Available on: https://nursingjurnal.respati.ac.id/index.php/JKRY/index
Jurnal Keperawatan Respati Yogyakarta, 12(1), January 2025, 61 – 67

The Mount Merapi Eruption Disaster Education Program Increases Community Knowledge in the Working Area of the Ngemplak II Sleman Community Health Center

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Abstract

Indonesia is prone to volcanic eruptions, with Mount Merapi in Yogyakarta being one of the most active volcanoes in the country. Despite the risks, the community's preparedness for volcanic eruptions is still lacking. This research contributed to evaluate the effectiveness of an educational program in improving community preparedness for Mount Merapi eruption disasters in the Ngemplak II Puskesmas working area. A quasi-experimental design with a pretest-posttest one-group design was used, involving 66 respondents from Widodomartani Village Indonesia. The educational program consisted of a lecture, discussion, poster installation, and booklet distribution. The results showed a significant increase in community knowledge after the educational program, with a Wilcoxon test value of 0.000. The study concludes that the educational program is effective in improving community preparedness for Mount Merapi eruption disasters. The findings suggest that a comprehensive educational program that combines different media can increase community knowledge and preparedness for volcanic eruptions. The study recommends the implementation of similar educational programs in disaster-prone areas to enhance community resilience.

Keywords: *Eruption; Education Programs; Knowledge*

Article info*: Article info: Sending on November 11, 2024; Revision on January 13, 2025; Accepted on January 30, 2025*

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1. Introduction

Indonesia is an archipelago with the longest volcanic arc in the world. Indonesia has 130 active volcanoes. This means that about 13% of all active volcanoes worldwide are located in Indonesia (Malawani et al, 2021). Based on disaster risk index data per province in Indonesia, the Special Region of Yogyakarta (DIY) is included in the high-risk class and is threatened by one of the risks posed by the eruption of Mount Merapi (Charbonnier et al, 2023). Due to its geographical location, geological disasters still occur frequently in Indonesia. Indonesia is located at the confluence of four plates, namely the continental plate, the Australian continent, the Indian Ocean plate, and the Pacific plate (Malawani et al, 2021). Indonesian Disaster Information Data (DIBI)-BNPB) Shows that of the more than 1,800 disasters that occurred between 2005 and 2015, more than 78% (11,648) were hydrometeorological disasters, and about 22% (3,810) were hydrometeorological disasters. Hydrometeorological disasters are geological disasters (earthquakes), tsunamis, volcanic eruptions, and landslides. The relative number of disaster events of both types of disaster groups continues to increase. (Malawani et al, 2021)

The largest volcanic eruption disaster in Yogyakarta occurred from October to November 2010, the eruption of Mount Merapi. The disaster claimed 223 lives. 182 people died from burns, and 41 people died from non-burn injuries. In addition, 236 survivors received treatment at the hospital. The number of refugees reached 374,202 people and a total of 4,444,314 evacuation centers. Volcano eruption caused the loss of buildings, crops, land, and livestock belonging to the community (Soekardi, Sukismanto, & Dewi, 2020)

In January 2024, it was seen several times that Mount Merapi emitted hot clouds. The glide distance of the hot cloud was as far as 2,400 to the southwest. The Center for the Investigation and

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Development of Geological Disaster Technology (BPPTKG) set an alert status on Mount Merapi. The public is also advised to avoid a radius of 5-7 km because volcanic ejections in the event of an explosive eruption can reach 3 km (Kusuma, 2024)

The concept of disaster management is currently undergoing a paradigm shift towards a risk management approach that focuses on prevention and mitigation efforts (Anies, 2018). Law No. 24 of 2007 states that preparedness is very important to anticipate disasters through organization and appropriate and effective steps (Soekardi, Sukismanto, & Dewi, 2020). Disaster preparedness, especially mountain eruptions that are lacking, is caused by a lack of public understanding of mountain eruptions, attitudes or behaviors become the cause of how people behave when an eruption occurs. Lack of information about mountain eruptions and what to do during a mountain eruption is also the cause of many victims during an eruption (Prasetyo & Tjahjono, 2021)

To improve preparedness, it is necessary to carry out an educational program to increase knowledge, understanding, preparedness, and skills to detect and be prepared early for every kind of disaster, especially in disaster-prone areas (Rosdiyani, 2020). The implementation of disaster management requires integrated efforts from community and government participation by maximizing the potential and local resources. Disaster management is a shared responsibility between the government and the community that relies on community independence and self-reliance. Disaster management is focused on the stage before the disaster, which includes prevention, taming, preparedness, and rescue activities to minimize and reduce the impact caused by the disaster. (Chotib, 2024)

