation that were not suitable added to the increasing mental stress. The longer the time spent in the evacuation, the more refugees experienced psychological disorders (Kertamukti & Thufeil Imtinan, 2024).

Indonesia is located between the meeting of four significant plates: Eurasia, Indo-Australia, the Philippines, and the Pacific Ocean (Wiguna et al., 2020). In addition, a series of active volcanoes and geographical locations also cross the equator. This puts the Indonesian region at risk of earthquakes, volcanic eruptions, tsunamis, and other geological disasters (Yanuarto et al., 2019). Mount Merapi, located in Sleman Regency, is one of the most active volcanoes in the world. Its eruption cycle is relatively short, occurring every 3 to 7 years. Almost every day, Mount Merapi shows its activity in the form of lava dome falls. The eruption period of Mount Merapi makes the surrounding community constantly vigilant and ready to face the threat of the danger of Mount Merapi eruptions (BPBD DIY, 2021).

Preparedness is a series of valuable activities to anticipate disasters or ensure quick and appropriate action can be taken when a disaster occurs. The concept of disaster management has undergone a paradigm shift to focus more on developing structural and non-structural risk management approaches in prevention and mitigation efforts in disaster-prone areas and efforts to build Preparedness Law No. 24 of 2007. Preparedness is essential to anticipate disasters by organizing appropriate and efficient steps (Anies, 2018).

Mount Merapi, one of the most active volcanoes in the world, is located in the Special Region of Yogyakarta and has a history of eruptions that have significantly impacted the lives of the surrounding community. The last major eruption in 2010 caused casualties and mass evacuations, which, until now, still leaves trauma and challenges in community mitigation and preparedness efforts (Hermawan et al., 2024; Krisanti et al., 2024).

Community preparedness must be built to save lives and property during a disaster. Disaster mitigation efforts are significant in reducing the negative impacts of disaster events. Disaster mitigation includes all preventive actions before a disaster occurs, such as education, training, and strengthening early warning systems (Sim et al., 2021). In this case, community involvement in mitigation activities is crucial in building community capacity and resilience. Unfortunately, mitigation activities are still not evenly distributed in various disaster-prone areas (Aisa et al., 2024).

Previous research revealed that although most people in Kepuharjo Village have high preparedness and self-efficacy, there are still gaps in the emergency response aspect, which can be attributed to the lack of disaster training and education (Priambada & Nirmalasari, 2025). On the other hand, previous research has proven that educational interventions using animated video media can significantly increase students' preparedness to face Mount Merapi's eruption. This shows that a systematic and planned mitigation approach can encourage changes in knowledge, attitudes, and preparedness behavior in children and adults (Kurniawan & Nirmalasari, 2023).

Turgo area is located on the slopes of Mount Merapi. The village is located in the Medium Volcanic Disaster Prone Area. This area has the potential to be hit by hot clouds, lava flows, rockfalls, avalanches, and heavy ash rain. Areas included in this area are generally on the slopes and feet of volcanoes and lava flows. Mount Merapi has been at an alert level for several years, but small eruptions still occur frequently. Residents around the Mount Merapi area are accustomed to volcanic activity. Activities on the slopes of Mount Merapi, including the Turgo area, are still running as usual. Good knowledge will support mitigation and preparedness in facing disasters. Good disaster preparedness will improve emergency response behavior during disasters. Community mitigation and preparedness are essential to reduce the impact of disasters.

Currently, limited research specifically explores the relationship between community involvement in disaster mitigation and the level of preparedness, particularly in disaster-prone areas. Gaining a deeper understanding of this relationship is crucial for designing effective and sustainable community-based disaster interventions. This study investigated how involvement in disaster mitigation impacts community preparedness for volcanic eruptions. The aim is for the findings to serve as a basis for developing policies and programs focused on community-based disaster education.

METHODS

This study employs a descriptive correlational design with a cross-sectional approach. Data collection occurred from August 2024 to February 2025. The population was the entire community in Turgo District. Sampling was done using purposive sampling with inclusion and exclusion criteria. The inclusion criteria were people who lived in Turgo, aged 17-65, who could read and write. The exclusion criteria were people with physical limitations or disabilities and mental disorders. The number of samples was 131 respondents. The independent variable was mitigation, while the dependent variable was preparedness.

