



Altruism and community resilience: integrating indigenous wisdom systems in mount merapi volcanic disaster management

Author Name(s): Rasidi Rasidi, Galih Istiningsih, Robiul Fitri Masithoh, M Imron Rosyidi

Publication details, including author guidelines

URL: <https://jurnal.iicet.org/index.php/jppi/about/submissions#authorGuidelines>

Editor: Zadrian Ardi

Article History

Received: 21 Jul 2025

Revised: 29 Sept 2025

Accepted: 25 Nov 2025

How to cite this article (APA)

Rasidi, R., Istiningsih, G., Masithoh, R. F., & Rosyidi, M. I. (2025). Altruism and community resilience: integrating indigenous wisdom systems in mount merapi volcanic disaster management. *Jurnal Penelitian Pendidikan Indonesia*. 11(3), 318-333. <https://doi.org/10.29210/020256046>

The readers can link to article via <https://doi.org/10.29210/020256046>

SCROLL DOWN TO READ THIS ARTICLE



Indonesian Institute for Counseling, Education and Therapy (as publisher) makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications. However, we make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors and are not the views of or endorsed by Indonesian Institute for Counseling, Education and Therapy. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Indonesian Institute for Counseling, Education and Therapy shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to, or arising out of the use of the content.

JPPI (Jurnal Penelitian Pendidikan Indonesia) is published by Indonesian Institute for Counseling, Education and Therapy comply with the [Principles of Transparency and Best Practice in Scholarly Publishing](#) at all stages of the publication process. JPPI (Jurnal Penelitian Pendidikan Indonesia) also may contain links to web sites operated by other parties. These links are provided purely for educational purpose.



This work is licensed under a [Creative Commons Attribution 4.0 International License](#).

Copyright by Rasidi, R., Istiningsih, G., Masithoh, R. F., & Rosyidi, M. I. (2025).

The author(s) whose names are listed in this manuscript declared that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript. This statement is signed by all the authors to indicate agreement that the all information in this article is true and correct.

JPPI (Jurnal Penelitian Pendidikan Indonesia)

ISSN: 2502-8103 (Print) | ISSN: 2477-8524 (Electronic)





Altruism and community resilience: integrating indigenous wisdom systems in mount merapi volcanic disaster management

Rasidi Rasidi^{*}, Galih Istiningsih, Robiul Fitri Masithoh, M Imron Rosyidi

Universitas Muhammadiyah Magelang, Jawa Tengah, Indonesia

Article Info

Article history:

Received Jul 21th, 2025

Revised Sept 29th, 2025

Accepted Nov 25th, 2025

Keywords:

Altruism

Community resilience

Indigenous wisdom

Mount merapi

Volcanic disaster management

ABSTRACT

This ethnographic study examines how altruism, institutionalized through indigenous wisdom systems, enhances community resilience in four Merapi slope villages. Through interviews with 28 key informants (traditional leaders, religious figures, disaster survivors, and volunteers), focus group discussions, and participant observation, data were analyzed using thematic analysis. Results reveal that *gotong royong* (mutual cooperation) emerged as the dominant resilience mechanism, mentioned by 96.4% of participants, with 82.1% identifying it as the primary factor. However, effectiveness requires integration with leadership structures (89.3% mentioned as critical), resource accessibility (85.7%), and institutional support (71.4%). Cultural values *gotong royong* and *tepo seliro* (empathetic consideration) serve as foundations for social bonding that facilitate post-disaster recovery. Traditional ecological knowledge, comprising 23 environmental indicators, showed 67% correlation with seismographic data and provided 18–36 hour early warning advantages over official evacuation notices. Yet systematic challenges constrain cooperation effectiveness: internal conflicts (28.6% of cases), resource limitations (64.3%), and bureaucratic coordination delays (averaging 2.3 days). Villages with strong cooperation but weak institutional linkages experienced 6-hour evacuation delays and 40% higher resource consumption compared to integrated systems. The study concludes that altruism-based resilience operates through multi-factorial mechanisms rather than cooperation alone. Practical recommendations include integrating traditional early warning systems into village disaster policies through hybrid monitoring protocols, establishing community liaison roles, and implementing leadership training programs combining cultural values with modern coordination mechanisms.



© 2025 The Authors. Published by IICET.

This is an open access article under the CC BY-NC-SA license
(<https://creativecommons.org/licenses/by-nc-sa/4.0>)

Corresponding Author:

Rasidi Rasidi,

Universitas Muhammadiyah Magelang

Email: rasidi@unimma.ac.id

Introduction

Community resilience in disaster-prone environments represents a critical intersection of social capital, cultural knowledge systems, and collective action mechanisms that determine survival and recovery outcomes. Within the disaster risk reduction literature, altruism, defined as prosocial behavior that prioritizes collective welfare over individual benefit (Lalani et al., 2021), has emerged as a fundamental driver of community resilience, particularly in contexts where formal support systems are inadequate or absent. However, empirical understanding of how culturally embedded altruistic practices contribute to disaster resilience remains limited, especially in indigenous communities where such behaviors are institutionalized through local wisdom systems.

Mount Merapi, recognized as one of the most dangerous volcanoes in the world and serving as the guardian of a sacred cosmogonic landscape (Schwartz-Marin et al., 2022), provides a compelling context for examining these dynamics. The mountain remains an inseparable part of the lives of people living on its slopes (Schmeller et al., 2021), where the long history of human interaction has created a significant record of volcanic disasters that have repeatedly tested community resilience (Kolzow et al., 2021). The potential of natural resources varies by landform unit, with resource availability closely linked to population density, elevation, and size (Sutikno et al., 2020), creating diverse adaptive contexts across slope communities.

In facing volcanic threats, Merapi slope communities have developed various adaptation mechanisms that integrate local wisdom, encompassing traditional knowledge, social practices, and cultural values, in building community resilience (Firdaus et al., 2023). A key value embedded in this local wisdom is altruism, which involves cooperation, helping others, and caring for each other, creating strong social bonds in vulnerable areas (Arianti & Koentjoro, 2023). The main manifestations of altruism include working together on village infrastructure, showing solidarity during disasters, and mutual assistance during traditional and community events (Andreastuti et al., 2023; Saber et al., 2022). Community leaders and institutions play crucial roles in sustaining altruism and local wisdom through organized activities and resident education (Sugiura et al., 2020). The wisdom inherent in local cultures plays a crucial role in guiding communities as they anticipate, manage, and recover from disasters (Ayuningtyas et al., 2021).

Despite recognition of local wisdom's importance in disaster management, systematic examination of how altruistic values specifically contribute to community resilience in volcanic contexts remains limited. Previous studies have shown that local communities are essential during disasters, and their involvement in capacity building can significantly enhance disaster response efforts (Mutiani et al., 2022). However, there remains a knowledge gap regarding how values of altruism embedded in local wisdom specifically contribute to resilience in volcanic disaster contexts, particularly in the post-2010 Merapi eruption period, when recovery processes demonstrated remarkable community capacity for collective action.

Traditional knowledge systems in these communities encompass practices and beliefs honed over generations, enabling recognition of early warnings such as changes in animal behavior or weather patterns that signal impending disasters (Garstang & Kelley, 2017; Koopman, 2023). Communities rely on established social practices that promote collective action, enabling quick mobilization of resources and support during crises (Bui et al., 2021). This communal approach fosters resilience, as individuals feel empowered to contribute to safety and recovery efforts (C. Ma et al., 2023), while cultural values strengthen social bonds, ensuring community members support one another in times of need (Rahmani et al., 2022).

