



DISASTER CONDITIONS OF THE ERUPTION OF MOUNT SEMERU: THE ROLE OF HEALTH WORKERS AND COMMUNITY PARTICIPATION IN HEALTH PROBLEMS

Erna Desi Faradinah*, Ali Badrudin and Isa Ma'rufi

Magister of Public Health, University of Jember.

Article Received date: 02 January 2024

Article Revised date: 22 January 2024

Article Accepted date: 12 February 2024



*Corresponding Author: Erna Desi Faradinah

Magister of Public Health, University of Jember.

ABSTRACT

Background: Mount Semeru poses a significant disaster potential, particularly due to the risk of cold lava and other disaster possibilities. These events can have adverse impacts on the declining quality of life for residents, particularly in terms of health. Post-disaster, healthcare services for disaster victims become crucial issue. **Material & Methods:** The data analysis employed in this study is analytical descriptive data analysis using a desk review method. **Result:** The role of healthcare professionals in disaster management is crucial, encompassing pre-disaster, during the event, and post-disaster phases. **Conclusion:** Hierarchical organization and the role of community health centers (Puskesmas) are of paramount importance. In this context, the involvement of Puskesmas in disaster-stricken areas, spanning pre-disaster, during the event, and post-disaster phases, is essential. Minimum standards have been established, encompassing healthcare services, infectious disease prevention, nutrition, environment, and basic health needs. In the 2021 eruption of Mount Semeru, the number of casualties could be minimized through the presence of efficient healthcare personnel and effective coordination among agencies. Active community participation also plays a vital role in disaster mitigation.

KEYWORDS: Disaster Management, Semeru Eruption, Healthcare Professionals' Role.

A. INTRODUCTION

Disaster can occur anywhere, including in Indonesia. With its diverse geographical conditions, ranging from mountainous regions to lowlands and highlands, coupled with climatic factors, many areas are prone to floods. Indonesia is also known as an archipelagic nation with the highest number of active volcanoes globally. One such disaster that occurs is the eruption of volcanoes. The interpretation of volcanic eruption disasters is dynamic, shaped by various layers of societal perceptions. This dynamic has implications for disaster hazard management during and after the event, necessitating policy measures to mitigate both direct and indirect impacts.

Mount Semeru is the highest volcano on Java Island, primarily located in the Lumajang Regency, with a small portion in the Malang Regency, standing at an elevation of 3,676 meters above sea level (masl). Positioned at 08°06.5' S latitude and 112°55' E longitude, Mount Semeru features the Mahameru summit with the Jonggring Saloko crater. Semeru is a stratovolcano with a lava dome, and its crater mouth points southeast, directing lava flow towards the Lumajang Regency. The surrounding area of Mount Semeru carries a considerable

disaster potential, particularly due to the risk of cold lava and other potential disasters. These disasters can adversely impact the quality of life for residents, including their health. Post-disaster, healthcare services for disaster victims become a significant challenge. Various legal instruments (regulations, standards) have been issued for the health management of disaster victims, highlighting the crucial role of Community Health Centers (Puskesmas) In disaster mitigation (Ministry of Health of the Republic of Indonesia, 2007; Directorate General of Community Health Development, Ministry of Health, 2006; Center for Health Problem Management, Secretariat General of the Ministry of Health, 2001). This article aims to address the challenges arising from the eruption of Mount Semeru and discuss the roles of healthcare professionals and community participation in disaster mitigation.

B. METHODOLOGY

The data analysis employed in this study is analytical descriptive analysis, aiming to describe the gathered data from various sources such as manuscripts, interviews, field notes, documents, etc. (Hardani et al., 2015). Subsequently, the data is explicated to provide clarity regarding the observed reality. Additionally, the data and

information utilized in this article are obtained through a desk review method, focusing on information related to the eruption of Mount Semeru in 2021. While numerous studies address disaster management in Indonesia, none have specifically delved into the roles of healthcare professionals and the community, especially in the context of the Mount Semeru eruption.

C. RESULTS

Impact of Semeru Eruption on the Population

According to the report from the Center of Volcanology and Geological Disaster Mitigation (PVMBG) until November 2023, Indonesia is home to 127 volcanoes (approximately 13% of the world's total) spread from Sabang to Merauke, forming an archipelagic arc across Sumatra, Java, Bali, Nusa Tenggara, Maluku, North Maluku, northern Sulawesi, and the Sangir Talaud Islands. Of these, 76 are classified as highly active, labeled as Type-A volcanoes, having erupted since 1600, and three are submarine volcanoes (Buana Wuhu/Sangir, Hobal, and Emperor of China/Flores). Currently, 68 volcanoes are continuously monitored through 75 observation posts as part of volcano eruption mitigation efforts. Eruptions can lead to disasters for the population living around them, with approximately 4.5 million people residing and conducting activities near active volcanoes, posing a significant risk.