This study utilized three questionnaires as measurement tools: a demographic questionnaire, a mitigation questionnaire, and a community preparedness questionnaire. The mitigation questionnaire has nine questions about passive mitigation and active mitigation. The disaster preparedness questionnaire has 37 questions covering knowledge, emergency response plans, warning systems, and resource mobilization.

The researchers first worked with a facilitator to find possible respondents who fit the predetermined inclusion and exclusion criteria to gather the data. The researchers visit the residence. One by one, the researchers met with the potential respondents to introduce themselves, go over the goals and purpose of the study, and extend an invitation to participate. Following the prospective participant's agreement, the researchers gave them a questionnaire to complete and an informed consent form to sign as a sign of consent to take part in the study. It took an average of ten to fifteen minutes to complete the questionnaire. The researcher assisted the respondents who were having trouble answering. After collecting the data, the researcher confidently verified and clarified it with the respondents before proceeding with the analysis. A dedicated research assistant contributed to the data collection process.

Statistics application was used in data analysis. Data was analyzed using the Chi-Square Test. The Universitas Jenderal Achmad Yani Yogyakarta Research Ethics Commission has granted ethical approval for the study (Number 005/KEP/I/2025). As a sign of their agreement to participate in the survey, the respondents have signed informed consent and are free to leave at any moment without facing penalties. They received assurances from researchers that information and other things would be kept private.

RESULTS

This study involved 131 community respondents grouped based on gender, age, education, and occupation.

Table 1. Characteristics of respondents based on gender, age, education and occupation in Facing Volcanic Eruption (n=131 respondents)

Data	Frequency (f)	Percentage (%)
Gender		
Male	64	49
Female	67	51
Total	131	100
Age		
>55 years	9	7
46 - 55 years	34	26
< 45 years	88	67
Total	131	100

Education		
No School	3	3
Elementary School	13	10
High School	95	72
College	20	15
Total	131	100
Occupation		
Doesn't work	56	43
Work	75	57
Total	131	100

Source: Primary Data (2025)

Table 1 shows that the majority of respondents were female 67 people (51%), aged <45 years 88 people (67%), had a high school education 95 people (72%), and were employed 75 people (57%).

The results of the research analysis on the level of mitigation in the community are described with the following results:

Table 2. Community Mitigation in Facing Volcanic Eruption (n=131 respondents)

Community Mitigation	Frequency (f)	Percentage (%)
Moderate	4	3
High	127	97

Source: Primary Data (2024)

Table 2 shows that most respondents have a high level of mitigation, namely 127 respondents (97%). At the same time, only a tiny portion of 4 respondents (3%) are at a moderate level. This shows that most of the population in this study have strong or practical mitigation steps and are in the high category.

The research analysis results on the level of preparedness in the community are described with the following results:

Table 3. Community Preparedness in Facing Volcanic Eruption (n=131 respondents)

Community Preparedness	Frequency (f)	Percentage (%)
Fair	8	6
Good	123	94

Source: Primary Data (2024)

Table 3 shows that most respondents have a good level of preparedness, namely 123 respondents (93.9%), while only 8 respondents (6.1%) are in the sufficient category. This shows that the majority of respondents have a fairly high level of preparedness in facing disaster situations.

The results of the analysis of the correlation between mitigation and preparedness in facing volcanic eruptions in the community are presented in the following table:

Table 4. Analysis Correlation between Mitigation and Preparedness in Facing Volcanic Eruptions (n=131 respondents)

Community Mitigation	Community preparedness				Total		Correlation coefficient (r)	p-value
	Fair		Good					
	f	%	f	%	f	%		
Moderate	1	12.5	3	75.0	4	100	2.569	0.109
High	7	5.5	120	94.5	127	100		
Total	8	6.1	123	93.9	131	100		

**Chi-Square*

The analysis of the relationship between mitigation and preparedness in facing volcanic eruptions in the Turgo area community shows that the correlation coefficient (r) value is 2.569 with a significance value (p-value) of 0.109. This significance value is more significant than 0.05, indicating no statistically significant relationship between mitigation and preparedness.

However, the frequency distribution table shows that most respondents with a "High" mitigation level have a "Good" level of readiness, which is 94.5% of the total population. In contrast, respondents with a "Moderate" mitigation level only reached 5.5% at the "Fair" level of preparedness. These results indicate that although there is an optimistic tendency between better mitigation and higher preparedness, the relationship is not strong enough to be proven statistically. This study suggests the need for a more comprehensive approach to improving community preparedness, including education, disaster simulations, and collaboration between the community and related parties to ensure the effectiveness of mitigation programs.

