

Strengthening Community-Based Disaster Health Emergency Response Through University–Community Collaboration: A Participatory Action Research

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ABSTRACT

Disasters pose major public health challenges by disrupting health services, increasing disease risks, and reducing community response capacity. Strengthening community-based emergency health response systems requires collaboration among multiple stakeholders, including universities through the implementation of the Tri Dharma of Higher Education. This study aimed to develop and evaluate a university-community collaboration model to strengthen disaster emergency health response through community empowerment. A Participatory Action Research (PAR) approach was conducted with 80 participants, including health cadres, community leaders, disaster volunteers, village officials, health workers, lecturers, and students. Interventions comprised disaster health education, first aid training, risk communication, emergency response simulations, the establishment of disaster preparedness health cadres, and continuous mentoring. Data were collected through questionnaires, observations, interviews, and focus group discussions, then analyzed using quantitative and qualitative methods. Results demonstrated significant improvements in disaster health knowledge, preparedness attitudes, emergency response skills, and overall community preparedness ($p < 0.001$). The intervention also established a disaster health coordination forum, community action plans, disaster preparedness health cadres, and stronger collaborative networks among universities, communities, health facilities, and local governments. The collaborative model effectively enhanced community capacity and institutional preparedness, strengthening sustainable disaster health response systems. This model is adaptable for implementation in other disaster-prone areas with consideration of local contexts.

Keywords: Participatory Action Research, Disaster Preparedness, Community Empowerment, Health Emergency Response, University–Community Collaboration



INTRODUCTION

Natural and non-natural disasters remain an increasingly complex global challenge for health systems in various countries. Climate change, uncontrolled urbanization, environmental degradation, and increased population mobility have contributed to the increasing frequency and intensity of various disasters, such as floods, earthquakes, landslides, tsunamis, disease outbreaks, and other health crises. The World Health Organization reported that throughout 2023 there were 72 health emergencies requiring an international response, indicating that the threat of disasters and health crises continues to increase and requires strengthening the capacity of global health systems (World Health Organization, 2023). The impacts include not only loss of life and physical injury, but also mental health disorders, an increased risk of infectious diseases, damage to health facilities, and disruption of basic health services for the community (World Health Organization, 2024).

From a public health perspective, a disaster is an event that has the potential to significantly disrupt the functioning of a health system. Damage to health facilities and disruption to access to services can increase community vulnerability to infectious diseases, mental health problems, malnutrition, and even increase morbidity and mortality rates. Therefore, the WHO developed the Health Emergency and Disaster Risk Management (Health EDRM) approach, which emphasizes the importance of integrated prevention, preparedness, response, and recovery efforts to strengthen the resilience of health systems and communities to various disaster threats (World Health Organization, 2025).

Indonesia is one of the countries with the highest disaster risk levels in the world due to its location at the confluence of three major tectonic plates: the Eurasian, Indo-Australian, and Pacific. This geographic location results in a high potential for earthquakes, tsunamis, and volcanic activity. Furthermore, climate change is increasing the incidence of hydrometeorological disasters such as floods, landslides, and extreme weather, which directly impact public health. Sofyana et al. (2024) showed that Indonesia experienced more than 5,400 disasters in 2021, a significant increase compared to previous years, necessitating comprehensive, cross-sectoral management.

The high incidence of disasters in Indonesia presents various challenges in providing emergency health services. When disasters occur, there are often limitations in healthcare personnel, medical logistics, communication systems, transportation facilities, and access to affected areas. This situation causes delays in evacuation processes and healthcare services for victims. Furthermore, Indonesia's geographical characteristics as an archipelagic nation often pose operational challenges to the distribution of healthcare aid, particularly in remote and disaster-prone areas (Sofyana et al., 2024).

The evolving paradigm of disaster management demonstrates a shift in approach from one previously focused on government responses to a collaborative approach involving multiple stakeholders. In this new paradigm, communities are no longer positioned as recipients of aid, but rather as key actors involved in mitigation, preparedness, response, and post-disaster recovery. This approach is believed to increase the effectiveness of disaster management because communities are the first on the scene when a disaster occurs.