Volcanoes are mountains actively releasing materials from the Earth's interior, including solids, liquids, gases, and mixtures. According to global tectonic theory (mountain formation), volcanoes form due to the collision of tectonic plates. This collision generates molten magma in the lower crust, which then moves through layers towards the surface. When magma reaches the Earth's surface, a volcanic eruption occurs. The intensity of eruptions varies among volcanoes due to factors such as magma viscosity, magma chamber depth, eruption point depth, gas content in magma, and external influences. Therefore, each volcano exhibits unique eruption characteristics, and even the same volcano may alter its behavior during an eruption. The common types of volcanic eruptions in Indonesia are Strombolian and Vulcanian (McDonald, 1972:45).

Mount Semeru stands as the highest volcano on Java Island, predominantly situated in the Lumajang Regency with a small portion extending into the Malang Regency, boasting an elevation of 3,676 meters above sea level (masl). Positioned at 08°06.5' S latitude and 112°55' E longitude, Mount Semeru's summit is known as Mahameru, crowned with the Jonggring Saloko crater. This stratovolcano features a lava dome, and its crater mouth points southeast, directing lava flow towards the Lumajang Regency. The surrounding area of Mount Semeru holds a significant disaster potential, primarily stemming from the risk of cold lava and other potential disasters, necessitating integrated disaster control.

Volcanic eruptions can profoundly affect community life, especially due to materials emitted during eruptions. Direct volcanic hazards include lava flows, pyroclastic flows, ashfall, eruption-induced lahars, and toxic volcanic gases. Secondary hazards occurring during or after eruptions include lahars triggered by rain, flash floods, and volcanic landslides. The eruption of Mount Semeru on December 4, 2021, at 15:20 WIB resulted in lahars, material explosions, and ashfall hitting the Lumajang Regency, concentrated in the Pronojiwo and Sumberwuluh sub-districts. Even four days after the eruption, Semeru's activity remained fluctuating. On December 8, 2021, five rockfall earthquakes, five blast earthquakes, one deep volcanic earthquake, and one distant tectonic earthquake occurred. Semeru, located in Malang and Lumajang, East Java, is the highest mountain on Java Island, with Mahameru, its summit, reported to be at an elevation of +3676 m above sea level. As an active Type-A volcano, Semeru has erupted around 90 times since its recorded history began in 1818 (Abidin *et al.*, 2004). A significant disaster occurred in 1976 due to a cold lava flood, claiming 118 lives. Besides eruptions, the Semeru region is also susceptible to floods, landslides, and forest fires.

The Impact of Mount Semeru Eruption on Public Health

As outlined by the Ministry of Health (2021:12), health issues among disaster victims can be categorized into two main types: direct and indirect consequences. Direct consequences are the primary impacts experienced by victims in disaster-stricken areas during the event. Common cases include.

a. Trauma

Trauma results from direct exposure to sharp or blunt objects, causing injuries such as tears, stabs, cuts, and fractures. Trauma cases necessitate varying degrees of medical attention and are prevalent in various disasters, including earthquakes, tsunamis, landslides, floods, storms, transportation accidents, industrial accidents, riots, terrorist bombings, and more.

b. Respiratory Disturbances Respiratory issues arise from trauma to the airways, such as the inhalation of dust, toxic liquids, and gases. Respiratory problems are frequently observed in disasters like tsunamis, volcanic eruptions, fires, accidents, and industrial incidents.

c. Burn Injuries

Burn injuries result from direct exposure to heat, fire, or chemicals. Burn cases are common in disasters such as fires, volcanic eruptions, industrial accidents, riots, terrorist bombings, and more.

d. Psychological Complaints and Psychiatric Disorder (Post-Traumatic Stress)

Post-traumatic stress is a complaint associated with experiences during a disaster, commonly encountered in nearly every disaster event.

e. Fatalities

Disaster Victim Identification (DVI) becomes essential for identifying deceased victim post-disaster, serving both health and investigative purposes.