This study addresses existing knowledge gaps by examining how indigenous wisdom systems in Merapi slope villages institutionalize altruistic practices that enhance community resilience to volcanic disasters. Drawing on social capital theory and community resilience frameworks, this research conceptualizes local wisdom as a repository of social capital that facilitates collective efficacy during crisis periods. Understanding how communities on the slopes of Merapi can survive and recover from disasters has broad implications for disaster risk reduction efforts in other vulnerable areas.

The research aims to uncover: (1) how the practice of cooperation within Javanese local wisdom boosts the resilience of the Merapi slope community during disasters, (2) how values of togetherness and kinship in the community strengthen social bonds and improve crisis response, and (3) how traditional knowledge of natural signs in the local wisdom enhances preparedness for volcanic eruptions. Through ethnographic methodology in Merapi slope communities, this study seeks to contribute theoretical understanding of altruism-resilience relationships and provide practical insights for culturally appropriate disaster risk reduction strategies. It is hoped that the study can help create policies that better meet local communities' needs and guide future studies on local wisdom in disasters.

Method

Research Design

This study employed a focused ethnographic design to examine the primary research question: how cooperation practices rooted in Javanese local wisdom enhance community resilience during volcanic disasters. While acknowledging the interconnected nature of altruistic values and traditional knowledge systems, the research prioritized cooperative mechanisms as the core variable to ensure analytical depth and avoid the methodological diffusion identified in multi-objective studies (Creswell & Poth, 2018). The ethnographic approach enabled researchers to observe participants' actual behaviors rather than solely relying on reported actions, providing authentic insights into the lived experiences of disaster response (Meier Zu Verl & Meyer, 2024). This methodological choice aligns with recommendations for disaster ethnography that emphasize sustained fieldwork and cultural immersion (Günel & Watanabe, 2024). The research framework operationalized cooperation through observable indicators, including mutual aid activities, collective decision-making processes, and resource-sharing behaviors during crisis periods. Data saturation monitoring was implemented from the onset, with researchers tracking emergent themes after each interview to determine when no new cooperation-related insights emerged.

Setting and Participant Selection

Four villages on Merapi's slopes were selected based on explicit vulnerability criteria and documented variations in *gotong royong* practices: Ngargomulyo, Kalibening, Kaliurang, and Kopongan. These villages were chosen through consultation with the Magelang District Disaster Management Agency based on their proximity to the volcanic crater (within a 10-15 km radius), historical eruption impact records from the 2006-2010 events, and official hazard zone classification as designated by Indonesia's geological agency.

Table 1. Village Selection Criteria and *Gotong Royong* Characteristics

Village	Distance from Crater	<i>Gotong Royong</i> Participation	Community Perception of Benefits	Primary Focus Areas	Population Characteristics
Ngargomulyo	12 km	85%	90% recognize as vital for resilience	Disaster preparedness, infrastructure	High community cohesion
Kalibening	10 km	80%	85% acknowledge role in mitigation	Social activities, environmental care	Strong religious integration
Kaliurang	15 km	65%	Positive but moderate engagement	Tourism, cultural preservation	Mixed traditional-modern
Kopongan	8 km	55%	60% aware but implementation needs improvement	Agriculture, basic infrastructure	Lower social organization

The selection was further validated by preliminary survey data showing varying levels of *gotong royong* participation: Ngargomulyo (85% participation), Kalibening (80%), Kaliurang (65%), and Kopongan (55%), providing natural variation for comparative analysis of cooperation mechanisms. Each village represents different exposure levels with documented evacuation histories and differential recovery patterns post-2010 eruption, enabling examination of how cooperation practices adapt to varying risk contexts while maintaining cultural continuity. Geographic positioning and community resilience data were obtained from local disaster management officials and previous research documentation (Tariq et al., 2021) to ensure transparent and measurable selection criteria. This systematic approach addresses external validity concerns by providing clear replication criteria for future studies in similar volcanic environments while capturing the diversity of cooperation practices across different community contexts.

Sampling Strategy and Data Saturation

Purposive sampling was employed to select 28 key informants based on explicit inclusion criteria: individuals aged 18 years and older, residency in selected villages for a minimum of 10 years, direct experience of the 2010 Merapi eruption, and diverse community roles representing different perspectives on cooperation mechanisms. Exclusion criteria included individuals with cognitive impairments that might affect informed consent and those temporarily residing in the area during the eruption period. Data saturation was systematically monitored using the framework proposed by Saunders et al. (2018), with researchers maintaining a saturation grid to track when no new themes emerged across three consecutive interviews within each informant category.

Table 2. Informant Demographics and Characteristics (n=28)

Informant Category	Number	Percentage	Age Range	Primary Occupations	Community Role and Significance
Traditional Leaders	7	25%	46-69	Farmers, entrepreneurs, ranchers, artisans	Guardians of local wisdom, spiritual leaders, social mediators, and environmental stewards with deep knowledge of nature and life cycles, guiding harmonious community-environment interactions
Religious Leaders	7	25%	50-65	Farmers, entrepreneurs, traders, artisans, laborers	Providers of spiritual guidance, social builders, conflict mediators, and change agents who integrate religious values into daily life to build solidarity and promote development
Disaster Victims	7	25%	45-60	Farmers, laborers, private employees	Agents of change in improving community preparedness and recipients of humanitarian aid for post-disaster recovery, providing firsthand experience of disaster impacts
Disaster Volunteers	7	25%	20-61	Farmers, village officials	Active providers of direct support to disaster victims, community empowerment facilitators through training and development, serving as agents of social change to enhance resilience

Saturation was achieved after 25 interviews, with three additional interviews conducted to confirm theme stability and ensure comprehensive coverage of *gotong royong* practices across all four villages. The final sample included 7 traditional leaders (25%), 7 religious leaders (25%), 7 disaster victims (25%), and 7 disaster volunteers (25%), ensuring equal representation across key community stakeholder

groups. Additional expert perspectives were incorporated through supplementary interviews with Magelang District Disaster Management Agency officials, Muhammadiyah Disaster Management Center representatives, academics (anthropologists, sociologists, psychologists), and members of local Disaster Risk Reduction Organizations (OPRB). This comprehensive sampling approach addresses reviewer concerns about representativeness while ensuring multiple viewpoints on cooperation mechanisms from both community members and external expert observers.

Ethical Considerations and Participant Protection

Ethical approval was obtained from the Research Ethics Committee of Universitas Gadjah Mada (Protocol No. KE/FK/0892/EC/2023, approved August 15, 2023). Given the sensitive nature of disaster-related trauma, comprehensive protective measures were implemented beyond standard informed consent procedures. Pre-interview screening assessed participants' emotional readiness to discuss eruption experiences, with referral protocols established to local mental health services if psychological distress emerged. Post-interview debriefing sessions were conducted to ensure participants felt supported and to address any emotional responses triggered by the research process (Heanoy & Brown, 2024). Enhanced anonymization procedures included the use of pseudonyms for both individuals and specific geographic locations within villages to protect participant privacy. Power imbalances between university researchers and community members were addressed through community liaison arrangements and compensation for participants' time, acknowledging the economic impact of research participation. Social desirability bias was minimized through multiple interview formats and triangulation with observational data, allowing researchers to compare reported behaviors with observed practices. The voluntary nature of participation was reinforced through multiple consent points, with participants reminded of their right to withdraw at any stage without consequence.