DISCUSSION

The percentage of gender of respondents in the community is primarily female. This is in line with the previous study, which showed that 59% of respondents were female (Kurniawan & Nirmalasari, 2023). In line with research on disaster preparedness, it was found that 54.2% of respondents were female, and 71.5% were less than 45 years old (Priambada & Nirmalasari, 2025). This demographic composition is relevant because women are often vulnerable and essential to family preparedness. Age is one factor influencing preparedness and anxiety levels in the event of a natural disaster. More productive people will be more active in increasing their knowledge about disasters and strive to be more prepared to deal with mountain eruption disasters (Jannah & Sari, 2023). Previous research found that productive age groups are more likely to participate in mitigation training because they see the importance of disaster preparedness for family and economic survival (Adha & Lestari, 2024).

Previous experience in dealing with disasters has also been shown to be a reinforcement of preparedness. Prior research shows that direct experience with disasters can increase risk awareness and encourage mitigation actions (Rahmawati, Wahyuni, Haksama, et al., 2023). This can be seen from the Turgo community, which collectively remembers the Merapi eruption and has built community-based preparedness mechanisms such as evacuation plans, emergency storage, and cross-community coordination (Sugiyana et al., 2024).

According to the study, most respondents had their last education in secondary school. This high level of education allows people to understand information related to disaster mitigation more easily. This result supports research that found that people with medium to high levels of education have a better understanding of mitigation measures (Istiqomah & Prajayanti, 2023). Meanwhile, people with primary education or no education require special attention. This group often has limited access to mitigation information and needs to be reached through community-based approaches such as hands-on training or simulation programs (Cahyo et al., 2023).

In general, the results of this study indicate that most communities have a good level of mitigation and preparedness, although some groups are still in the moderate category. The high level of readiness cannot be separated from the active involvement of the community in community-based activities such as disaster simulations, counseling, and the formation of mitigation working groups. This model has proven effective in strengthening the capacity of community preparedness (Rahmawati, Wahyuni, & Haksama, 2023; Rahmawati, Wahyuni, Haksama, et al., 2023; Sugiyana et al., 2024).

The results showed that most of the community is economically active, as evidenced by the fact that it works in the formal sector. Previous research shows that people working in the formal sector are more likely to access mitigation information through training organized by their workplace or related institutions. On the other hand, non-working groups require different approaches, such as community-based empowerment, to increase their involvement in mitigation efforts. (Dewabrata et al., 2023; Rahil & Amestiasih, 2021).

The study's findings indicate that most of the Turgo community is highly aware of disaster risks, with many adopting mitigation measures. However, it is noteworthy that a

significant proportion of the community still falls within the medium mitigation category. This indicates that the people of the Turgo area have a high awareness of disaster risk and have taken effective mitigation measures. However, there are still people who have not fully adopted these steps. The high level of mitigation in this study is in line with research that reveals that direct experience of disasters significantly impacts the level of community preparedness. The Turgo community, which has historical experience with the eruption of Mount Merapi, has built preparedness mechanisms such as evacuation plans, emergency goods storage, and coordination between residents. This contributes to the high mitigation level of the majority of respondents (Sugiyana et al., 2024).

This is also in line with other research on mitigation, with 40 respondents confirming that community-based programs are very effective in improving disaster mitigation. In this approach, communities are actively involved in disaster simulations, counseling, and the formation of mitigation working groups. This active participation contributes to establishing strong preparedness and sustainability of mitigation programs at the community level (Rahmawati, Wahyuni, Haksama, et al., 2023)

The research analysis results show that most of the people of Turgo Hamlet have a good level of preparedness in dealing with disasters. However, there are still people who have a sufficient level of preparedness. This illustrates that the people of the Turgo area have had a high level of preparedness in dealing with emergencies, such as the potential eruption of Mount Merapi. This high level of preparedness is influenced by the experience of people living in disaster-prone areas and the existence of adequate socialization and mitigation training. Previous research revealed that direct experience in facing disasters can improve the ability of communities to respond better to risks (Rahmawati, Wahyuni, Haksama, et al., 2023). In addition, the high level of education of most respondents also contributed positively to the understanding of preparedness measures, as explained in a study that emphasized the importance of education in improving mitigation capacity (Maharani et al., 2024).