Victims are categorized for prompt and accurate assistance

- 1) Emergency Cases
- 2) Non-emergency cases
- 3) Non-emergency non-urgent cases
- 4) Death cases

Indirect consequences are secondary impacts experienced by disaster victims during evacuation, including inadequate waste disposal, poor environmental hygiene (garbage and liquid waste), leading to high vector density (flies). Infectious diseases prevalent in evacuation centers due to the aforementioned risk factors include diarrhea, typhoid, acute respiratory infections/pneumonia, measles, malaria, dengue fever, and skin diseases. Health problems related to the lack of clean water sources and poor environmental health commonly include diarrhea, respiratory infections, malaria, measles, skin diseases, tetanus, tuberculosis, chickenpox, hepatitis, worm infestations, typhoid, and more. Reproductive health issues, such as complications during pregnancy and childbirth, unintended pregnancies, the spread of sexually transmitted infections (STIs), violence against women and children, are also prevalent. Various psychological complaints and psychiatric disorders related to the experiences during the disaster, such as post-traumatic stress, depression, anxiety, and more, are observed.

Mitigation of Semeru Eruption

Law No. 24/2007 defines disaster management as a series of efforts that include establishing development policies at risk of disasters, disaster prevention activities, emergency response, rehabilitation, and reconstruction. Disaster often leads to chaotic or chaotic conditions that inevitably disrupt normal activities, resulting in suboptimal outcomes. Through effective disaster management, chaotic conditions will persist, but efforts are made to minimize the duration, thereby achieving more optimal results. There are three fundamental aspects in disaster management:

- 1) Response to disaster
- 2) Preparedness for facing disaster
- 3) Mitigation of disaster effects

These three aspects of disaster management correspond to the phases in what is called the "disaster cycle."

Here are the phases in the disaster cycle

a. Pre-Disaster: Activities undertaken to mitigate the loss of assets and human casualties caused by hazards and to ensure that existing losses are also minimized when a disaster occurs. This includes activities:

- 1) **Preparedness:** a series of activities carried out to

anticipate through organization and through appropriate and effective measures. These preparedness steps are taken before a disaster event occurs and are aimed at minimizing loss of life, service disruptions, and damage when a disaster occurs. Examples include preparing evacuation locations, contingency planning, and disseminating regulations/guidelines for disaster management.

2) Mitigation: a series of efforts to reduce the risk of disasters, whether through physical development or awareness-raising and enhancing the ability to face disaster threats (Law No. 24/2007).

3) Prevention: efforts made to prevent the occurrence of disasters (if possible, eliminate hazards). For example, prohibiting forest burning in agricultural areas and prohibiting stone mining in steep areas.

4) Early warning: efforts to provide a warning sign that a disaster is likely to occur soon. Early warning should be accessible to the community, immediate, clear and not confusing, and official in nature.

b. During disasters (emergency response): A series of activities carried out promptly during a disaster event to address the adverse impacts. This includes activities:

- 1) Rescue and evacuation of both victims and assets.
- 2) Fulfillment of basic needs, protection, and management of refugees.
- 3) Rescue and recovery of infrastructure and facilities.
- 4) Emergency assistance (relief): Efforts to provide assistance related to meeting basic needs such as food, clothing, temporary shelter, health, sanitation, and clean water.

c. Post-Disaster, Recovery: the emergency recovery process of communities affected by a disaster by restoring infrastructure and facilities to their original condition. Efforts involve repairing (reconstructing) infrastructure and facilities for basic services such as roads, electricity, clean water, markets, health centers, and others. This includes activities:

1) Rehabilitation: measures taken after a disaster event to assist communities in repairing their homes, public facilities, and essential social facilities, while also revitalizing the economic activities.

2) Reconstruction: a medium and long-term program aimed at the physical, social, and economic improvement to restore the community's life to the same or better condition than before. Specific actions that can be taken in the case of the eruption of Mount Semeru can be seen in the table below.

Pre-disaster	During Disaster	Post-disaster
<ol style="list-style-type: none"> 1. Pay attention to the directives from the Center for Volcanology and Geological Hazard Mitigation (PVMBG) regarding the development of volcanic activity. 2. Prepare masks and protective goggles to anticipate volcanic ash. 3. Be aware of evacuation routes and shelters prepared by the authorities. 4. Prepare alternative evacuation scenarios if the impact of the eruption extends beyond expert predictions. 5. Prepare logistical support, such as ready-to-eat food and drinks, flashlights and spare batteries, sufficient cash, specific medications tailored to individual needs, and other necessities. 	<ol style="list-style-type: none"> 1. Ensure that you are already in an evacuation shelter or another safe location away from the impact of the eruption. 2. Avoid disaster-prone areas. 3. Use masks and protective goggles. 4. Always follow the instructions from the authorities while staying in the evacuation shelter. 	<ol style="list-style-type: none"> 1. Ensure basic needs are met if staying for an extended period in the evacuation shelter. 2. Accompany children and teenagers to reduce stress or pressure while in the evacuation shelter. 3. Continue to use masks and protective goggles when in areas affected by volcanic ash. 4. Stay informed about developments from authorities through radio or announcements. 5. Be vigilant about the possibility of a secondary hazard such as cold lava floods triggered by heavy rainfall, carrying volcanic material or debris along rivers from downstream to upstream.

