Disaster Preparedness and Mitigation in Indonesia: A Narrative Review

*Dumilah Ayuningtyas [1], Sri Windiarti [2], M. Sapoan Hadi [1], Ulya Uti Fasrini [3], Sandra Barinda [1]

1. *Faculty of Public Health, Universitas Indonesia, Depok, Indonesia*
2. *Regional Public Hospital in Bima City, Bima, Indonesia*
3. *Faculty of Medicine, Universitas Andalas, Padang, Indonesia*

*Corresponding Author: Email: dumilah.ayuningtyas@gmail.com

Abstract

Background: The tectonic activities at the meeting points of three large plates make Indonesia a high-risk disaster-prone area. Nevertheless, disaster risk reduction efforts in various regions of Indonesia are still lacking, in terms of both knowledge and the ability to analyze disaster risks. This study examines the implementation of disaster preparedness and mitigation in Indonesia.

Methods: The method used in this study was narrative review. The authors collected the articles through searching for 3 data sources from 2016–2019 using Google Scholar, iSeek, and Microsoft Academic. Content analysis of all information to obtain the thematic phenomena of this study completed the methodological approach.

Results: After applying the exclusion criteria and removing duplicates, six studies remained that focused on disaster mitigation in remote areas of Indonesia. Implementation of regulation and policy framework in disaster management is not yet optimal. Disaster preparedness and mitigation is characterized by the low utilization of technology and information related to the disaster, and various obstacles in the process of evacuation and transportation. Promoting local wisdom and enhancing it through integrating science can increase disaster resilience.

Conclusion: The existence of a disaster-resilient village is very influential in community preparedness in dealing with disasters and other emergencies. This study provides some recommendations for disaster risk reduction: a) strengthening policies related to evacuation procedures in the health sector by local government, b) integrating transportation modes in remote areas, c) enhancing all parties with education and training, d) establishing community-based information systems; and e) strengthening the disaster resilience of villages.

Keywords: Coastal area; Disaster; Mitigation; Remote area; Preparedness

Introduction

The tectonic activities at the meeting points of three large plates, namely the Indo-Australian plate, Eurasian plate, and the Pacific plate, place Indonesia in an interesting position from a geo-

logical perspective. In addition to extensive continental exposure areas (Sunda and Sahul Exposure), there are also the highest fold mountains in the tropics and eternal snow (Central Papua Mountains). Indonesia is also the only country in the world with a bottomless inter-island sea between two archipelago arcs, namely the Banda Sea (more than 5,000 meters) and the Weber Trench (more than 7,000 meters). Two major volcanic paths in the world and several mountain paths in the world's folds meet one another in Indonesia. The tectonic activity of these three plates has made Indonesia a disaster-prone area (1).

Based on the Indonesian Disaster Information Data, the trend of disaster events has fluctuated in the last decade and increased in the last four years (Fig. 1). As many as 3,814 disasters occurred in 2019, with 478 people dead, 111 people missing, 3,421 injured, and 6.1 million affected or displaced (2).
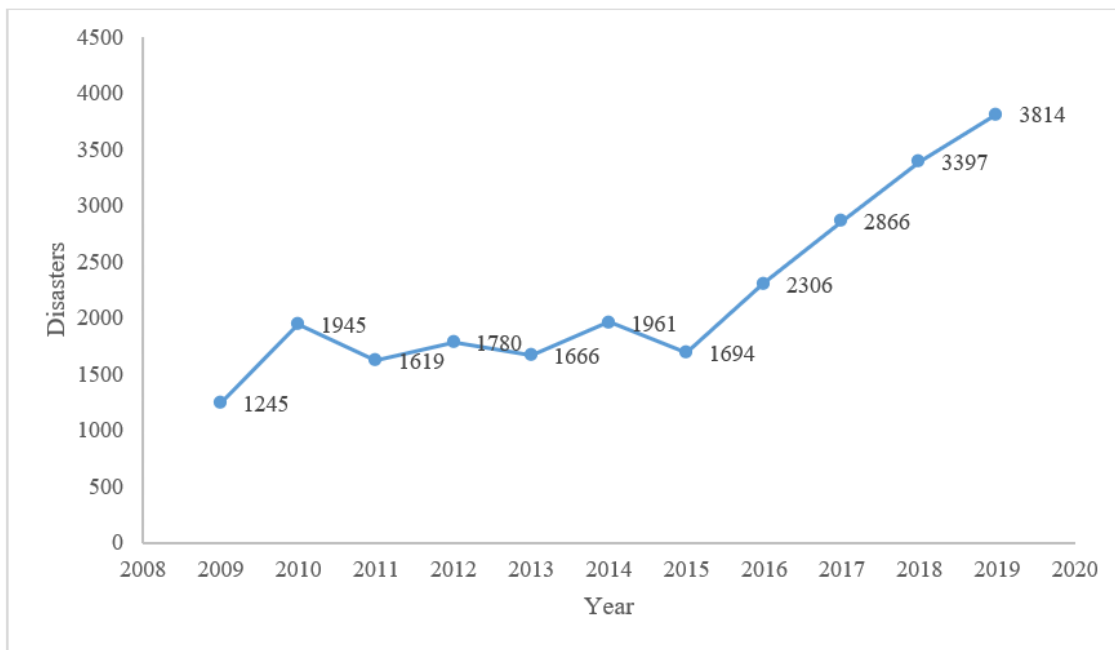