One widely applied approach to disaster risk reduction is Community-Based Disaster Risk Reduction (CBDRR). This approach emphasizes active community involvement in identifying risks, developing mitigation plans, enhancing preparedness, and developing response mechanisms tailored to local conditions. Research conducted by Budhiana et al. (2024) shows that social cohesion

and community attitudes significantly influence a community's level of tsunami preparedness. The higher a community's level of social cohesion, the better its ability to respond and adapt to disaster threats.

Community involvement in disaster management has also been shown to increase evacuation effectiveness, expedite the rescue process, and strengthen community resilience. Therefore, disaster risk reduction cannot rely solely on government capacity but requires collaboration with various institutions with relevant resources and competencies, including universities (Budhiana et al., 2024).

Universities hold a strategic position in the disaster management system, serving as educational, research, and community service providers. Through the implementation of the Tri Dharma Perguruan Tinggi (Three Pillars of Higher Education), universities have a responsibility to contribute to resolving various social issues, including strengthening community capacity to respond to health emergencies caused by disasters. Universities can serve as centers for knowledge development, innovation, and human resource providers to support community preparedness.

The contribution of universities to disaster management can be realized through various activities, such as disaster research, development of appropriate technology, preparation of risk assessments, volunteer training, health education, and community assistance in disaster-prone areas (Pramesti et al., 2023). Furthermore, student involvement in community service activities can be a potential resource in supporting the strengthening of community-based health preparedness and response. Findings by Sofyana et al. (2024) indicate that a Public Health Nursing-based disaster preparedness training model is effective in increasing community capacity in various aspects of disaster management, including knowledge, attitudes, emergency planning, early warning systems, and resource mobilization.

Despite this, various collaborative programs between universities and communities in the field of disaster management still face a number of challenges. Many community service activities are incidental and short-term, resulting in less sustainable impacts. Furthermore, coordination between universities, communities, healthcare facilities, and local governments is often suboptimal. As a result, universities' academic resources are not being fully utilized to support community-based health emergency response systems.

Another issue is the lack of an integrated partnership model between universities, communities, health facilities, and local governments to strengthen the emergency health response system for disasters. Most programs still focus on short-term education without ongoing mentoring, community capacity evaluation, or strengthening cross-sector collaborative networks. However, building community capacity requires a continuous process so that acquired skills and knowledge can be effectively applied when a disaster strikes.

From a public health perspective, community capacity building should be directed at enhancing first aid capabilities, community-based health surveillance, risk communication, emergency health post management, and referral systems in crisis situations. WHO (2025) emphasizes that community capacity building is a critical component in building public health resilience against various disaster threats and health emergencies.

Based on these conditions, a collaborative model is needed that integrates university academic resources with community capacity to strengthen the disaster health emergency response system. This model can be implemented through health education activities, preparedness training,



disaster simulations, the formation of disaster preparedness health cadres, and ongoing community mentoring. This approach is expected to improve community knowledge, skills, and preparedness, thus making them more responsive in dealing with health emergencies caused by disasters.

The novelty of this program lies in the development of a university-community collaboration model that integrates health education, community empowerment, and strengthening health emergency response networks within a sustainable community service framework. Unlike programs that generally focus on post-disaster response, this model emphasizes strengthening community capacity before a disaster occurs through ongoing partnerships. Thus, the developed model is expected to become a more applicable, participatory, and sustainable alternative disaster risk reduction strategy for building resilient communities to health emergencies caused by disasters.

METHODS

This study employed a Participatory Action Research (PAR) design to develop and evaluate a university–community collaboration model for strengthening community-based disaster health emergency response. PAR was selected because it emphasizes active participation and collaboration among researchers, community members, local authorities, and healthcare providers throughout the research process, including problem identification, collaborative planning, intervention implementation, reflection, and evaluation. This approach enables the co-creation of context-specific solutions while promoting community empowerment and sustainable disaster preparedness.

The study was conducted in Kuranji Village, Padang City, West Sumatra, Indonesia, an urban area recognized as one of the disaster-prone regions in Padang. The area is exposed to multiple natural hazards, including earthquakes, floods, landslides, and potential tsunami impacts due to its proximity to active tectonic faults and its geographical characteristics. Seasonal flooding caused by high rainfall and inadequate drainage systems frequently disrupts community activities and increases the risk of waterborne and vector-borne diseases. In addition, West Sumatra is located along the Sunda Megathrust subduction zone, making the region highly vulnerable to major seismic events that may trigger widespread health emergencies.