It is hoped that by making appropriate and rapid preparedness preparations, the number of victims and damage can be minimized. Preparedness is a mandatory requirement for disaster risk reduction. Preparedness for various disaster phenomena can be obtained from informal education. Informal education is carried out by families and the environment in the form of independent learning activities. Learning about disaster phenomena can be obtained through experience, print media, and counseling. This learning can shape individual perceptions of various objects or phenomena around them (Prasetyo & Tjahjono, 2021)

Ngemplak II Health Center oversees 2 villages. There are Wedomartani and Widodomartani. Widodomartani Village is located north of Wedomartani Village. Wedomartani is >10 km far away from Merapi. Widodomartani village is passed by Kali Kuning, which is the flow of Merapi lava during an eruption. Widodo Martini village is located on the middle slope of Merapi volcano with an undulating slope. The results of the initial assessment showed that the community lacked knowledge about the impact of the eruption and what to do during an eruption.

This research contributed to nursing as to see how the education program can affect community preparedness for Mount Eruption Disaster: A Case Study of Disaster Education Program Implementation in the Ngemplak II Puskesmas Working Area. It is hoped that this research can improve community preparedness for Mountain Eruption Disaster: Case Study of Disaster Education Program Implementation in the Ngemplak II Puskesmas Working Area. In addition, it can be used as a reference in the preparation programs by the Padukuhan, Village, and BPBD governments. For future researchers, this research can be used as a reference for the preparation of further research.

2. Method

This type of research is Quasi-Experimental with Pretest-posttest one-group design. The population in this study was the community in the selected Padukuhan. The sampling technique used was stratified random sampling. Ngemplak II Health Center Working Area consists of two villages, namely Widodomartani and Wedomartani. Widodomartani consists of 19 hamlets and Wedomartani 26 hamlets. The researcher drew starting from the village and then continued to draw Padukuhan. All people in the selected Padukuhan who are willing to be respondents, follow all the research, and are 18-59 years old (adult age) will be used as respondents. The data used primary data and secondary data. Primary data was collected using a questionnaire while secondary data regarding the number of people according to the criteria from the Padukuhan data.

The results were selected for Widodomartani Village with Padukuhan Pondok I Wonolelo. The number of respondents obtained was 66 respondents. Data collection will be carried out in June 2024 through a mechanism after prospective respondents were given an explanation of the purpose and objectives of the study, the researcher delivered a questionnaire regarding preparedness for volcanic eruptions. After being filled in and returned to the researcher, the intervention of providing educational programs was then carried out. After completion of the educational program once again the respondents were given a questionnaire with the same questions to be filled in. The educational program in this study was the provision of health education to respondents as much as 1x, then continued to install posters about

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eruptions in the village and distribute booklets containing guidelines on eruption preparedness.

The measuring instrument used in this research is a questionnaire, which will be tested by expert judgment validity. Data analysis in this study used univariate analysis to determine the frequency distribution of knowledge about community preparedness to face volcanic eruptions before and after the intervention. Bivariate analysis was conducted to determine the success of the intervention using the Wilcoxon test because the data distribution was not normal.

3. Results and Discussion

Table 1 shows that most of the respondents were adults (80.3%), followed by adolescents (18.18%), and the elderly (1.52%). The majority of respondents were female (62.12%), while males amounted to 37.88%. Respondents with junior high school education dominated (62.12%), followed by senior high school (19.7%), elementary school (13.64%), and university degree (4.55%). As many as 63.64% of respondents had never received information related to disasters, while 36.36% had received information. Information about disasters was mostly obtained from the Internet and schools (29.17% each), followed by social media (24.99%), government (12.5%), and TV (4.17%).

Age can affect people's level of knowledge due to various factors related to cognitive development, life experiences, and access to information. During childhood through adolescence, learning abilities and cognitive understanding continue to develop. Children tend to receive knowledge from their surroundings, but their understanding is often limited to basic concepts. In adults, cognitive functions are usually mature, allowing them to understand more complex concepts (Lövdén, et all, 2020)

Older people tend to have more varied experiences than younger ones. These experiences can provide additional insights that enhance knowledge, especially in the context of understanding society and health. For example, someone who has seen or experienced a health crisis may have a deeper understanding of the importance of disease prevention (Sadana et al, 2016)