Fig. 1: Trends of disasters in the last decade (2)

The main problems in Indonesia in terms of its vulnerability to natural disasters are the low performance of disaster management (DM), the lack of attention to disaster mitigation, and the weak role of education in the introduction of disaster mitigation education (3). Mitigation is a DM phase that occurs before a disaster (4). Indonesia was criticized by the United Nations Secretariat for International Strategy for Disaster Reduction in its 2014 report, which stated that the policy of protecting against natural disasters in Indonesia is still weak in terms of inter-ministerial coordination. The report also stated that the budget for DM was minimal at 0.699% of the national budget, while the concept of disaster risk reduction (DRR) had not been evenly distributed across all regions in Indonesia. This was in addition to the country's weak ability to analyze disaster risk, its low quality technology and information, and its lack of disaster preparedness education (5).

The Indonesian government is aware that disaster issues must be taken seriously since the earthquake and the tsunami that followed in Aceh and surrounds in 2004. Gradually, Indonesia developed a national system of DM to reduce the risk

of natural disasters, starting with the enactment of Law Number 24 Year 2007 on DM. This law became a reliable and comprehensive legal framework for DM and later, the DRR policy in Indonesia in order to manage better disaster risk by anticipating and preventing the worse outcome of a disaster. This law contains a set of provisions and regulations that summarize the responsibilities of the central and regional governments, the rights and obligations of the community, the role of businesses and international institutions, the different stages of DM, as well as the financial assistance for DM. As part of sustainable development, DRR policy needs to be integrated into disaster risk management (DRM) practice. Mitigation as part of DRM activities involves strengthening structures and infrastructure, while preparedness activities involve building the awareness, knowledge, and capacities of stakeholders in the disaster-prone areas (4). This framework provides the foundation on which to develop the structure, rights, and responsibilities of integrating DRR into the DM sector in Indonesia (6).

The lack of synergy in DRM in Indonesia, especially in the efforts to increase mitigation and disaster preparedness, is a crucial evaluation finding. It is related to political commitment, the legal and institutional umbrella of DM, and financial support for disaster issues (7,8). Thus, the president of the Republic of Indonesia stated that it was appropriate for the government, together with the House of Representatives, to allocate a larger budget to improving disaster mitigation and related education in the community. President Jokowi also asked relevant ministries and institutions to increase community preparedness to face disasters (9). The existence of a visible and innovative DM system is a crucial factor in increasing public awareness of the potential for natural disasters in the area. Collaboration between the government and the community can create a good synergy in DM.

We aimed to examine the extent of the implementation of disaster preparedness and mitigation, especially in the island, coastal, and remote areas of Indonesia.

Methods

The method used in this study was narrative review. The authors collected the articles through searching for data sources from 2016–2019 using Google Scholar, iSeek, and Microsoft Academic. To increase the diversity of information, we also reviewed relevant news and articles in online mass media. All data used are public data. Content analysis of all information to obtain the thematic phenomena of this study completed the methodological approach.

Search Strategy and Study Selection
The authors searched three electronic data sources (Google Scholar, iSeek, and Microsoft Academic) to review possible articles within the range 2016–2019. The keywords were a) remote area, coastal area, b) disaster mitigation, disaster preparedness c) Indonesia, and d) implementation, quantitative study and/or qualitative study.