The community of Kuranji Village is characterized by heterogeneous socioeconomic conditions, with residents primarily engaged in small-scale trade, agriculture, private employment, and public services. Although previous disaster experiences have increased public awareness of disaster risks, variations remain in community knowledge, preparedness, emergency response capacity, and implementation of clean and healthy living behaviours during disasters. Community preparedness programs have largely focused on emergency response, while preventive public health measures, environmental sanitation, disease prevention, and coordinated community response remain relatively underdeveloped.

Health services in the study area are primarily provided through a Puskesmas, several Posyandu, village health cadres, and community-based health volunteers who play important roles in preventive and promotive health activities. However, these facilities continue to face challenges in disaster situations, including limited emergency preparedness training, insufficient logistical resources, and the need for stronger coordination among healthcare providers, disaster management agencies, universities, and local governments. Therefore, strengthening institutional collaboration and community participation is considered essential for improving disaster health emergency preparedness.

Kuranji Village was purposively selected as the intervention site because it represents a community with high disaster risk, previous disaster experience, active community organizations, and existing local health structures that provide opportunities for implementing sustainable community-based interventions. Furthermore, the availability of community leaders, health cadres, disaster volunteers, and local government support created a favourable environment for applying the Participatory Action Research approach. These characteristics make the area appropriate for evaluating the effectiveness of a university–community collaboration model in strengthening disaster health emergency response systems.

Participants were recruited using a purposive sampling technique to ensure the inclusion of individuals who play strategic roles in disaster preparedness and community health. Eligible participants included community leaders, village officials, health cadres, disaster volunteers, healthcare workers, lecturers, students involved in community service activities, and adult community representatives. The inclusion criteria were: (1) aged 18 years or older; (2) permanent residents or stakeholders actively involved in community disaster preparedness activities; (3) willing to participate throughout the intervention; and (4) providing written informed consent. Participants who failed to complete both the pretest and posttest assessments, withdrew during the intervention, or submitted incomplete questionnaires were excluded from the analysis.

The minimum sample size was estimated using the formula for paired mean comparison in a one-group pretest–posttest design with a significance level of 5%, statistical power of 80%, and an anticipated moderate effect size (Cohen's $d = 0.50$). The calculation indicated a minimum requirement of 64 participants. After considering a potential non-response rate of approximately 20%, the final recruitment target was increased, resulting in 80 participants, all of whom completed the study and were included in the final analysis.

The intervention was implemented through four sequential stages: community needs assessment, collaborative program planning, intervention implementation, and participatory evaluation. The needs assessment involved field observations, in-depth interviews, and focus group discussions to identify disaster-related health problems, existing community capacities, available local resources, and barriers to disaster health emergency response. The findings informed the development of educational modules covering disaster risk reduction, emergency first aid, environmental sanitation, communicable disease prevention, risk communication, community-based health surveillance, emergency evacuation procedures, and management of temporary health posts. The intervention combined interactive lectures, small-group discussions, disaster simulations, practical demonstrations, and continuous mentoring to strengthen community knowledge, preparedness, practical skills, and institutional collaboration.

Data were collected using a structured disaster health questionnaire, preparedness assessment questionnaire, observation checklists, interview guides, and focus group discussion protocols. The questionnaires were developed based on the Indonesian National Disaster Management Agency (BNPB) disaster preparedness guidelines, the Ministry of Health disaster health management guidelines, and relevant scientific literature. Content validity was assessed by three experts in disaster management, environmental health, and public health education, yielding satisfactory relevance for all questionnaire items (Item Content Validity Index ≥ 0.80). Prior to the study, the instruments were pilot-tested among 30 individuals from a neighbouring community



with similar characteristics, demonstrating good internal consistency with a Cronbach's alpha coefficient of 0.87.