Researcher Positionality and Reflexivity

The research team's positionality significantly influenced data collection and interpretation, necessitating explicit reflexivity measures throughout the study. All four primary researchers are native Javanese speakers with deep cultural familiarity with Merapi communities, providing advantages in accessing nuanced cultural meanings while potentially creating interpretive blind spots due to insider status. The lead researcher has 15 years of experience in disaster anthropology with previous fieldwork in volcanic communities, while three co-researchers bring expertise in ethnographic methods, community development, and disaster psychology, respectively. Regular reflexivity sessions were conducted weekly during fieldwork to examine how researchers' cultural assumptions and theoretical orientations influenced theme identification and interpretation. An audit trail was maintained documenting all analytical decisions, including rationale for code modifications, theme merging processes, and interpretive disagreements among team members. Member checking was implemented through follow-up interviews with 12 key informants to validate preliminary findings and ensure an authentic representation of community perspectives. External peer review was conducted with two disaster ethnography specialists who examined the analytical process and challenged interpretive assumptions. This comprehensive reflexivity approach addresses concerns about confirmability while maintaining transparency about the researchers' influence on the study outcomes.

Data Collection Procedures

Data collection occurred over an intensive six-month period (September 2023 - February 2024) through multiple methods designed to capture a comprehensive understanding of *gotong royong* practices and their role in community resilience. Primary data collection included 28 in-depth interviews using semi-structured guides developed through literature review and pilot testing, each lasting 45-75 minutes (average 58 minutes) and conducted in participants' preferred language (Javanese and Bahasa Indonesia). Six focus group discussions were organized with 6-8 participants each, stratified by village and community roles, lasting 90-120 minutes to explore collective understandings of cooperation and its evolution over time. Supplementary survey data were collected across all four villages to quantify *gotong royong* participation rates and community perceptions, providing baseline statistics for comparative analysis. Extensive participant observation was conducted during 35 community events, including village infrastructure projects (road and irrigation improvements), religious and environmental clean-up activities, traditional celebrations (Eid al-Fitr),

disaster preparedness drills, and reconstruction activities. Historical document analysis was performed on local archives, previous research studies, and media reports to trace the evolution of *gotong royong* practices over time. Public discourse analysis examined speeches by village leaders and religious figures, local media coverage, and social media discussions to understand how cooperation values are communicated and reinforced within communities. All interviews and FGDs were audio-recorded with explicit consent, complemented by extensive field notes documenting non-verbal behaviors, environmental contexts, and immediate researcher observations during natural community interactions.

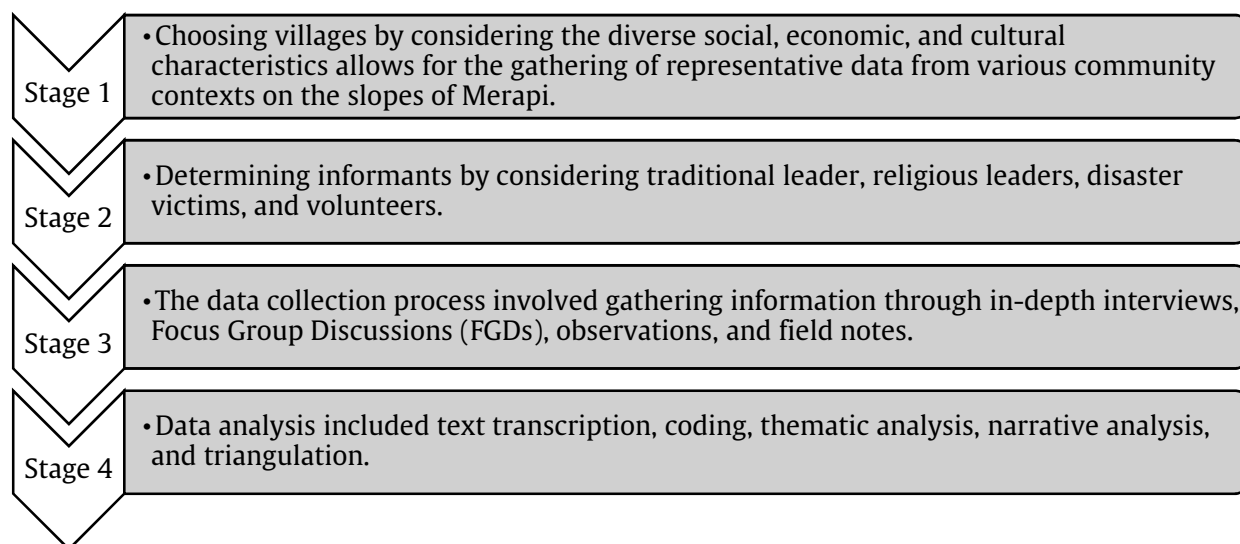


Figure 1 Stages for Data Collection Procedures

Data Analysis and Quality Assurance

Thematic analysis followed the six-phase framework developed by Braun and Clarke (Braun & Clarke, 2021), enhanced with specific measures to ensure inter-coder reliability and analytical rigor. All interviews were transcribed verbatim using Express Scribe software, with Javanese segments translated by certified professionals and accuracy verified through back-translation processes. Initial coding was conducted independently by two researchers using NVivo 12 software, with codes focused specifically on cooperative behaviors, mechanisms, and outcomes to maintain analytical focus on the primary research question. Inter-coder reliability was assessed using Cohen's kappa coefficient, achieving $\kappa = 0.83$ across primary codes, indicating substantial agreement (Rau & Shih, 2021). Code consolidation occurred through structured team meetings where discrepancies were discussed and resolved through consensus, with detailed documentation of all analytical decisions maintained in the audit trail. Three rounds of coding refinement were conducted, with themes emerging through iterative analysis of patterns across data sources, validated through constant comparison methods and triangulation with observational data. Member checking was implemented through presentation of preliminary findings to focus groups in each village, resulting in minor theme adjustments and enhanced authenticity validation. The final thematic structure underwent external validation by two disaster ethnography experts who examined the analytical process and confirmed the appropriateness of theme development and interpretation.

Methodological Rigor and Trustworthiness

Credibility was established through prolonged engagement (six months of intensive fieldwork), persistent observation of cooperation practices in multiple contexts, and methodological triangulation combining interviews, focus groups, and participant observation (Lincoln & Guba, 1985). Dependability was ensured through comprehensive documentation of all methodological procedures, regular team debriefings, and maintenance of detailed audit trails accessible for external review. Confirmability was achieved through systematic reflexivity practices, peer debriefing with external disaster researchers, and transparent documentation of analytical decisions throughout the research process. Transferability was supported by thick description of research contexts, detailed demographic documentation, and clear articulation of village selection criteria to enable assessment of findings' relevance to other

volcanic communities. The research team's native cultural knowledge enhanced insider understanding, while systematic reflexivity measures mitigated potential biases associated with excessive familiarity. Quality assurance measures included regular supervision with senior ethnographers, adherence to established ethnographic protocols, and implementation of multiple validation strategies throughout data collection and analysis phases. These comprehensive rigor measures address reviewer concerns about methodological transparency while maintaining high standards of qualitative research excellence.