Study Criteria
The inclusion criteria for the documents were as follows: a) targeted group—remote or coastal areas of Indonesia; b) outcomes—implementation of disaster mitigation or disaster preparedness; c) research method—quantitative and/or qualitative study; and d) research in the English language.

The exclusion criteria were a) a non-full paper, b) not an original research article, c) irrelevant title and abstract, d) a non-English journal as a source, and e) a document published before or after 2016–2019. Additionally, duplicate documents were omitted from the process. The document selection process can be seen in Fig. 2.
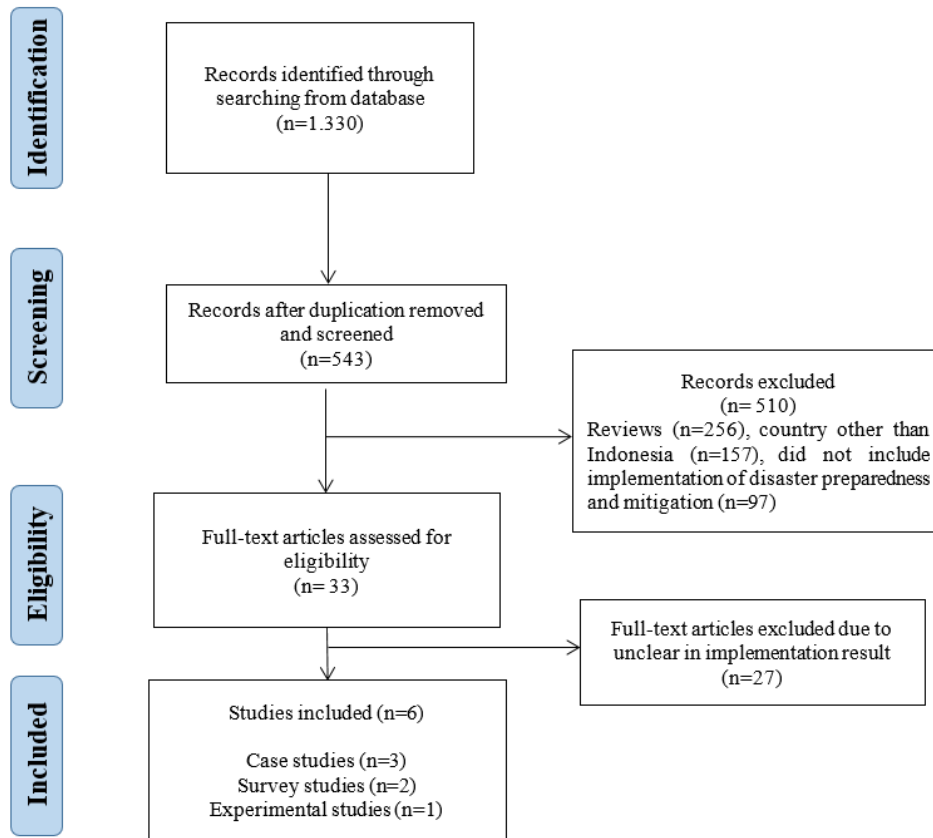
Fig. 2: Flowchart of search results

Results

There were 1,330 studies found through searching for the keywords and through other sources (date, language, publication title). After applying the exclusion criteria and removing the duplicates, six studies remained that focused on disaster mitigation in remote areas of Indonesia. The research that was included in the analysis was performed in several locations of Indonesia (Mt. Merapi – Central Java, Padang – West Sumatra, Aceh, South Sulawesi, and Mt. Selamet – Central Java) and included case studies, survey studies, and an experimental study.

In the first article, which discusses the role and formation of informational and social capital in community disaster resilience, it is stated that for people to understand disaster response, cooperation is required between various parties such as government, institutions, disaster researchers, and most importantly community members. One of the critical factors of DM is information clarity. Some researchers say that information is the key to acting appropriately in times of crisis (10). This article aims to explain the impact of information technology on disaster resilience, specifically, how information technology plays a crucial role in social mobilization. While information may be essential, it does not guarantee the implementation of an action; there must be capital accumulation as a basis for taking collective action in response to emergencies. Social interaction, public trust, and values shape perceptions of the level of risk and decision-making in the face of disasters (16,17). Thus, the strength of collective action and community participation is needed to develop adequate programs for disaster preparedness (10,17) (Table 1).