Baseline data were collected before implementation of the intervention using pretest questionnaires, whereas post-intervention assessments were conducted immediately after completion of all educational sessions and simulation activities using the same instruments. Quantitative data were analyzed using IBM SPSS Statistics version 27.0. Descriptive statistics were used to summarize participant characteristics and study variables. The normality of continuous data was assessed using the Shapiro–Wilk test. Differences between pretest and posttest scores were analyzed using the paired-sample *t*-test for normally distributed data or the Wilcoxon signed-rank test for non-normally distributed variables. Qualitative data obtained from interviews and focus group discussions were analyzed using thematic analysis involving data transcription, coding, theme development, and interpretation. Data credibility was strengthened through triangulation of sources, methods, and investigators.

This study received ethical approval from the Health Research Ethics Committee of Medan State University under approval number No. 368/KEPK/2026 prior to data collection. All participants received written and verbal explanations regarding the study objectives, procedures, potential benefits, confidentiality, and their right to withdraw at any time without consequences. Written informed consent was obtained from every participant before enrolment, and all personal information was anonymized to ensure participant privacy and confidentiality throughout the study.

RESULTS

1. Characteristics of Research Participants

Table 1. Characteristics of Participants in the University–Community Collaboration Program in the Disaster Health Emergency Response System (n=80)

Characteristics	Frequency (n)	Percentage (%)
Gender		
Man	31	38.8
Woman	49	61.2
Participant Group		
Health cadres	24	30.0
Public figure	12	15.0
Disaster volunteers	16	20.0
Village/sub-district apparatus	10	12.5
Health workers	8	10.0
Students and lecturers	10	12.5
Experience Facing Disasters		
Once	58	72.5
Never	22	27.5

The composition of participants demonstrates the involvement of various strategic community elements that play a role in the health emergency response system. The predominance of health cadres and disaster volunteers demonstrates that the program reaches groups with significant potential to drive community-level preparedness. Most participants also have experience

dealing with disasters, allowing the training and mentoring process to be directly connected to real-life situations.

2. Changes in Disaster Health Knowledge

Table 2. Comparison of Knowledge Scores Before and After Intervention

Variables		Pre-test Mean $\pm$ SD	Post-test Mean $\pm$ SD	Mean Difference	p-value
Disaster	Health Knowledge	64.75 $\pm$ 8.94	84.63 $\pm$ 6.57	19.88	<0.001

The analysis showed that the disaster health education activities implemented through a university-community collaboration successfully improved participants' understanding of health risks, first aid, risk communication, and emergency response procedures. This improvement indicates that the materials provided effectively strengthened the community's disaster health literacy.

3. Changes in Community Attitudes and Preparedness

Table 3. Comparison of Attitude and Preparedness Scores Before and After Intervention

Variables	Pre-test Mean $\pm$ SD	Post-test Mean $\pm$ SD	p-value
Attitudes towards Disaster Preparedness	68.42 $\pm$ 9.12	86.35 $\pm$ 7.28	<0.001
Community Preparedness	62.18 $\pm$ 10.06	83.74 $\pm$ 8.11	<0.001

The program not only improved knowledge but also encouraged behavioral changes and participant preparedness in responding to health emergencies. Participants demonstrated increased commitment to participating in preparedness activities, understood the importance of community coordination, and were better prepared to deal with potential disasters in their areas.

4. Health Emergency Response Skills Enhancement

Table 4. Results of the Health Emergency Response Skills Assessment

Skill Categories	Before Intervention n (%)	After Intervention n (%)
Good	14 (17.5)	58 (72.5)
Enough	28 (35.0)	18 (22.5)
Not enough	38 (47.5)	4 (5.0)

First aid training, evacuation simulations, and emergency health post management had a significant impact on participants' practical skills. After the program, the majority of participants were able to perform initial emergency actions more accurately and in a structured manner. These findings demonstrate that practice-based and simulation-based approaches are effective in improving community response capacity.

5. Establishment of a University-Community Collaboration Network

Table 5. Achievements of Strengthening Collaborative Networks

Indicator	Before the Program	After the Program
Health emergency response coordination forum	Not yet available	Formed
Disaster preparedness health cadres	Not yet formed	25 active cadres
Community action plan	Not yet available	Composed



Routine emergency response simulation	There isn't any	Scheduled
University-health facility-government partnership	Limited	Integrated

One of the key findings of this study was the establishment of a more systematic collaboration mechanism between universities, communities, health facilities, and local governments. The existence of a coordination forum, disaster preparedness health cadres, and community action plans demonstrated that the program not only resulted in increased individual capacity but also strengthened institutions and the sustainability of the health emergency response system at the community level.