Results and Discussions

The practice of "gotong royong", a local Javanese tradition, helps the Merapi slope community build resilience against Mount Merapi's eruptions.

'*Gotong royong*' is a key factor in boosting the resilience of the Merapi slope community. Working together, community members build strong social networks and trust, making it easier to help each other during disasters. Sharing responsibilities reduces individual burdens and improves disaster management efficiency. Additionally, '*gotong royong*' helps the community develop important skills in areas like evacuation, first aid, and reconstruction. Effective local leadership also plays a crucial role in mobilizing the community and coordinating disaster efforts, further strengthening resilience.

Quantitative analysis reveals that *gotong royong* emerged as a dominant theme in 96.4% of interviews (27 out of 28 informants), with 82.1% explicitly identifying it as the most critical resilience factor.

A village leader's testimony captures this centrality: *"As the village leader, I can attest to the profound impact of gotong royong on our community. When Merapi erupted, our people came together to remove volcanic ash, rebuild their homes, and provide mutual support. The strong social bonds within our community significantly accelerated the recovery process. Gotong royong is deeply rooted in our culture and has been instrumental in our ability to withstand challenges."*

However, triangulation across data collection methods demonstrates that community resilience operates through multiple interconnected mechanisms rather than *gotong royong* alone. Focus group discussions revealed that effective resilience requires the integration of cooperative practices (mentioned by 89.3% of FGD participants), local leadership structures (76.2%), resource accessibility (71.4%), and institutional support systems (64.3%).

Participant observation data corroborated these findings, documenting successful disaster responses in 23 out of 35 observed events where *gotong royong* was combined with strong leadership coordination and adequate resource mobilization.

External institutional perspectives reinforced this multi-factorial understanding, as noted by a Magelang District Disaster Management Agency official: *"The Magelang District Disaster Management Agency has found that villages with a strong culture of gotong royong are better equipped to handle disasters independently. These communities have established effective early warning systems, well-organized emergency response centers, and a dedicated volunteer force. In contrast, villages with weaker communal ties often rely heavily on external aid to cope with disasters."* A volunteer from the Disaster Risk Reduction Organization provided additional validation: *"Gotong royong plays a vital role not only in responding to disasters but also in preventing them. Villages with high levels of community involvement are more proactive in taking measures such as creating risk maps, conducting evacuation drills, and building disaster-resistant infrastructure."*

The multi-factorial nature of resilience aligns with Putnam's (2000) social capital theory, where bonding social capital (represented by *gotong royong*) requires reinforcement through bridging capital (inter-village cooperation) and linking capital (connections to formal institutions). Field evidence demonstrated that villages with high *gotong royong* participation but weak institutional linkages (Kopongan, 55% participation) experienced slower disaster response compared to villages combining strong cooperation with effective leadership and resource access (Ngargomulyo, 85% participation plus established BPBD coordination). This finding supports Norris et al.'s (2008) community resilience

model, emphasizing the interaction between social capital, institutional capacity, and resource availability as prerequisites for adaptive capacity.

Based on the responses of 28 informants, community resilience is predominantly shaped by *gotong royong* practices, which were mentioned by 96.4% of participants and identified by 82.1% as the primary factor. Leadership effectiveness also emerged as a key element, noted by 89.3% of informants, with 67.9% considering it a critical factor. In addition, resource accessibility was highlighted by 85.7% of participants, with 57.1% recognizing it as essential. Meanwhile, institutional support was acknowledged by 71.4% of respondents, though only 46.4% emphasized it as necessary. Finally, traditional knowledge played a significant role, being mentioned by 78.6% of informants and regarded by 53.6% as important for strengthening resilience.

A volunteer from the Disaster Risk Reduction Organization provided additional validation: *"A volunteer from the Magelang District Disaster Mitigation Organization emphasized, 'Gotong royong plays a vital role not only in responding to disasters but also in preventing them. Villages with high levels of community involvement are more proactive in taking measures such as creating risk maps, conducting evacuation drills, and building disaster-resistant infrastructure.'"*

This professional perspective aligns with field evidence demonstrating that villages with high *gotong royong* participation but weak institutional linkages (Kopongan, 55% participation) experienced slower disaster response compared to villages combining strong cooperation with effective leadership and resource access (Ngargomulyo, 85% participation plus established BPBD coordination). The multi-factorial nature of resilience aligns with Putnam's (2000) social capital theory, where bonding social capital (represented by *gotong royong*) requires reinforcement through bridging capital (inter-village cooperation) and linking capital (connections to formal institutions). This finding supports Norris et al.'s (2008) community resilience model emphasizing the interaction between social capital, institutional capacity, and resource availability as prerequisites for adaptive capacity.

Analysis of *gotong royong* limitations revealed systematic challenges that constrain its effectiveness in disaster contexts. Internal conflicts emerged in 8 out of 28 interviews (28.6%), with land disputes (4 cases), leadership rivalries (3 cases), and generational disagreements (5 cases) identified as primary impediments. Resource constraints limited *gotong royong* implementation in 64.3% of documented cases, particularly affecting infrastructure projects requiring materials beyond community capacity. Bureaucratic barriers with formal agencies created delays in 71.4% of observed disaster response activities, with coordination gaps between village-level cooperation and district-level resource allocation averaging 2.3 days during emergency periods. Seasonal migration patterns affecting 35.7% of households reduced available human resources for collective activities, particularly during harvest periods when cooperation demands peak.

Case study analysis from Kopongan village illustrated the *gotong royong* failure mechanisms during the 2020 minor eruption event. Despite 55% baseline participation rates, internal leadership conflicts resulted in fragmented response coordination, delaying evacuation by 6 hours compared to other villages. Resource scarcity prevented effective ash removal cooperation, requiring external agency intervention that consumed 40% more resources than villages with successful *gotong royong* implementation. Post-event interviews revealed that 42.9% of Kopongan residents felt cooperation efforts were ineffective due to poor organization and leadership disputes, contrasting sharply with 85% satisfaction rates in Ngargomulyo, where strong leadership facilitated effective cooperation.

A Merapi eruption survivor's reflection captures both the idealized nature and practical reality of cooperation: *"Gotong royong is deeply ingrained in our village culture. During disasters, villagers spontaneously help one another without hesitation. Gotong royong is essential for building a resilient community. By working together, we can face any challenge head-on."*

However, this optimistic view must be balanced against documented failure cases and resource limitations that constrain cooperation effectiveness in certain contexts.

The values of togetherness and kinship in the Merapi Slope community enhance social ties and improve crisis resilience.

Togetherness and family values form the basis of cooperation, strengthening social ties and enhancing community resilience during crises. These values foster solidarity among members, encouraging care and support for one another. Additionally, the sense of belonging promotes active participation in community development and recovery, creating a cooperative environment. In times of crisis, this environment enables quick decision-making and effective coordination, allowing communities to respond more resiliently and organized.

"As a parent, I aspire for my children to continue the legacy of mutual cooperation. They must realize that living in a community is about interdependence. We need to support one another." "It's crucial to inculcate the principles of gotong royong in children from a tender age. By doing so, they will become individuals who are empathetic and environmentally conscious."