With age, interest in certain information may change. For example, older people may be more interested in information about health or economics than children or teenagers. In addition, adults often have greater access to information sources, such as seminars, news media, and professional training. (Czaja et al, 2018). Age is often closely related to the level of education completed. Adults usually have completed formal education and have the opportunity to increase their knowledge through work experience or additional education. (Lövdén, et all, 2020)

Gender can influence people's level of knowledge due to differences in social roles, access to education, and cultural influences that can impact the experiences and information gained by individuals based on their gender. In many societies, the roles and responsibilities assigned to men and women can differ. For example, in some cultures, men are more often involved in work outside the home which provides opportunities to obtain information from various sources, whereas women may spend more time at home, limiting their sources of information. These different social roles can affect the type of information each gender acquires and masters (Lee et al, 2021).

Table 1. Characteristics of Respondents from Padukuhan Pondok I Wonolelo, Ngemplak, Sleman

Characteristic	n	%
Age		
Early Adulthood	43	65.15
Middle Adult	9	13.64
Late Elderly / Pre-elderly	14	22.21
Total	66	100
Gender		
Female	41	62.12
Male	25	37.88
Total	66	100
Last Education		
Elementary School Equivalent	9	13.64
Junior high school equivalent	41	62.12
High school equivalent	13	19.7
Bachelor's degree	3	4.55
Total	66	100
Have you ever received information		
Yes	24	36.36
No	42	63.64
Total	66	100
Source of Information		
TV	1	4.17
Government	3	12.5
Internet	7	29.17
Social Media	6	24.99
School	7	29.17
Total	24	100

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In some places, gender differences still affect educational opportunities, especially for women. If women have less access to education than men, then their knowledge levels may also be lower. In places with greater educational equality, the influence of gender on knowledge may be smaller (Bambr et al, 2021)

Gender-related cultural norms and stigmas often influence the type of information that men or women consider important or worth learning. For example, women may be encouraged to pay more attention to family health and children's education, while men may be directed more toward work-related or political knowledge. This leads to variations in the type and depth of knowledge acquired (Hong, 2018)

Preferences for certain topics are often influenced by gender stereotypes. For example, men may be more encouraged to be interested in technology or science, while women are more geared towards social or nursing fields. These preferences play a role in their level of knowledge in certain areas, although their influence tends to diminish in more egalitarian societies (Ellemers, 2018)

Media often portrays gender roles in specific ways, which can influence people's interests and knowledge. Media that tend to associate women with traditional roles can influence the information accessed by women and lead them to have different interests than men (Hong, 2018)

The level of education affects a person's level of knowledge because education is one of the main ways to acquire, understand, and develop new information. Formal education opens up opportunities to access information and knowledge in various fields. A person who attains a higher level of education tends to have access to more complex and diverse subject matter, including literature, research, and analysis methods. This broadens their horizons and improves their understanding of various topics. (Batterham et al, 2016).

Education helps hone critical thinking, analytical, and problem-solving skills. With these skills, individuals are better able to understand information, evaluate the reliability of knowledge sources, and make decisions based on their knowledge. These critical thinking skills are usually developed in greater depth in higher education (Kanbay, & Okanlı, 2017).

Higher levels of education are often associated with improved literacy and communication skills. Individuals with good literacy can understand complex texts or information, extract the gist from various sources, and communicate their knowledge. Literacy also makes it easier for people to learn new things, including topics outside their formal education field (Levin et al, 2017).

At higher levels of education, such as at college or university, people are often taught research skills, including how to find, evaluate, and use relevant information. This enhances their ability to access and develop new knowledge independently, whether from academic journals, the internet, or other sources.

Higher education tends to introduce individuals to different perspectives, theories, and ideas from different disciplines. This exposure broadens the way of thinking and helps one better understand different views and diversity of information. This makes individuals more open and sensitive to new or alternative knowledge.(Levin et al, 2017)

Formal education teaches learning habits, such as reading, repeating information, and seeking references that can be applied throughout life. Individuals with good study habits tend to continue their learning process outside the formal education environment, thus continuously updating and expanding their knowledge (Benavot et al, 2022). Access to information can increase one's knowledge because information is the primary basis for learning and understanding. When a person has broad access to information, they have a greater chance of knowing, understanding, and processing a wide range of topics. Access to information allows one to be exposed to different types of knowledge sources, such as books, journals, online articles, social media, and other digital sources. With more options, individuals can get a wider and more diverse range of information, which enriches their understanding of various fields (Hahn & Truman, 2015)

Information is constantly evolving and changing over time, especially in areas such as science, technology, and health. Access to information allows one to keep up with the latest developments, update old knowledge, and gain relevant insights according to recent changes. This makes their knowledge more accurate and up-to-date (Moro et al, 2017).