6. Qualitative Findings from FGD and Interview Results

Table 6. Main Themes of Qualitative Analysis Results

Theme	Key Findings
Increased risk awareness	People are more aware of the health threats caused by disasters.
Strengthening community capacity	Participants felt more confident in making their initial response.
Improved coordination	Communication between stakeholders becomes more structured.
Trust in universities	Universities are seen as strategic partners in strengthening preparedness.
Program sustainability	The community wants regular assistance and training.

Qualitative analysis showed that the program successfully built community ownership of disaster preparedness efforts. The collaboration fostered stronger relationships between the community and the university, while also increasing public trust in the community-based capacity-building program. Participants also assessed that continued mentoring was crucial for maintaining established preparedness.

Overall, the implementation of the university-community partnership model has proven effective in improving knowledge, attitudes, preparedness, and skills in disaster health emergency response. In addition to increasing individual capacity, the program has also successfully built a cross-sector collaborative network, which serves as a critical foundation for developing a more resilient and sustainable community-based health emergency response system.

DISCUSSION

1. Changes in Disaster Health Knowledge

The results showed a significant increase in participants' disaster health knowledge levels after participating in the university-community collaborative intervention program, with the mean score increasing from 64.75 ± 8.94 in the pre-test to 84.63 ± 6.57 in the post-test, with a mean difference of 19.88 and a p-value < 0.001 . The decrease in the standard deviation from 8.94 to 6.57 in the post-test also indicated homogenization of understanding among participants, reflecting the program's success in building a more equitable knowledge base across target groups.

This increased knowledge can be understood through the framework of Bandura's Social Learning Theory, which asserts that individuals acquire knowledge and skills through observation, imitation, and direct experience within a supportive social context. This program designs the learning process not only didactic but also through participatory methods that encourage

participants to learn from each other, health workers, and experienced volunteers. The learning context, relevant to real-world conditions and potential disasters in the participants' areas, also strengthens the process of more effective knowledge internalization.

This finding aligns with the research of Amini et al. (2024) which showed that a three-month structured training program effectively improved the knowledge of natural disaster volunteers with a significant mean difference ($p < 0.001$), and the effect of this increase was proven stable within three months post-intervention. The stability of this intervention effect strengthens the argument that systematically designed and sustainable educational programs have a more lasting impact than incidental education (Amini et al., 2024). Rajeswari et al. (2025) also reported that communities facilitated by community change agents experienced a 44.6% increase in disaster preparedness knowledge scores, with a significant positive correlation between knowledge, attitudes, and skills ($r = 0.52-0.54$, $p = 0.001$) (Rajeswari et al., 2025). These findings strengthen the role of community-based approaches in holistically improving knowledge in disaster-prone areas.

Susmini et al.'s (2022) research in Indonesia found that disaster preparedness education interventions significantly improved community knowledge in areas prone to strong winds ($p < 0.003$) (Susmini et al., 2022). The similarities in Indonesia's geographic context and disaster vulnerability reinforce the relevance of these findings to this study and emphasize that contextual, community-based interventions are an appropriate strategy for improving disaster health literacy in Indonesian communities.

The significant increase in knowledge in a relatively short time interval indicates that most participants had not previously received structured and comprehensive disaster health education. A clear "literacy gap" existed in the target community, which was effectively filled through an approach that integrated scientific materials with local experiences and context. The researchers assumed that the sustainability of this knowledge would be optimal if supported by regular reinforcement sessions and easily accessible educational media, given the varying characteristics of participants in terms of education level and access to information.

2. Changes in Community Attitudes and Preparedness

The intervention program resulted in significant changes in participants' attitudes and preparedness dimensions. The mean score for attitudes toward disaster preparedness increased from 68.42 ± 9.12 to 86.35 ± 7.28 ($p < 0.001$), while the community preparedness score increased from 62.18 ± 10.06 to 83.74 ± 8.11 ($p < 0.001$). The decrease in standard deviations for both variables at post-test indicates the formation of a more consistent and homogeneous collective understanding of the importance of disaster preparedness among participants who initially had diverse backgrounds and experiences.