Table 1: Result of narrative review

No	Title	Author and year	Study design	Summary
1.	Informational capital and disaster resilience: the case of Jalin Merapi (10)	Tasic & Amir, 2016	Case study	This research shows that informational and social capital are important assets when sudden disasters occur. Increased access to information, particularly in remote areas, and strong social relationships in the community can be utilized to organize information to facilitate collective action in dealing with an emergency crisis effectively.
2.	A dynamic decision support system based on geographical information and mobile social networks: a model for tsunami risk mitigation in Padang, Indonesia (11)	Ai, Comfort, & Znati, 2015	Experimental study	This study recommends that, when disaster occurs, to quickly and safely evacuate communities in coastal areas, we need a system including dynamic disaster risk analysis, timely dissemination of evacuation strategies to community members, and real-time detection of environmental risks and evacuation support. This system was designed as a field experiment in Padang, Indonesia, to help public officials design tsunami risk maps with timely evacuation routes and send these maps to influential leaders in local environments exposed to tsunami risk.
3.	Assessing disaster preparedness and mental health of community members in Aceh, Indonesia: a community-based, descriptive household survey of a national program (12)	Ismail, Suwannapong, Howteerakul, Tipayamongkhol gul, & Apinuntavech, 2016	Survey study	This study concluded that education in society is not effective unless accompanied by a well-prepared health system, especially an information system. CMHNP (community mental health nurse program) education in the community may not be the best way to help people prepare for a disaster, because a large population is involved. Community participation and networking are also needed.
4.	The implementation of local wisdom in reducing natural disaster risk: a case study from West Sumatra (13)	Zulfadrim, Toyoda, & Kanegae, 2018	Case study	In West Sumatra, the traditional practice of mutual assistance (*gotong royong*) and the traditional housing and culture have saved many lives. Promoting local wisdom and enhancing it through integrating science can increase the resilience of indigenous cultures in terms of DRR.
5.	Handling disaster risks with the community-based approach (14)	Hanifa et al., 2019	Survey study	Community-based DRM improved the capacity of local communities in South Sulawesi through the components of knowledge of natural disasters, community preparedness, and emergency response. All components are needed to strengthen the community's role in and commitment to achieving the goal of DRR.
6.	Household disaster management capacities in disaster prone II area of Mt. Slamet (15)	Dewanti, Ayuwat, & Yongvanit, 2019	Survey study	This study revealed the direct and indirect effects of household characteristics and capacities on DM capacity, particularly in terms of mitigation and preparedness. Both internal and external factors could improve this capacity in disaster-prone area II households.

In an exploratory case study, focusing on the 2010 eruption of the Merapi volcano in Central Java, Indonesia, researchers analyzed the emergence of a disaster response that was fully organized by grassroots groups in Yogyakarta. In advancing the concept of informational capital, this paper analyzes how grassroots groups can mobilize resources for disaster mitigation, where

social capital based on community response plays a vital role in disaster recovery. Furthermore, mutual interaction facilitated by the use of information technology significantly enhances the mobilization of social capital. The mutual interaction is evident in the role of Jalin Merapi, a web-based organization formed to respond to crises following volcanic eruptions (10).

The research concluded that people living at the foot of Merapi showed signs of extraordinary resilience to the 2010 eruption. Community disaster resilience was partly built on well-developed informational capital. Present informational capital, which is modern and unique, is different from traditional approaches based on Merapi's spiritual volcanic culture. More specifically, regardless of the coping advantage, traditional informational capital embodies low potential risks (18), subjective feelings of security (19), and blind belief that disaster can be reduced through spiritual activities (20). In contrast, through the unique activities of Jama'ah Nahdliyin Community, the concept of informational capital is presented as a robust social capital reinforced by the intense nature of information technology. In this way, informational capital connects affected communities with external resources, such as information and humanitarian assistance, for appropriate disaster response and recovery.

The second article discusses the importance of evacuating coastal communities to safe areas immediately after a tsunami. In practice, this is not easy to do because of limited information transfer and difficult access to transportation. This article discusses a dynamic decision support system based on geographic information and social networking, a model for tsunami risk mitigation in Padang, Indonesia.