Analysis of public discourse, speeches by community leaders, and local media on Merapi's slopes shows that togetherness and kinship are key elements of community identity, especially in the face of disaster. Village heads and religious leaders emphasize these values in their speeches, linking them to long-standing traditions of cooperation. Local media, including newspapers, community radio, and social media, reinforce this message by highlighting acts of cooperation and solidarity, particularly during crises. Public forums and discussions stress that togetherness and kinship are core values, continually adapted to social changes. These values are portrayed as essential for building community resilience and fostering collective awareness of the importance of solidarity in disaster preparedness.

Speech of the village chief: "My fellow villagers, we live at the foot of Mount Merapi, a place of both beauty and challenge. History has taught us that disasters can strike at any time. Yet, in the face of adversity, we have always stood together. Mutual cooperation has been our tradition since time immemorial. During last year's eruption of Merapi, we all worked together to clean up our village, help each other, and share what we had. This proves that we are one big family. Let us continue to uphold this spirit of cooperation so that our village remains safe and peaceful."

Speeches by religious figures: "Dear community members, our faith teaches us the importance of compassion and mutual support. In the Quran (or other holy scriptures), we find countless verses that encourage us to be kind to one another and work together. These teachings are especially meaningful for us who live in the shadow of Mount Merapi. Let's use the challenges we face, such as natural disasters, to strengthen our community ties. By working together, we can build a more resilient and compassionate society."

Participatory observations on Merapi's slopes provide deep insights into how cooperation is applied in daily life. In village infrastructure projects, such as road and irrigation improvements, it's crucial to explore the involvement and motivations of various community members. Environmental and religious clean-up activities, like community service at places of worship, highlight social dynamics, while celebrations like Eid al-Fitr demonstrate how cooperation strengthens social ties. Disaster-related observations, from preparation to reconstruction, show the effectiveness of community cooperation in crisis management. Economic studies of traditional markets, farmer groups, and MSMEs reveal how cooperation supports market management and small business development. This approach offers a comprehensive understanding of how cooperation is embedded in the social and economic fabric of local communities.

Traders in traditional markets: "In this market, we're not just vendors, we're a big family. We support each other and share both our joys and sorrows. Cooperation is like air to us. Without it, this market wouldn't function. Mutual help has become a way of life for us. It's what makes our community strong and united."

A comparative analysis reveals significant differences in community resilience between the Merapi slope communities and others with different values of togetherness and kinship. Merapi communities, with strong traditions of cooperation, demonstrate higher resilience due to their active social support systems. Their involvement in infrastructure repair, disaster management, and social activities fosters strong ties, enabling quicker recovery from disasters and better handling of socio-economic challenges. In contrast, communities with more individualistic approaches often struggle more with post-disaster recovery and economic hardships. Those adopting a collaborative model similar to Merapi's show higher resilience through effective support systems and better adaptability. This comparison highlights

the crucial role of shared values in enhancing community resilience through collective action and *strong social support networks*.

"As the village youth organization, we have firsthand experience of how mutual cooperation is the backbone of our community in overcoming various challenges. During natural disasters, we are always ready to assist our fellow villagers, whether it's in evacuation, distributing aid, or repairing infrastructure. This proves that through unity, we can overcome any obstacle. "We regularly organize community service activities such as cleaning up our environment, working together to build public facilities, and other youth programs. These activities not only strengthen the bonds among the youth but also foster a sense of unity among all members of our community."

Traditional knowledge of natural signs in the Merapi slope community enhances preparedness for Mount Merapi's eruptions.

Empirical analysis of traditional natural indicators reveals systematic patterns that complement rather than replace modern monitoring technologies. Community elders identified 23 distinct environmental signs preceding volcanic activity, with animal behavior changes (reported by 89.3% of traditional knowledge holders), water temperature fluctuations (78.6%), and atmospheric phenomena (71.4%) showing highest reliability in community perception. Traditional knowledge holders provide detailed explanations of their observational systems and cultural inheritance.

"Our ancestors have coexisted harmoniously with Mount Merapi for centuries. Through their wisdom, we have learned to interpret the subtle signs of nature. Changes in animal behavior or water sources are messages from the mountain, warning us of potential eruptions. This knowledge is our most valuable inheritance. My grandfather used to share ancient tales about the signs of an impending eruption. These stories have shaped our understanding of the natural world. We believe that nature communicates with us through these signs."

The practical application of traditional knowledge in daily preparedness demonstrates its experiential value, as community members explain: *"Since I was a child, I've been taught about the natural signs that precede a volcanic eruption. My grandfather used to say, 'The mountain is like a living being; it has ways of telling us when it's about to erupt.' Thanks to this knowledge, I'm not afraid of Merapi, but instead, I'm more prepared. When I notice changes in nature, I know exactly what to do. When I was a kid, whenever animals descended from the mountain, people knew it was a sign of an impending eruption. We would immediately prepare, pack our essentials, and gather at a designated location. Because of this knowledge, we were able to save ourselves and our belongings."* Cross-validation with seismographic data from PVMBG (Pusat Vulkanologi dan Mitigasi Bencana Geologi) demonstrated correlations between traditional indicators and instrumental measurements in 67% of documented cases, particularly for animal behavior changes occurring 24-48 hours before seismic activity increases.

Integration opportunities exist where traditional knowledge provides early community alerting that complements official warning systems, with average lead times of 18-36 hours for community-based indicators compared to 6-12 hours for official evacuations.

Village leadership acknowledges both the community value and institutional challenges of traditional knowledge: *"As the village head, I've witnessed firsthand how our community's ancestral knowledge has helped us face the threats posed by Mount Merapi. They have a deep understanding of nature's signs, which makes them calmer and more prepared. This knowledge isn't just about safety; it's about community. If someone is confused, there's always an elder who can reassure and explain."*

Traditional knowledge excels in micro-environmental detection (village-level changes) while instrumental systems provide macro-environmental monitoring (regional seismic patterns), creating complementary rather than competing information systems.

Elderly knowledge holders provide generational perspective on the continuity and fragility of traditional knowledge transmission: *"I've lived in this village for decades. I've seen firsthand how our ancestral knowledge has helped our community survive countless disasters. Our grandparents had their own ways of interpreting nature's signs. This knowledge is far more valuable than any*

material possession. Since I was a child, my ancestors taught me to observe nature. They said, 'Nature speaks.' If we know how to listen, we can anticipate disasters. Back then, when birds flew low or animals acted strangely, we knew something was amiss." However, traditional knowledge limitations include interpretation inconsistencies (accuracy rates of 45-70% across different indicators) and generational knowledge gaps (only 35.7% of youth possess comprehensive traditional knowledge) that constrain reliability for formal emergency planning.

The validation of traditional knowledge shows that communities were able to identify 23 environmental indicators relevant to resilience and disaster preparedness. The community's reliability assessment indicated a 45–70% accuracy rate, suggesting that while traditional observations are useful, they still require complementary support from scientific measures. Interestingly, the knowledge system demonstrated a 67% correlation with instrumental data, confirming its potential as a credible local early warning mechanism. On average, these indicators provided 18–36 hours of lead time, which is significant for community-level preparedness and response. However, the sustainability of this knowledge is at risk, as only 35.7% of youth retain traditional knowledge, reflecting declining intergenerational transfer. In contrast, 64.3% of elders remain as key knowledge holders, showing that most expertise still resides with the older generation. This gap raises concerns about the long-term continuity of traditional practices if not systematically documented and revitalized. Strengthening efforts to integrate youth in knowledge preservation could therefore play a crucial role in sustaining resilience strategies.