This change in attitude can be explained through the Health Belief Model (HBM) developed by Rosenstock, which states that individuals are more likely to take preventive action when they perceive a threat as serious, relevant, and manageable. Through an educational program complemented by case studies of real disaster events and discussions based on local experiences, participants are encouraged to reevaluate their perceptions of disaster risk in their surrounding environment. This encourages a more proactive attitude toward preparedness efforts. The simulation and group discussion components of the program play a particular role in increasing participants' perceived self-efficacy regarding their ability to respond to emergency situations.



Rajeswari et al. (2025) reported a 39.4% improvement in attitudes in the intervention group compared to only 0.6% in the control group, confirming that a community-based approach with active facilitation is significantly more effective than a conventional approach without the involvement of community agents. Amini et al. (2024) also showed that structured training significantly improved disaster volunteer attitudes ($p = 0.001$), emphasizing the importance of integrating cognitive and affective aspects in a comprehensive training design (Amini et al., 2024; Rajeswari et al., 2025).

Fathoni et al. (2022) found in their study in Indonesia that the preparedness of healthcare workers in community health centers (Puskesmas) in disaster-prone areas still requires significant capacity building, particularly in coordination and emergency response procedures (Fathoni et al., 2022). This finding reinforces the urgency of similar programs that reach all levels of society in an inclusive manner, as was done in this study through the involvement of health cadres, community leaders, volunteers, village officials, healthcare workers, as well as students and lecturers.

Significant improvements in the attitudes and preparedness dimensions reflect the program's success in moving beyond mere cognitive aspects to deeper behavioral changes. Researchers assume that attitudinal changes formed through active, contextual, and experience-based learning processes will be more lasting than those stemming solely from one-way, informative education. The involvement of community leaders and cadres in the program also strengthened social norm changes that promote preparedness as a collective community value, not just an individual responsibility.

3. Improving Health Emergency Response Skills

The results of the health emergency response skills assessment showed a significant transformation. The proportion of participants with "Good" skills increased substantially from 17.5% (14 people) to 72.5% (58 people), while the "Poor" category experienced a drastic decrease from 47.5% (38 people) to only 5.0% (4 people). This shift in distribution illustrates a comprehensive capacity transformation from a predominance of incompetence to adequate ability to independently respond to health emergencies.

These skill changes can be understood through the framework of Experiential Learning Theory (Kolb, 1984), which emphasizes that skill mastery is achieved through an iterative learning cycle that includes concrete experience, observational reflection, abstract conceptualization, and active experimentation. The first aid training program, evacuation simulation, and emergency health post management implemented in this study comprehensively reflect this experiential learning cycle, allowing participants to integrate theoretical knowledge with skill practice in a realistic context.

Su et al. (2022) in their systematic review of nursing skills in various types of disasters emphasized that first aid, triage, emergency communication, and psychological support are critical competencies that all first responders, including trained laypersons, must possess (Su et al., 2022). This reinforces the relevance of the training material covered in this program, which covers standardized initial emergency actions.

Torres-Aguero et al. (2025) in their systematic review found that simulation-based training is effective in improving technical skills, confidence, and decision-making abilities in disaster situations, particularly in the domains of triage, evacuation, and general preparedness. The authors

asserted that integrating simulation into community training programs has the potential to reduce costs and increase the scale of emergency response (Torres-Aguero et al., 2025). These findings support the simulation approach implemented in this study, where participants have the opportunity to practice emergency response procedures in scenarios that closely approximate real-world conditions in their area.

Phattharapornjaroen et al. (2023) demonstrated that a three-level collaborative exercise in an emergency evacuation scenario significantly improved coordination and leadership skills among actors, which are crucial components of an effective multi-stakeholder emergency response (Phattharapornjaroen et al., 2023). The relevance of these findings to this study lies in the multi-stakeholder coordination dimension of the simulation, which involved cadres, volunteers, and health workers simultaneously in a single, integrated exercise scenario.

The significant improvement in skills within a relatively short period of time indicates that participants with direct experience in dealing with disasters more easily integrate new knowledge into real-world skills practice. Researchers assume that the effectiveness of skills training will be more optimal and sustainable if the program is supplemented with regular deliberate practice, given that motor and procedural skills tend to degrade without continuous practice. A regularly scheduled simulation agenda, as demonstrated in Table 5, is an important complement to maintaining established skills competency.