In recent years, spatial information has become a valuable resource used in dynamic decision support for emergencies, and cellular networks have become the primary social communication tool for interacting during emergencies. This article outlines the design and development of a prototype centric geographic information system, a social media-based dynamic decision support system (GIS-SM-DDSS) that integrates geographic information with Twitter technology. This system allows an independently organized information network to support the decision making and collective action of all stakeholders in emergencies, including government policymakers, policy managers, social leaders who are influential in local communities, and policy implementers and city residents affected by the disaster. The main system functions include dynamic disaster risk analysis, timely dissemination of evacuation strategies to community members, and real-time detection of environmental risks and evacuation support. This system was designed as a field experiment in Padang, Indonesia, to help public officials design tsunami risk maps with up-to-date evacuation routes and send these maps to prominent leaders in local environments exposed to tsunami risk. Each ward leader then tweets the detailed route to citizens. The proposal has the potential to support evacuation strategies and real-time guidance for communities at risk during disasters (11).

The third article aimed to assess disaster knowledge and preparedness among community members in Aceh, Indonesia. A community-based descriptive household survey was conducted in 40 villages in three tsunami-affected districts in Aceh province, Indonesia. In total, 827 randomly selected community members were interviewed with a structured questionnaire during the September–October 2014 period. The study found that although community members in the study area had direct experience of tsunamis, the proportion of people with good disaster knowledge (57.6%) and good disaster preparedness (26.0%) was far lower than the Aceh government target indicator, which is set at 70% (12). This study concludes that education in society is not effective unless it is supported by a well-prepared health system and information systems in particular. CMHNP may not be the best way to help people prepare for disaster because of the large population involved. Community participation and networking are also needed.

The fourth article intended to explore the usefulness and challenges of local wisdom in West Sumatra regarding its DRR efforts. This paper suggested that local wisdom, which is locally bound,

context specific, non-formal, and dynamic, is developed by the community during interactions with nature. As knowledge developed through extensive experience, the indigenous knowledge of local people was still effective in understanding the nature of natural hazards. This local or traditional knowledge could be effectively utilized in choosing the best mitigation action, how to respond in the emergency phase, and the options for the recovery process (13).

West Sumatra, as described in the article, has unique Minangkabau traditional houses, namely *Rumah Gadang*. Next to *Rumah Gadang*, there is another structure called *Rangkiang/Lumbuang*, which is used as granary or rice barn use in times of scarcity and unpredicted events. These structures have survived through some natural events and have met people's needs after disasters with stockpiles (13).

Mentawai island has local wisdom that has also saved many lives. Mentawai villagers use *tuddukat* as an early warning tool before tsunamis. It is a wooden drum, which is struck to produce sound. Uma, Mentawaians' traditional houses, must have a *tuddukat* as an accessory. Mentawaians also bury sago, their staple food, underground. This food source can last for months. However, modernization has decreased both traditional practices for many reasons. The author concluded that although local wisdom might not the best choice for modern DRR, it still has potential for knowledge transfer and can be applied to areas with similar risks and contexts to improve resiliency (13).

The fifth article explained the importance of a community understanding the characteristics of disasters in the area to build disaster resiliency. The DM concept has shifted from handling emergencies to DRR. Rather than reconstructing and rehabilitating after a calamitous event, it is much better to reduce the losses, damage, and complications caused by disasters.

This article specifically discusses the need for the participation of stakeholders and communities in handling disaster-related issues. As described in the article, Southeast Sulawesi, where the study was conducted, is known for natural hazards such as floods, earthquakes, drought, landslides, cyclones, abrasion, and fires. This province already has a disaster risk map divided into a hazard map and a vulnerability map. The area is profoundly prone to floods and cyclones in almost all districts/cities. In dealing with these disasters, an early warning from the Regional Disaster Management Agency (BPBD) that the local government responds to quickly will benefit the local community. Two important things to consider pertaining to disasters are the area that is affected by the disaster and the severity of its threat to the society and environment (14).

Furthermore, this article explained that comprehensive and integrated approaches to disaster emergency response and DM are needed in Southeast Sulawesi. A comprehensive approach includes prevention, mitigation, preparation, response, and recovery. An integrated approach relies on active collaboration among stakeholders, including the community. Community-based DRM should aim to improve the knowledge of natural disasters, increase community preparedness, and prepare a more effective and efficient emergency response. This study concludes that to achieve these goals in DRR, it is necessary to strengthen the role, participation, and commitment of each component (14,21).