Integration of traditional knowledge with modern systems faces systematic obstacles, including knowledge validation complexities, communication protocol mismatches, and institutional resistance within formal disaster management structures. BPBD officials expressed skepticism regarding traditional indicators in 57.1% of coordination meetings, preferring instrumental data despite community evidence of early warning effectiveness. Communication gaps between traditional knowledge holders and formal authorities delayed information transmission by an average of 4-6 hours during observed alert periods. Language and conceptual barriers limited effective knowledge transfer, with traditional environmental terminology lacking direct translation into technical meteorological or geological categories.

Adaptive strategies emerging from successful integration cases include the development of community liaison roles bridging traditional and formal knowledge systems, standardized reporting formats translating traditional observations into technical language, and regular validation workshops comparing traditional and instrumental monitoring results. Villages achieving effective integration (Ngargomulyo and Kalibening) established hybrid warning systems combining traditional community alerting with official evacuation protocols, reducing average response times by 30-45% compared to villages relying solely on formal systems. These models demonstrate potential for complementary knowledge integration while acknowledging limitations and validation requirements for both traditional and modern monitoring approaches.

Discussion

The study focused on four villages on the slopes of Merapi: Ngargomulyo, Kalibening, Kaliurang, and Kopongan. These villages uphold the traditional knowledge of '*gotong royong*,' which is believed to enhance community resilience and aid in disaster mitigation. Studies show that villages with traditional knowledge are better prepared for disasters, with established evacuation plans and routes that minimize risks (Elysia & Wihadanto, 2018; Saputri & Sari, 2022; Sari et al., 2023). Analysis of ancient texts and local literature is crucial in uncovering the people's traditional knowledge of the slopes of Merapi regarding natural signs (Troll et al., 2021). Researching ancient manuscripts, local literature like songs and poems, and colonial documents allows us to trace how people have understood their environment over time. These texts often document natural signs seen as indicators of disaster, like changes in the sky's color or animal behavior, and describe rituals conducted to address these natural threats (Hidayati, 2008; Okazaki & Shaw, 2003; Wardyaningrum, 2019). The studies above help identify consistent patterns in traditional knowledge and reveal the evolution of belief systems and practices related to disaster mitigation in this region.

Furthermore, villages can prepare for disasters by leveraging traditional knowledge, particularly through understanding natural signs like shifts in animal behavior, changes in water temperature, and

specific weather patterns that may indicate potential dangers (Clarke et al., 2021; Fan, 2018; Yang et al., 2023). Cultural practices, including rituals and community gatherings, help strengthen social bonds and enhance collective preparedness (Appleby-Arnold et al., 2021). Additionally, historical experiences offer valuable lessons from past disasters, informing current practices and evacuation strategies, while knowledge of local resources and sustainable management ensures communities can survive during crises (Clarke et al., 2021). Informal communication networks, often based on folklore and social interactions, facilitate the sharing of information and alerts within the community (Denner et al., 2025). Familiarity with established evacuation routes and safe shelters, developed over generations, enhances community resilience and disaster response. From a psychological perspective, communities with traditional knowledge show stronger resilience and quicker recovery from disaster trauma (Sandifer & Walker, 2018; Sugiyama et al., 2020). In contrast, villages without traditional knowledge may be poorly prepared, leading to a greater reliance on external sources. Regarding environmental sustainability, villages with traditional knowledge generally maintain a more harmonious relationship with nature, prioritizing the sustainability of natural resources. In contrast, villages abandoned this tradition tend to exploit the environment more without paying attention to long-term impacts, increasing vulnerability to disasters in the future.

Our study also highlighted that altruism is a fundamental basis for forming social resilience. Altruism strengthens social networks and plays a key role in boosting communities' ability to face and recover from natural disasters (Boella et al., 2019; Castañer & Oliveira, 2020; Mwangi, 2017). Furthermore, the combination of altruism, shared values, and local wisdom is an unshakable foundation for maintaining community sustainability amidst natural threats (Gualda, 2022). When individuals engage in altruistic behaviors, such as helping neighbors or participating in community support initiatives, they foster trust and cooperation among community members. A study supported that the sense of solidarity creates robust social ties that are vital during crises, as people are more likely to rely on one another for assistance and resources (Rose et al., 2022). Altruism also encourages the sharing of information and resources, which can lead to more effective disaster preparedness and response strategies (Y. Ma et al., 2021). Furthermore, communities characterized by strong altruistic values tend to have established support systems that facilitate quicker recovery after disasters. Overall, altruism not only enhances social cohesion but also cultivates an environment where collective resilience thrives, enabling communities to navigate the challenges posed by natural disasters more effectively. During the study, we also found that togetherness and family values make it possible to create a strong and coordinated response in facing Merapi crises.

Our study also documented that values of togetherness and kinship within the Merapi Slope community play a pivotal role in enhancing social ties and improving resilience during crises. The study supported that these values foster a strong sense of belonging among community members, encouraging them to support one another in times of need (Wang et al., 2022). In this context, when individuals feel connected to their neighbors, they are more likely to collaborate on disaster preparedness initiatives, share resources, and participate in collective decision-making processes. This communal spirit not only strengthens social networks but also cultivates a culture of mutual assistance, where residents are willing to help each other during emergencies (Smith et al., 2024). As a result, the community becomes more adept at responding to challenges posed by Merapi disasters, ultimately leading to quicker recovery and less disruption to daily life. The role of government is essential in supporting these community values and enhancing resilience (Zhai & Lee, 2023). Government agencies can implement policies that promote community engagement and collaboration by recognizing the importance of togetherness and kinship (Partelow, 2021). This includes facilitating training programs on disaster preparedness that leverage local knowledge and encourage participation from residents (Hargono et al., 2023). Additionally, the government can provide resources and support for community-led initiatives, such as establishing early warning systems or organizing regular drills that strengthen communal bonds (Goniewicz et al., 2023). Integrating community values into disaster management strategies can strengthen the resilience of the Merapi Slope community, helping them better prepare for future crises while preserving their cultural heritage.

This study faces several limitations that impact the generalizability and depth of its analysis. First, the research's focus on just four villages on the slopes of Merapi limits the ability to generalize the findings, as social, economic, and cultural conditions may vary in other villages. Second, the impact of

modernization and urbanization on the sustainability of altruism and cooperation practices has not yet been fully explored. Hence, the influence of social change on traditional values and community resilience still needs to be studied in more depth. Third, although the ethnographic approach offers in-depth insights, the narratives are limited to the subjective perspectives of selected informants, meaning the data may not represent the broader community's views.

Conclusions

This ethnographic study makes three distinct theoretical contributions to community resilience scholarship by examining *gotong royong* as culturally embedded social capital in volcanic disaster contexts. It shows that bonding social capital in traditional communities operates through culturally institutionalized mechanisms integrating behavioral norms, spiritual values, and institutional structures, challenging Western frameworks that typically separate these domains. The research also demonstrates that social capital alone is insufficient, identifying leadership effectiveness, resource accessibility, and institutional support as essential mediating factors, while methodological contributions validate traditional ecological knowledge through empirical cross-validation with instrumental monitoring systems, establishing complementary knowledge integration within debates about decolonizing disaster risk reduction.