4. Establishment of University–Community Collaboration Network

One of the most strategic achievements of this research was the establishment of a systematic and structured collaboration mechanism between the university, the community, health facilities, and the local government. A health emergency response coordination forum was successfully established, 25 disaster preparedness health cadres were activated, community action plans were developed, emergency response simulations were regularly scheduled, and previously limited partnerships between stakeholders evolved into integrated ones. This institutional transformation transcended the impact of individual capacity and represented a strengthening of the community health emergency response system that was sustainable and could be maintained without relying solely on the presence of the research team.

The formation of this collaborative network can be analyzed through the perspective of the Community Resilience Framework, which emphasizes that community resilience to disasters is not solely determined by individual capacity, but rather by the quality of social networks, inter-agency coordination, and the availability of community resources that can be quickly activated in times of crisis. This program successfully strengthened all three foundations simultaneously: increasing individual capacity, strengthening social ties between stakeholder groups, and developing coordination mechanisms that can be activated when disasters occur.

Phattharapornjaroen et al. (2023) emphasized that a three-level collaborative exercise between health institutions, the government, and the community effectively built a more integrated coordination mechanism, reduced communication barriers between stakeholders, and strengthened situational leadership in emergency situations (Phattharapornjaroen et al., 2023). These findings mirror the results of the coordination forum established in this study, where various stakeholders previously operating separately now have a structured coordination platform.



Weinstein et al. (2025) reported that a train-the-trainer approach involving community leaders as change agents proved effective in building community resilience to the health impacts of climate change in vulnerable areas (Weinstein et al., 2025). This model is conceptually similar to the disaster preparedness health cadre development approach implemented in this study, where trained cadres are positioned as internal community capacity builders, ensuring the program's sustainability even after the university's direct involvement subsides.

Maddah et al. (2022) emphasized that Risk Communication and Community Engagement (RCCE) is a critical component of a health emergency response system because it ensures that individuals and communities are actively involved in the problem-solving process, enabling them to make informed decisions to protect their own health (Maddah et al., 2022). The establishment of a coordination forum, community action plan, and regular simulation schedule in this study are concrete manifestations of this RCCE principle, where communities are no longer the objects of intervention but rather active subjects in building their own health resilience.

From the perspective of the Tri Dharma of Higher Education, the university's involvement in this research not only fulfills its formal research function but also embodies its substantive and sustainable community service function. The university acts as a facilitator of scientific knowledge transfer, a community capacity builder, and a liaison between stakeholders, all of which are strategic contributions to building a more resilient community-based health emergency response system.

The establishment of a structured collaborative network is the strongest indicator of program sustainability, as institutional change tends to be more durable and harder to erode than changes in individual capacity alone. Researchers assume that the sustainability of this network depends heavily on the institutional commitment of each party, particularly local governments and health facilities, to allocate adequate resources and integrate these collaborative mechanisms into existing formal disaster management planning systems.

5. Qualitative Findings and Their Relationship to Quantitative Results

Qualitative analysis through FGDs and in-depth interviews produced five main themes that consistently reflect and reinforce the quantitative findings in Tables 2 to 5, namely: (1) increased risk awareness, (2) strengthened community capacity, (3) improved coordination, (4) trust in the university, and (5) expectations of program sustainability. This convergence between qualitative and quantitative data strengthens the internal validity of the study while deepening understanding of the mechanisms of change that occurred.

The theme of increased risk awareness is directly related to the findings in Table 2, which show that increased knowledge is a cognitive mechanism underlying changes in community perceptions of disaster threats. Communities that better understand the health risks posed by disasters tend to develop a higher level of vigilance toward potential threats in their surroundings. This finding aligns with the WHO (2025) view that comprehensive disaster health education is a key component in building proactive and sustainable community health resilience.

The theme of strengthening community capacity—marked by participants' increased confidence in conducting initial emergency responses—reflects the quantitative findings in Tables 3 and 4. A more proactive attitude toward disaster preparedness synergized with a significant increase in emergency response skills, creating a higher sense of self-efficacy among participants. Sofyana et al. (2024) emphasized that an integrated Public Health Nursing-based disaster

preparedness training model has proven effective in increasing community confidence and capabilities in various aspects of disaster management, including knowledge, attitudes, emergency planning, and resource mobilization.