Roles of Officials- Roles of Officials and Community Participation: Mount Semeru Eruption 2021

The Regional Disaster Management Agency (BPBD) of East Java Province informs that the eruption of Mount Semeru on December 4, 2021, has resulted in casualties. The eruption affected Lumajang Regency and Malang City with coordinates -8.151761, 112.902557. The reported figures until January 31, 2022, indicate a total of 4,019 evacuees, 62 fatalities, and significant losses in the local community, including 1,107 damaged or lost houses, 3,026 livestock, a broken Gladak Perak bridge, and damages to educational facilities, health facilities, and places of worship (totaling 47 units) (BPBD, 2022).

Mount Semeru, with recurrent activities since November 8, 1818, and increased frequency from 1963, has made the local communities around Semeru accustomed to its volcanic character. However, the sudden eruption on December 4, 2021, caught many off guard, leading to significant loss of life and property.

Disaster management efforts involve the government, NGOs, external community aid (individuals and groups), state-owned enterprises (BUMN), and local communities. Data shows that 80% of disaster management is conducted by local communities as the first responders. Notably, there is a concern about the general lack of disaster awareness, with many perceiving Semeru's eruptions as commonplace. Additionally, local communities heavily depend on agricultural yields around Mount Semeru for their livelihoods.

The role of healthcare workers in disaster management is crucial and should be implemented from pre-disaster, during disaster, and post-disaster phases. In the pre-disaster phase, healthcare workers undergo disaster training and conduct health promotion activities to enhance public knowledge about disasters. During the

disaster phase, healthcare workers are expected to remain calm and lead in providing assistance to victims of the Merapi eruption. They assist people in evacuation centers and facilitate the treatment of victims. Finally, in the post-disaster phase, healthcare workers help address PTSD experienced by victims and collaborate with other professions and sectors to manage public health issues after the emergency and expedite the recovery phase towards a healthy and safe condition.

D. CONCLUSION

Health issues resulting from disasters are diverse, including the increased potential for infectious and non-communicable diseases, environmental and sanitation health problems, as well as women's and couples' reproductive health. Conditions can worsen, partly due to inadequate healthcare provision during disaster situations. Various guidelines for addressing health problems arising from disasters have been issued at the national level. These efforts are essentially implemented to ensure the fulfillment of community rights, including the right to receive assistance in meeting basic needs.

The organization of the health sector is carried out hierarchically. In this regard, the role of community health centers (Puskesmas) in disaster locations becomes crucial during the pre-disaster, disaster, and post-disaster phases. Initial rapid health assessments, for example, are essential activities that healthcare workers need to carry out, aiming to map vulnerable groups and various health problems and disease risks resulting from disasters. Minimum standards have been established, covering aspects of healthcare services, prevention and control of infectious diseases, nutrition and food, environment, and basic health needs.

In the 2021 eruption of Mount Semeru, the number of casualties could be minimized due to agile healthcare

workers and effective coordination between agencies. Additionally, active community participation played a significant role in disaster management.

E. REFERENCES

1. Abidin, H., *Penentuan Tinggi Orthometrik Gunung Semeru Berdasarkan Data Survei GPS dan Model Geoid EGM 1996*. ITB Journal of Sciences, 2004; 36(2): 145– 157.
2. Purba, Anggiat. *Analisis Kapasitas Masyarakat Terdampak Erupsi Gunung Semeru*. PENDIPA Journal of Science Education, 2022; 6(2): 599-608.
3. Kemenkes RI No 145/MENKES/SK/I/2007 tentang Pedoman Penanggulangan Bencana Bidang kesehatan.
4. Kurnianti, Mizam Ari. *Peran Tenaga Kesehatan Dalam Penanganan Manajemen Bencana*. Jurnal Ilmiah Kesehatan Media Husada I Volume 01/NOMOR 01/AGUSTUS, 2012.
5. Santoso, Guntur, D.T., (08 Desember). Laporan Evaluasi Tingkat Aktivitas Gunungapi Indonesia Bulan November 2023. vsi.esdm.go.id. <https://vsi.esdm.go.id/press-release/laporan-evaluasi-tingkat-aktivitas-gunungapi-indonesia-bulan-november,2023>.
6. Press Release Kenaikan Tingkat Aktivitas Gunung Api Semeru Tanggal 16 Desember, 2021. magma.esdm.go.id. <https://magma.esdm.go.id/index.php/v1/press-release/211/press-release-kenaikan-tingkat-aktivitas-gunung-api-semeru-tanggal-16-desember-2021>