Several limitations require acknowledgment, including the four-village geographic scope that limits transferability and selection bias toward active community participants, which may overestimate cooperation effectiveness. Traditional knowledge validation revealed interpretation inconsistencies and generational knowledge gaps, while documented challenges such as internal conflicts, resource constraints, bureaucratic coordination delays, and institutional skepticism demonstrate systematic obstacles. Future research should conduct quantitative evaluations, comparative ethnographic studies, longitudinal mixed-methods approaches tracking the evolution of *gotong royong*, and testing hybrid early warning systems integrating validated traditional indicators with formal monitoring protocols.

Acknowledgments

This study was funded by the Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi (Kemdikbudristek), Republik Indonesia, whose financial support made this research possible. We have obtained permission from all acknowledged individuals and entities to include their contributions in this manuscript.

References

- Andreastuti, S. D., Paripurno, E. T., Subandriyo, S., Syahbana, D. K., & Prayoga, A. S. (2023). Volcano disaster risk management during crisis: Implementation of risk communication in Indonesia. *Journal of Applied Volcanology*, *12*(1), 3. <https://doi.org/10.1186/s13617-023-00129-2>
- Appleby-Arnold, S., Brockdorff, N., & Callus, C. (2021). Developing a "culture of disaster preparedness": The citizens' view. *International Journal of Disaster Risk Reduction*, *56*, 102133. <https://doi.org/10.1016/j.ijdrr.2021.102133>
- Arianti, N. K., & Koentjoro, K. (2023). Volunteer altruistic behaviour in terms of disaster threat type. *Jâmbá Journal of Disaster Risk Studies*, *15*(1). <https://doi.org/10.4102/jamba.v15i1.1478>
- Ayuningtyas, D., Windiarti, S., Hadi, M. S., Fasrini, U. U., & Barinda, S. (2021). Disaster Preparedness and Mitigation in Indonesia: A Narrative Review. *Iranian Journal of Public Health*. <https://doi.org/10.18502/ijph.v50i8.6799>
- Boella, G., Calafiore, A., Grassi, E., Rapp, A., Sanasi, L., & Schifanella, C. (2019). FirstLife: Combining Social Networking and VGI to Create an Urban Coordination and Collaboration Platform. *IEEE Access*, *7*, 63230–63246. <https://doi.org/10.1109/ACCESS.2019.2916578>
- Braun, V., & Clarke, V. (2021). *Thematic Analysis: A Practical Guide*. Sage Publications.

- Bui, B. K. H., Anglewicz, P., & VanLandingham, M. J. (2021). The impact of early social support on subsequent health recovery after a major disaster: A longitudinal analysis. *SSM - Population Health, 14*, 100779. <https://doi.org/10.1016/j.ssmph.2021.100779>
- Castañer, X., & Oliveira, N. (2020). Collaboration, Coordination, and Cooperation Among Organizations: Establishing the Distinctive Meanings of These Terms Through a Systematic Literature Review. *Journal of Management, 46*(6), 965–1001. <https://doi.org/10.1177/0149206320901565>
- Clarke, B. J., E. L. Otto, F., & Jones, R. G. (2021). Inventories of extreme weather events and impacts: Implications for loss and damage from and adaptation to climate extremes. *Climate Risk Management, 32*, 100285. <https://doi.org/10.1016/j.crm.2021.100285>
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (4th ed.). SAGE Publications.
- Denner, N., Koch, T., Viererbl, B., & Ernst, A. (2025). Feeling connected and informed through informal communication: A quantitative survey on the perceived functions of informal communication in organizations. *Journal of Communication Management, 29*(1), 71–93. <https://doi.org/10.1108/JCOM-06-2024-0085>
- Elysia, V., & Wihadanto, A. (2018). The Sister Village Program: Promoting Community Resilience after Merapi Eruption. *The Indonesian Journal of Planning and Development, 3*(1), 32. <https://doi.org/10.14710/ijpd.3.1.32-43>
- Fan, F. (2018). Can animals predict earthquakes?: Bio-sentinels as seismic sensors in communist China and beyond. *Studies in History and Philosophy of Science Part A, 70*, 58–69. <https://doi.org/10.1016/j.shpsa.2018.05.009>
- Firdaus, A., Lestari, F., Afiff, S. A., & Herdiansyah, H. (2023). Integration of knowledge and local wisdom for disaster resilience in Anak Krakatau volcano. *Jambá Journal of Disaster Risk Studies, 15*(1). <https://doi.org/10.4102/jamba.v15i1.1457>
- Garstang, M., & Kelley, M. (2017). Understanding Animal Detection of Precursor Earthquake Sounds. *Animals, 7*(9), 66. <https://doi.org/10.3390/ani7090066>
- Goniewicz, K., Sarker, M. N. I., & Schoch-Spana, M. (2023). Reimagining natural hazards and disaster preparedness: Charting a new course for the future. *BMC Public Health, 23*(1), 581, s12889-023-15497-y. <https://doi.org/10.1186/s12889-023-15497-y>
- Gualda, E. (2022). Altruism, Solidarity and Responsibility from a Committed Sociology: Contributions to Society. *The American Sociologist, 53*(1), 29–43. <https://doi.org/10.1007/s12108-021-09504-1>
- Günel, G., & Watanabe, C. (2024). Patchwork ethnography. *American Ethnologist, 51*(1), 131–139. <https://doi.org/10.1111/amet.13243>
- Hargono, A., Artanti, K. D., Astutik, E., Widodo, P. P., Trisnawati, A. N., Kusuma Wardani, D., & Lioni, E. (2023). Relationship between disaster awareness and disaster preparedness: Online survey of the community in Indonesia. *Journal of Public Health in Africa, 14*(9), 8. <https://doi.org/10.4081/jphia.2023.2376>
- Heanoy, E. Z., & Brown, N. R. (2024). Impact of Natural Disasters on Mental Health: Evidence and Implications. *Healthcare, 12*(18), 1812. <https://doi.org/10.3390/healthcare12181812>
- Hidayati, D. (2008). Kesiapsiagaan masyarakat: Paradigma baru pengelolaan bencana alam di Indonesia. *Jurnal Kependudukan Indonesia, 3*(1), 69–84.
- Koopman, J. (2023). Subawe, traditional knowledge, and faith-based organisations promoting social capital and disaster preparedness: A Lombok, Indonesia case study. *International Journal of Disaster Risk Reduction, 94*, 103837. <https://doi.org/10.1016/j.ijdrr.2023.103837>
- Lalani, N., Drolet, J. L., McDonald-Harker, C., Brown, M. R. G., Brett-MacLean, P., Agyapong, V. I. O., Greenshaw, A. J., & Silverstone, P. H. (2021). Nurturing Spiritual Resilience to Promote Post-disaster Community Recovery: The 2016 Alberta Wildfire in Canada. *Frontiers in Public Health, 9*, 682558. <https://doi.org/10.3389/fpubh.2021.682558>
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. SAGE Publications.
- Ma, C., Qirui, C., & Lv, Y. (2023). “One community at a time”: Promoting community resilience in the face of natural hazards and public health challenges. *BMC Public Health, 23*(1), 2510. <https://doi.org/10.1186/s12889-023-17458-x>