However, statistical analysis shows no significant relationship between mitigation and preparedness. This can be interpreted as the fact that although some people have taken mitigation measures, not all individuals automatically have optimal preparedness. Other factors, such as education, disaster experience, and access to information, are additional determinants in shaping community preparedness. Previous studies have confirmed that disaster education and disaster simulations have a significant effect on increasing knowledge and preparedness (Husna et al., 2022; Jannah & Sari, 2023).

Good mitigation measures tend to align with a good level of preparedness, although some individuals with high mitigation do not have optimal preparedness. This condition indicates the need for efforts to increase community understanding of the importance of disaster preparedness that is integrated with mitigation measures. Another study stated that mitigation efforts involving community training and regular disaster simulations can strengthen community preparedness (Sugiyana et al., 2024).

Disaster preparedness is one of the crucial elements in disaster risk reduction and includes community awareness, readiness to provide appropriate responses, and rapid recovery. Communities have a role in reducing disaster risk. A literature study explained that community resilience to Community-Based Disaster Risk Reduction activities can be carried out effectively. Indicators that can be used include disaster knowledge, disaster prevention, disaster risk reduction, village/region disaster prevention documents, and implementation of disaster risk reduction. The results of the analysis of the selected articles show that community-based disaster risk reduction is quite effective in increasing regional resilience. Community-based disaster risk reduction can be effective but must be done in synergy to increase community participation, awareness of each component in supporting the program, and the role of stakeholders so that disaster knowledge, disaster prevention, disaster risk reduction,

village/region disaster prevention documents, and disaster risk reduction implementation can be achieved to create strong regional resilience (Sugiyana et al., 2024).

According to the earlier study, community disaster management initiatives are based on experiences. Community knowledge of disaster threats and disaster response behaviors are intimately linked to disaster management in the community. The secret to a successful evacuation is individual community preparedness in emergency management activities. Accountability and local participation are crucial for post-disaster interventions to be successful. (Astuti & Rimawati, 2021).

In line with a different study conducted on the slopes of Merapi, disaster preparedness capacity is mutually reinforced by structural and cognitive social capital. Involving the community in local mitigation efforts, such as creating volunteer organizations, village contingency plans, and other collective efforts for risk reduction, increased the structural dimension that had grown with the resilient village program idea. The cognitive dimension, which refers to the historical values and beliefs retained and upholding group standards and collaborative culture, is intimately associated with this structural presence. According to the findings, it is critical to support structural and cognitive methods when creating policies to increase community-based disaster resilience and, in terms of theoretical understanding, broaden the scope of disaster research. (Hermawan et al., 2024).

These findings emphasize the importance of integration between structural mitigation programs and strengthening individual preparedness. Active community involvement in training, village contingency planning, and strengthening collective norms through structural and cognitive social capital must be continuously encouraged (Hermawan et al., 2024). In community-based disaster risk reduction, maintaining these two dimensions is central to building sustainable regional resilience. Researchers argue that one of the weaknesses of the current mitigation approach is the lack of emphasis on the cognitive and emotional aspects of the community. Many programs emphasize technical procedures more, without touching on the psychosocial dimensions that affect individual preparedness. Aspects such as a sense of community responsibility, cooperation values, and trust in information sources are key to internalizing the meaning of preparedness.

Furthermore, communities with high disaster literacy and that have experienced disasters tend to demonstrate more mature risk management patterns. Individual preparedness is key to successful evacuation, and local community participation is the foundation of accountable and successful post-disaster interventions (Astuti & Rimawati, 2021; Hargono et al., 2023). On the other hand, the mismatch between mitigation and preparedness levels found in this study also indicates a gap between action and understanding. Communities may have attended training or have access to mitigation facilities, but do not fully understand the urgency to act quickly and appropriately when a disaster occurs. This needs to be a serious concern, especially in designing community-based mitigation programs that focus on information transfer and build self-efficacy and critical reflection on risk. Researchers believe the most effective disaster risk reduction strategy is participatory, utilizes local social capital, and encourages program sustainability through multi-stakeholder collaboration, including village governments, community leaders, and educational institutions. This approach strengthens community preparedness and builds long-term social resilience to the threat of recurring disasters.

CONCLUSION

This study's results indicate no significant correlation between mitigation and preparedness when facing volcanic eruptions. However, there is an optimistic tendency that better mitigation is followed by higher preparedness. Communities with high mitigation tend to be well prepared. This study recommends a more comprehensive approach, including

education, disaster simulations, and cross-sector collaboration to improve community preparedness. Further, researchers can develop and enhance research related to the community's readiness.

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