The sixth article discussed a smaller part of the community in terms of disaster preparedness: the individual household. Households in disaster-prone areas such as the Mt. Slamet area need to possess DM capacity and a resilient means to support their livelihood. DM was found to be strongly influenced by both household characteristics and capacity. The article explained the effect of household characteristics, household capital, and its transformation on the DM process and livelihoods (15).

This study revealed that the DM capacity of a household improves if it contains working-age members who use non-chemical fertilizer on their fields. However, the study also found that if a household member migrated, this might reduce the DM practices. Household capital could be used to cope with disasters. Regarding the transformation of processes and structures,

cultural practice (Ruwat Bumi) and spiritual practice influenced household capacity in DM. As the conclusion, this study proposed that DM in prone II area of Mt. Slamet is influenced by household characteristics and capacity, which can be improved by both internal and external factors (15).

Discussion

The implementation of disaster preparedness and mitigation in the provinces of Indonesia is based on local government policies. It is related to DM in the form of regional regulations concerning DM. Implementation at the district/city level was followed up with the establishment of a BPBD in all districts/cities in each province. Stages of implementation at the village/sub-district level are outlined in the form of a decree of the village head related to the formation of a disaster resilient village, but not all villages/sub-districts have implemented it.

Disasters have encouraged various parties to get involved in highlighting the issues and mobilizing aid and emergency response operations. Various central government agencies and local governments, the world of education, business institutions, and community organizations are engaged in these activities, both directly and indirectly. There is also assistance from individual communities, which commit minds, energy, and materials to the cause. BNPB carries out its role together with other ministries/agencies from the central government (including the military/police) and the governor of each province. BNPB carries out the coordination, command, and implementation functions in emergency response, as mandated by law. In addition to the various efforts above, the swift flow of information and communities' easy access to it, thanks to technological advancements, make information on disaster emergency management very dynamic.

Many important issues need to be addressed by all parties. The review of the above articles can allow stakeholders to reflect on policies and re-

source capacities in handling disasters in Indonesia for future improvement.

Transportation and Evacuation during Disasters

Various disasters in Indonesia have displayed the steps that the government has taken to reduce their impact, such as the establishment of an evacuation route by utilizing the existing road network. The suitability of the evacuation transportation-planning model for disasters in Indonesia is inseparable from the characteristics of the disasters, as well as local wisdom such as a culture of community compliance with leaders. The Transportation Modeling Concept for Disaster Evacuation is very beneficial for the government because, during the evacuation process, survivors can be easily directed to certain gathering points.

"There are eleven themes affecting healthcare management in disasters: human resources management, resources management, victims' transfer management, environmental hygiene monitoring, nutrition management, mental health control, inter-agency coordination, training, technology management, information and communication management, and budget management" (22). Success in handling health crises due to disasters is determined by DM and main activities such as handling mass casualties and providing basic health services in refugee camps, disease control, clean water and sanitation, emergency nutrition management, mental health management, logistics management, and health supplies. Problems that often arise in handling disasters on the ground include a lack of coordination, delays in transportation and distribution, as well as the unpreparedness of local governments in providing the necessary facilities and infrastructure. Therefore, in order to reduce the impact of risks, it is necessary to strengthen health efforts in the pre-disaster stage (prevention, mitigation, and preparedness). Some positive aspects show readiness, such as the competence and experience of most evacuation officers.

For the evacuation of the islands in Indonesia, the sea ambulance is available with a regional ap-

proach. However, the implementation is not optimal and has not been integrated with other transportation.

Information Management System

Earthquake DM in Indonesia involves government and non-government institutions. This is a strength as well as a major challenge, especially in terms of information management. Regulations and policies related to information management are widely available, but implementation is constrained by the limited knowledge and skills of the parties involved. Non-functioning telecommunications equipment is often used as a reason for delays and confusion in disaster information data. The challenge is coordination and the weakness of the information management system. Problems experienced on the ground are related to data collection and exchange, and the distribution of information, both strategic and tactical. This is because officers who should be actively providing reports, namely village heads, officials, and BPBD fast response team officers, are also affected by disasters and need 1–2 weeks to take care of their own families. In addition, many of them lack the skill to use tools for data collection and information management when there is infrastructure damage or disruptions in the function of communication devices.