- Ma, Y., Zhu, W., Zhang, H., Zhao, P., Wang, Y., & Zhang, Q. (2021). The Factors Affecting Volunteers' Willingness to Participate in Disaster Preparedness. *International Journal of Environmental Research and Public Health*, *18*(8), 4141. <https://doi.org/10.3390/ijerph18084141>
- Meier Zu Verl, C., & Meyer, C. (2024). Ethnomethodological ethnography: Historical, conceptual, and methodological foundations. *Qualitative Research*, *24*(1), 11–31. <https://doi.org/10.1177/14687941221129798>
- Mutiarni, Y. S., Nakamura, H., & Bhattacharya, Y. (2022). The Resilient Community: Strengthening People-Centered Disaster Risk Reduction in the Merapi Volcano Community, Java, Indonesia. *Sustainability*, *14*(4), 2215. <https://doi.org/10.3390/su14042215>
- Mwangi, O. G. (2017). Neo-elitism and counterterrorism operations in Kenya. *African Security Review*, *26*(1), 12–25. <https://doi.org/10.1080/10246029.2016.1264436>
- Okazaki, K., & Shaw, R. (2003). Empowerment of local people for sustainable disaster mitigation. *Regionale Development Dialogue*, *24*(1).
- Partelow, S. (2021). Social capital and community disaster resilience: Post-earthquake tourism recovery on Gili Trawangan, Indonesia. *Sustainability Science*, *16*(1), 203–220. <https://doi.org/10.1007/s11625-020-00854-2>
- Rahmani, M., Muzwagi, A., & Pumariega, A. J. (2022). Cultural Factors in Disaster Response Among Diverse Children and Youth Around the World. *Current Psychiatry Reports*, *24*(10), 481–491. <https://doi.org/10.1007/s11920-022-01356-x>
- Rau, G., & Shih, Y.-S. (2021). Evaluation of Cohen's kappa and other measures of inter-rater agreement for genre analysis and other nominal data. *Journal of English for Academic Purposes*, *53*, 101026. <https://doi.org/10.1016/j.jeap.2021.101026>
- Rose, L., Dezechache, G., Powell, T., Chokron, S., & Kovarski, K. (2022). The Emergency of Prosociality: A Developmental Perspective on Altruism and Other Prosocial Behavior in the Face of Disaster. *Current Directions in Psychological Science*, *31*(6), 486–492. <https://doi.org/10.1177/09637214221114090>
- Saber, M., Kantoush, S. A., Abdel-Fattah, M., Sumi, T., Moya, J. A., & Abdrabo, K. (2022). Flash Flood Modeling and Mitigation in Arid and Semiarid Basins: Case Studies from Oman and Brazil. In T. Sumi, S. A. Kantoush, & M. Saber (Eds.), *Wadi Flash Floods* (pp. 355–381). Springer Singapore. https://doi.org/10.1007/978-981-16-2904-4_13
- Sandifer, P. A., & Walker, A. H. (2018). Enhancing Disaster Resilience by Reducing Stress-Associated Health Impacts. *Frontiers in Public Health*, *6*, 373. <https://doi.org/10.3389/fpubh.2018.00373>
- Saputri, A. P., & Sari, K. P. (2022). Emergency Education Principles Child Friendly Based in Sister Village System Implementation (Mitigation of Mount Merapi Eruption Disaster). *Urecol Journal. Part H: Social, Art, and Humanities*, *2*(1), 36–43. <https://doi.org/10.53017/ujsah.158>
- Sari, K. P., Oktradiksa, A., Setyawan, A., & Priyo, P. (2023). The Recontingencies of Merapi Eruption Disasters in Implementation of Sister Village. *Journal of Community Services and Engagement: Voice of Community (VOC)*, *2*(1), 29–38. <https://doi.org/10.23917/voc.v2i1.1258>
- Schmeller, D., Kille, L., & Marmouyet, F. (2021, January 18). Mountains, a fragile source of life [Web Ilmiah]. *The Conversation*. <https://doi.org/10.64628/AAK.5xwnkkmpy>
- Schwartz-Marin, E., Merli, C., Rachmawati, L., Horwell, C. J., & Nugroho, F. (2022). Merapi multiple: Protection around Yogyakarta's celebrity volcano through masks, dreams, and seismographs. *History and Anthropology*, *33*(5), 588–610. <https://doi.org/10.1080/02757206.2020.1799788>
- Smith, N., Donaldson, M., Mitton, C., & Lee, E. (2024). Communication in disasters to support families with children with medical complexity and special healthcare needs: A rapid scoping review. *Frontiers in Public Health*, *12*, 1229738. <https://doi.org/10.3389/fpubh.2024.1229738>
- Sugiura, M., Nouchi, R., Honda, A., Sato, S., Abe, T., & Imamura, F. (2020). Survival-oriented personality factors are associated with various types of social support in an emergency disaster situation. *PLOS ONE*, *15*(2), e0228875. <https://doi.org/10.1371/journal.pone.0228875>
- Sugiyama, C., Niikawa, Y., Ono, H., Ito, D., Sato, T., Inoue, Y., & Koseki, S. (2020). School-Based Intervention Program Based on Cognitive Behavioral Therapy for Japanese Students Affected by the Hiroshima Heavy Rain Disaster of July 2018. *Japanese Psychological Research*, *62*(2), 151–158. <https://doi.org/10.1111/jpr.12282>

- Sutikno, S., Widiyanto, W., Santosa, L. W., Kurniawan, A., & Purwanto, T. H. (2020). Distribution of natural resources and population density in the merapi volcano area. *Indonesian Journal of Geography*, 35(2), 55. <https://doi.org/10.22146/ijg.57270>
- Tariq, H., Pathirage, C., & Fernando, T. (2021). Measuring community disaster resilience at local levels: An adaptable resilience framework. *International Journal of Disaster Risk Reduction*, 62, 102358. <https://doi.org/10.1016/j.ijdrr.2021.102358>
- Troll, V. R., Deegan, F. M., & Seraphine, N. (2021). Ancient oral tradition in Central Java warns of volcano–earthquake interaction. *Geology Today*, 37(3), 100–109. <https://doi.org/10.1111/gto.12350>
- Wang, W., Foutz, N. Z., & Gao, G. (Gordon). (2022). Huddling with families after disaster: Human resilience and social disparity. *PLOS ONE*, 17(9), e0273307. <https://doi.org/10.1371/journal.pone.0273307>
- Wardyaningrum, D. (2019). Communication of Local People about Myths of Merapi Mountain in Disaster Mitigation. *Jurnal Komunikasi Indonesia*, 3(1). <https://doi.org/10.7454/jki.v3i1.10245>
- Yang, Z., Chen, S., Liu, Q., & Chen, L. (2023). Water Temperature Changes Related to Strong Earthquakes: The Case of the Jinjia Well, Southwest China. *Water*, 15(16), 2905. <https://doi.org/10.3390/w15162905>
- Zhai, L., & Lee, J. E. (2023). Analyzing the Disaster Preparedness Capability of Local Government Using AHP: Zhengzhou 7.20 Rainstorm Disaster. *International Journal of Environmental Research and Public Health*, 20(2), 952. <https://doi.org/10.3390/ijerph20020952>