With access to extensive information, one can deepen their understanding of specific areas of interest or need. For example, a health professional who has access to medical journals can deepen their understanding of specific diseases, the latest technology, or effective treatment methods. Access to a wide range of information helps individuals develop analytical and critical thinking skills. When one can see multiple perspectives of different information, one learns to assess credibility, compare views, and draw well-founded conclusions. This is crucial for deeper knowledge

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and a better understanding of the complexity of an issue (Lim et al, 2022)

Access to information provides opportunities for self-learning. One can easily learn new topics without having to attend formal education. Online resources such as online courses, educational videos, and articles allow one to acquire new knowledge anytime and anywhere, supporting lifelong learning. Technological advancements have accelerated the dissemination of information, allowing people from different parts of the world to obtain the same information in a short period. This makes learning and knowledge enhancement more efficient, as one is no longer limited by location or time to acquire new information. Access to information also often allows interaction with others through forums, social media, or other online platforms. Discussions with others can enrich one's understanding, offer new perspectives, and help develop better ideas. (Lim et al, 2021).

Table 2. Differences in Knowledge Before and After Intervention among Respondents

Variable	Mean	Wilcoxon Test
Pra Knowledge	8.86	0.000
Post Knowledge	10.93	

Table 2 shows that the average knowledge of the community increased after the education program. The initial knowledge score (pre-test) had an average of 8.86, while after education (post-test) it increased to 10.93. Based on the Wilcoxon test, there was a significant difference (Wilcoxon value = 0.000) between knowledge before and after the education program, indicating the effectiveness of the program in improving community preparedness. These results indicate that the educational program implemented in the working area of Puskesmas Ngemplak II is effective in improving community understanding of preparedness for mountain eruption disasters.

Health education delivered through lecture and discussion methods, and supported by media such as posters and booklets, can improve community knowledge because this approach combines several effective ways of learning. Through lectures, material can be delivered in a structured way, so that people get important information thoroughly and clearly. The speaker can customize the delivery according to the needs of the audience, explaining basic concepts and highlighting key points that the community needs to understand. As such, participants gain a solid foundation of knowledge on the health topics discussed (Eljiz et al, 2020)

Discussions allow the community to actively engage by asking questions, sharing experiences, and clarifying understanding. These discussions encourage participation, which makes participants feel more engaged and motivated to understand the material. Through interaction, participants can strengthen their understanding by listening to others' views or getting answers to their questions, which makes the information easier to understand and remember (Mirzaei & Esmaeilzadeh, 2021)

Posters are simple, informative, and to-the-point visual media that grab people's attention. Images, graphics, and short text on posters help convey information quickly and attractively, making it more memorable to the audience. Posters can be put up in public places and viewed repeatedly, reinforcing the message and raising awareness (Lu et al, 2015)

Booklets serve as a more in-depth guide than posters. With booklets, people have materials that they can re-read at any time, allowing them to review the information and deepen their understanding. Booklets usually include more detailed explanations and practical steps that can be practiced, so that the material is not only remembered at the time but also applied in daily life. (Coolbrandt et al, 2018)

The combination of lectures, discussions, posters, and booklets accommodates various learning styles - visual, auditory, and kinesthetic. Lectures are suitable for those who learn through listening, discussions are suitable for social learners, posters for visual learners, and booklets for those who prefer to read and understand on their own. Thus, this approach makes information more accessible to different groups in a way that best suits their needs. (Oomen & Early, 2015)

Suplee et al (2016) said that posters on constant display and take-home booklets reinforce the messages that have been conveyed through lectures and discussions. With repetition, the information received by the community will be more embedded in the memory, making it easier to remember in the long term.

The combination of different media provides a consistent and strong message, so people are more likely to understand the importance of health and be motivated to take action. For example, posters and booklets can provide practical instructions or steps that can be followed, which makes the information more relevant and applicable to everyday life. (Chen & Yang, 2019).

Overall, the combination of lecture and discussion methods complemented by poster and booklet media increases the effectiveness of health education as it creates a comprehensive, engaging,

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and accessible learning experience for the community.

4. Conclusions and Suggestions

The Mount Merapi Eruption Disaster Education Program statistically increases community knowledge in the working area of the Ngemplak II Sleman community health center

5. Acknowledgments

Special thanks to Respati Yogyakarta of University and LPPM UNRIYO for the support

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