A UNOCHA report (2002) agreed on the Principles of Management and the Exchange of Humanitarian Information to emphasize the basic principle that the purpose of humanitarian assistance is to help people affected and at-risk. This should be done while upholding the principles of accessibility, inclusiveness, interoperability, accountability, verification, relevance, objectivity, humanity, timeliness, sustainability, reliability, reciprocity, and humanity. Law No. 24 of 2007 concerning Disaster Management Article 12 also mentions that BNPB is tasked with delivering information on activities to the public. Article 49 deals with the implementation of DM during an emergency response. Rapid and appropriate assessments are carried out to identify: a) coverage of disaster locations; b) number of victims; c) damage to infrastructure and facilities; d) disrup-

tion to public service functions and governance; and e) the abilities of natural and artificial resources (4).

Community Preparedness in Disaster Mitigation

When disasters occur, communities in Indonesia bring themselves to safety. People flee to meadows or rice fields. Seaside communities flee to the hills. People who are injured receive help from their families or neighbors. Those who need further treatment are taken by youths or the village head by car to the nearest clinic or hospital.

Increasing the capacity and readiness of communities to support disaster resilience, including their participation in the establishment and strengthening of disaster-resilient villages, is very important. The participation and capacity of empowered people have become inseparable parts of government policy on DM. In Law No. 24/2007 concerning Disaster Management, it is mentioned in Article 26 paragraph 1 point e that communities have the right to participate in making decisions on DM activities specifically relating to themselves and their communities. Community participation is also essential during reconstruction (Article 59) and in the provision of funds for DM (Article 60) (5). For damage reduction and a resilient recovery, resilience science and disaster mitigation are needed (23). It is clear that a systemic effort to increase knowledge and skills, and strengthen the network of community ties and social interaction is the basis for preparing a disaster response. This is built on the strengthening of infrastructure and integrated information systems involving all key stakeholders as the basis for ongoing collective action that is responsive, fast, and precise in handling risk and DM.

Conclusion

Handling a disaster emergency involves not only the government, but also communities, which need to be empowered in the first survival period (72 hours) after a disaster. Direct experience in

dealing with disasters does not necessarily increase the knowledge and preparedness of a community. Therefore, the formation of informational and social capital in community disaster resilience is urgently needed. Encouraging a better understanding of disaster response requires cooperation between government, community institutions, disaster researchers, and most importantly, communities affected by disasters. Communities have the main capital—cooperation—, which is a capacity that needs to be maintained as it, is very useful in the event of a disaster. The existence of a disaster-resilient village is very influential in community preparedness in dealing with disasters and other emergencies.

Taking into account the experience of regions that are already quite resilient in dealing with disasters, this research makes several important recommendations to improve the implementation of disaster mitigation:

1. With regard to disaster evacuation and transportation, policies related to evacuation procedures in the health sector need to be strengthened by local government regulations.
2. Furthermore, regarding disaster evacuation procedures in the islands, different transportation modes need to be integrated.
3. The competency of evacuation officers needs to be increased through education and training. It is also necessary to strengthen the capacity and training (including field simulations) of all parties potentially involved in disaster emergencies.
4. In terms of the BNPB information system, it is necessary to develop an integrated online information management system for disaster emergency data collection and reporting to manage such data and reports effectively.
5. It is crucial to improve on the concept of resilient villages both in terms of the number of villages and in terms of their quality. The BNPB Training Center has an important role in providing training for disaster-resilient village facilitators to produce qualified facilita-

tors that can assist in the formation of disaster-resilient villages.

Ethical considerations

Acknowledgements

Conflicts of interest

The authors declare no conflict of interest.