The theme of improved coordination is directly related to the outcomes in Table 5, where previously fragmented inter-stakeholder communication developed into a more structured one through the establishment of a coordination forum. Budhiana et al. (2024) emphasized that social cohesion and collaborative attitudes are strong predictors of community disaster preparedness. Participants' experiences reporting improved cross-group communication and coordination post-program reinforce the quantitative findings regarding the formation of more integrated partnerships.

The theme of trust in universities indicates that the presence of academic institutions as active partners—not merely providers of incidental, one-way assistance—can build more meaningful and sustainable relationships with communities. Rajeswari et al. (2025) demonstrated that empowering local agents as facilitators proved more effective and contextual than a top-down approach from outside the community. The role of students and faculty as active partners in all stages of the program—not just as instructors—is a concrete implementation of this principle that successfully builds community trust.

The program's sustainability theme reflects participants' internalized awareness of the importance of capacity building as a continuous process, not a single event. Weinstein et al. (2025) emphasized that a community-based training model will only have long-term impact if supported by a regularly scheduled mentoring and reinforcement mechanism. The spontaneous emergence of the sustainability theme from participants without any prompting from researchers indicates that the program has successfully internalized the value of disaster preparedness as a genuinely felt community need.

Overall, these qualitative findings serve as process validation, deepening our understanding of the mechanisms of change detected in the quantitative data. Together, they confirm that the university-community collaboration program not only produced measurable changes in knowledge, attitudes, preparedness, and emergency response skills, but also created perceptual and relational transformations that serve as a critical foundation for long-term community resilience.

The consistency between qualitative and quantitative findings reflects the program's strong and accountable internal validity. The researchers assume that this alignment is not merely coincidental, but rather the result of a methodologically integrated program design that encompasses education, training, simulation, and networking components. Furthermore, the researchers assume that the university-community collaboration model developed in this study has the potential to be adapted and replicated in other disaster-prone areas, with adjustments to the local social, geographic, and cultural characteristics of each target community.

CONCLUSIONS

This study demonstrates that a participatory, community-based, university-community collaboration model is effective in comprehensively strengthening the disaster health emergency response system. The intervention program resulted in a significant increase in disaster health knowledge, with a mean score increasing from 64.75 to 84.63 ($p < 0.001$), accompanied by significant improvements in attitudes toward disaster preparedness (68.42 to 86.35; $p < 0.001$) and community



preparedness (62.18 to 83.74; $p < 0.001$). In the emergency response skills dimension, the proportion of participants categorized as “Good” increased substantially from 17.5% to 72.5%, while the proportion of participants categorized as “Poor” decreased sharply from 47.5% to 5.0%. These overall changes confirm that a community-based educational approach that integrates practical training, simulations, and ongoing mentoring can produce statistically and practically meaningful changes in capacity in the field.

Beyond individual capacity changes, the program also produced strategic and sustainable institutional outcomes, including the establishment of a health emergency response coordination forum, the activation of 25 disaster preparedness health cadres, the development of a community action plan, the regular scheduling of emergency response simulations, and the development of university-health facility-government partnerships from limited to integrated. Qualitative findings from focus group discussions (FGDs) and in-depth interviews reinforced the quantitative findings by identifying five key themes of change: increased risk awareness, strengthened community capacity, improved coordination among stakeholders, growing trust in the university as a strategic partner, and expectations for program sustainability. The convergence of qualitative and quantitative data reflects the program's strong internal validity and demonstrates that the changes are holistic, encompassing cognitive, affective, psychomotor, and relational dimensions.

Overall, the university-community collaboration model developed in this study has been shown to not only enhance individual capacity but also build the institutional foundations and cross-sector networks necessary to sustain community-based disaster preparedness. These findings provide strategic implications for the development of disaster risk reduction policies in Indonesia, particularly regarding the integration of universities as active and ongoing partners in the community health emergency response system, rather than simply implementing incidental programs. Replication of this model in other disaster-prone areas, with adjustments to local social, geographic, and cultural contexts, is recommended as a priority agenda in developing more inclusive and equitable community preparedness programs.

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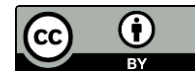
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