References

1. National Disaster Management Agency Republic of Indonesia (2016). Disasters risk of Indonesia. Available from: https://bnpb.go.id/kajian-bencana/risiko-bencana-indonesia
2. National Disaster Management Agency Republic of Indonesia (2019). Indonesian disaster data 2009-2019. Available from: https://gis.bnpb.go.id/
3. Rahma A (2018). Implementation of Disaster Risk Reduction program (DRR) through formal education. *J Varidika,* 30(1):1–11.
4. Indonesian Government (2007). *Law number 24 Year 2007 on Disaster Management.*
5. Health Disaster (2014). United Nations Secretariat for International Strategy for Disaster Reduction (UNISDR) criticism of weak natural disaster prevention and protection policies in Indonesia. Available from: https://bencana-kesehatan.net/index.php/13-berita/berita/2020-unisdr-kritik-lemahnya-kebijakan-pencegahan-dan-perlindungan-bencana-alam-di-indonesia
6. Red Cross Indonesia, International Federation of Red Cross and Red Crescent (2016).

Strengthening law and Disaster Risk Reduction (DRR) in Indonesia: assessment report based on checklist. Available from: https://www.ifrc.org/PageFiles/233375/Strengthening%20Law%20and%20DRR%20in%20Indonesia%20IND%20LR.PDF

7. Putra DI, Matsuyuki M (2019). Disaster management following decentralization in Indonesia: regulation, institutional establishment, planning, and budgeting. *J Disaster Res*,14(1):173–87.

8. Putra DI, Matsuyuki M (2020). The disaster-management capabilities of local governments: a case study in Indonesia. *J Disaster Res*, 15(4):471–80.

9. Kuwado, FJ (2019). Jokowi asks for education and disaster mitigation to be included in the education curriculum. Kompas. Available from: https://nasional.kompas.com/read/2019/01/07/18530361/jokowi-minta-edukasi-dan-mitigasi-bencana-masuk-kurikulum-pendidikan

10. Tasic J, Amir S (2016). Informational capital and disaster resilience: the case of Jalin Merapi. *Disaster Prev Manag*, 25(3):395–411.

11. Ai F, Comfort LK, Znati T (2015). A dynamic decision support system based on geographical information and mobile social networks: a model for tsunami risk mitigation in Padang, Indonesia. *Saf Sci*, 90:62–74.

12. Ismail N, Suwannapong N, Howteerakul N, Tipayamongkholgul M, Apinuntavech S (2016). Assessing disaster preparedness and mental health of community members in Aceh, Indonesia: a community-based, descriptive household survey of a national program. *Rural Remote Health*, 16(4):3788.

13. Zulfadrim Z, Toyoda Y, Kanegae H (2018). The implementation of local wisdom in reducing natural disaster risk: a case study from West Sumatera. *IOP Conf Ser Earth Environ Sci*, 106(1):012008.

14. Hanifa L, Sadat A, Mahmuda D, Nazar A, Jasiyah R, Wijaya RS, et al (2019). Handling disaster risks with the community-based approach. *IOP Conf Ser Earth Environ Sci*, 235(1): 012034.

15. Dewanti DS, Ayuwat D, Yongvanit S (2019). Household disaster management capacities in disaster prone II area of Mt. Slamet. *Jàmbá - Journal of Disaster Risk Studies*, 11(1):1-7.

16. Lavigne F, De Coster B, Juvin N, et al (2008). People's behaviour in the face of volcanic hazards: perspectives from javanese communities, Indonesia. *J Volcanol Geotherm Res*, 172(3–4):273–87.

17. Sagala S, Okada N, Paton D (2009). Modeling the social resilience of mountain communities under volcanic risks: a case study of Mt. Merapi. *Conf Proc - IEEE Int Conf Syst Man Cybern*, 1935–40.

18. Dove MR (2008). Perception of volcanic eruption as agent of change on Merapi volcano, Central Java. *J Volcanol Geotherm Res*, 172(3–4):329–37.

19. Schlehe J (2008). Cultural politics of natural disasters: discourses on volcanic eruptions in Indonesia. In: *Culture and the Changing Environment*.

20. Schlehe J (1996). Reinterpretations of mystical traditions: explanations of a volcanic eruption in Java. *Anthropos*, 91(4–6):391–409.

21. Rahman HA (2014). An overview of environmental disaster in Malaysia and preparedness strategies. *Iran J Public Health*, 43(3):17–24.

22. Pourhosseini SS, Ardalan A, Mehrolhassani MH (2015). Key aspects of providing healthcare services in disaster response stage. *Iran J Public Health*, 44(1):111–8.

23. Kaneda Y (2017). Resilience science for a resilience society in Seismogenic and Tsunamigenic countries. *J Disaster Res*, 12(4):712–21.