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Strengthening Public Health through Prioritization of Village Resilience Components Using the Quadrant of Difficulty-Usefulness Approach

Sunarto[1*], Heru Santoso Wahito Nugroho[1], Sulikah[1], Suparji[1], Aries Prasetyo[2], Setya Haksama[3]

[1]*Department of Midwifery, Health Polytechnic of the Ministry of Health Surabaya, Surabaya, Indonesia*

[2]*Departement of Environmental Sanitation, Health Polytechnic of the Ministry of Health Surabaya, Surabaya, Indonesia*

[3]*Disaster Management Graduate Program, Airlangga University, Surabaya, Indonesia*

Abstract

This study aims to evaluate the resilience of Disaster Resilient Villages (Destana) in Magetan Regency, East Java, Indonesia in facing public health crises due to disasters, and to map the priority of village resilience components using the Quadrant of Difficulty and Usefulness (QoDU) approach. This descriptive study took place over eight months in 32 villages, involving 640 respondents consisting of 20 active administrators per village. The evaluation was conducted using the PKD (Village Resilience Assessment) questionnaire which included 32 indicators and 128 questions, filled out through Focus Group Discussions (FGD), while determining the priority of components that had high benefits but were difficult to realize using the QoDU-VR (Quadrant of Difficulty-Usefulness Village Resilience Questionnaire) questionnaire. The results showed that 3 villages (9.4%) were in the primary category, 12 villages (37.5%) were in the middle category, and 17 villages (53.1%) were in the main category, with the district's resilience level at the middle level (score 80.06). The recovery preparedness component scored the lowest (69.94), followed by prevention and mitigation (70.75). Using the QoDU approach, the prevention and mitigation components were prioritized due to their high utility but difficulty in implementation, followed by the post-disaster recovery component. The study also found that disaster-resilient villages in the primary category were not yet fully capable of implementing prevention and mitigation measures, and that the majority of villages did not yet have a post-crisis recovery plan document. The QoDU approach helps establish strategic priorities in building public health resilience. These findings form the basis for strengthening public health through participatory studies based on component and sub-component prioritization strategies in further research.

Keywords: *Disaster, Public Health, Quadrant of Difficulty-Usefulness, Village Resilience.*

Introduction

The first village resilience assessment in Indonesia was conducted in 2019 by the National Disaster Management Agency (BNPB) as an annual program to support regional disaster management. The village resilience assessment framework adopted the village and sub-district disaster resilience standards in the Indonesian National Standard (SNI 8357:2017) and the Disaster Resilience of Place (DROP) model [1].

This study uses the PKD instrument, which consists of five components, namely:

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****Corresponding Author: sunartoyahyamuqaffi@gmail.com***

1. Basic services.
2. Disaster Management Regulations and Policies.
3. Prevention and Mitigation.
4. Emergency Preparedness.
5. Recovery Preparedness.

This instrument consists of 32 indicators and 128 questions. After conducting a resilience assessment, the score is used to determine the resilience category, namely: 1) Primary resilience score <58.33, 2) Middle resilience score 58.33-83.33, and 3) Main resilience score> 83.33. Based on the obtained score, recommendations are provided to increase resilience. Village capacity often has difficulty prioritizing which recommendations are prioritized to be implemented first, because there is no instrument that can be adopted. This research produces an instrument that can be used to measure the capacity to realize resilience, based on the level of difficulty and usefulness in the form of the QoDU-VR (Quadrant of Difficulty-Usefulness Village Resilience Questionnaire), with an I-CVI value of 0.92 [2].

Magetan Regency, East Java Province, Indonesia, has a total of 235 villages/sub-districts. As of mid-2024, only 30 villages/sub-districts (9.23%) had been designated as Disaster Resilient Villages (Destana). Of these, 14 villages/sub-districts were classified as primary, 12 as middle, and 4 as main [3]. However, none of these Destanas had documented health crisis contingency plans or a command structure for handling health crises resulting from disasters. As a result, village capacity to reduce the risk of health crises in the community remains limited, particularly in terms of identifying vulnerable health groups, mapping capacity, mapping risk areas for health crises, and mapping responses during health crises. This situation increases community vulnerability, such as high cases of stunting, malnourished infants and toddlers, anemia and low energy calorie pregnant women, elderly people with chronic diseases, difficulty accessing health services, and an increased risk of infectious diseases due to poor sanitation and overcrowding in evacuation sites [4].

In the long term, the various impacts of health vulnerability can lead to a decline in the achievement of public health indicators. Some indicators that indicate decline include: increasing rates of malnutrition, increasing prevalence of stunting, increasing morbidity and mortality, decreasing coverage of exclusive breastfeeding, and increasing cases of anemia among pregnant women and adolescents. These impacts contribute to socioeconomic losses, primarily due to high medical costs and decreased community productivity [5]. If not addressed promptly, community resilience to health crises caused by disasters will further weaken. This occurs because villages lack the capacity to prioritize activities that need to be implemented immediately to build health resilience through prevention, mitigation, and preparedness measures.

The low commitment of village governments to supporting disaster risk reduction programs, particularly in the public health sector, also hinders the overall strengthening of village resilience [6]. Previous research on the public health crisis response to disasters by the disaster health cluster generally focused on the emergency response phase, such as medical services, health logistics distribution, and victim referral systems [7]. This dominance of a curative approach indicates that the prevention, mitigation, and preparedness aspects of post-disaster public health recovery have not received adequate attention. This condition reflects that the capacity and potential of villages/sub-districts are not yet fully capable of ensuring public health resilience against disaster threats.

The urgency of this research lies in the importance of prioritizing resilience components or sub-components in realizing public health, based on recommendations from village resilience assessments. Each assessment result is always accompanied by

recommendations on components or sub-components that have not been implemented by existing capacity, because there are no specific guidelines regarding components and sub-components that need to be implemented immediately. Therefore, this research is very important to map priority components that have a high level of benefit but are difficult to implement, thereby encouraging more targeted and sustainable interventions in strengthening public health resilience. The novelty of this study lies in the use of the Quadrant of Difficulty-Usefulness (QoDU) approach in determining the priorities for developing village resilience in the health sector.

Materials and Methods

This descriptive study aims to identify the level of village resilience in facing health crises caused by disasters and map priority components that contribute to achieving this resilience, especially components that offer high benefits but are difficult to implement. This study was conducted for eight months, from March to October 2025, in 32 Disaster Resilient Villages (Destana) in Magetan Regency, East Java, Indonesia. The study sample consisted of 640 respondents, consisting of 20 respondents from each Destana. Respondents were selected purposively based on the following inclusion criteria: being an active administrator of the Destana Forum, representing village or sub-district officials, and being willing to participate by signing an informed consent. The variable studied was village resilience. The research instrument was a standardized village resilience assessment questionnaire consisting of 32 indicators with 128 questions from the National Disaster Management Agency (BNPB) [8]. To analyze priority recommendations in realizing village resilience, the Difficulty-Usefulness Questionnaire in Realizing Village Resilience (QoDU-VR) was used, which contained 26 questions according to the QoDU model, with an I-CVI of 0.92 [2]. Data collection was carried out by filling out questionnaires in focus group discussions (FGDs) in each village. To ensure the validity of the data, researchers also conducted field observations and secondary data reviews.

The collected data were analyzed descriptively to calculate the village resilience score and QoDU Analysis to prioritize the recommendations of the resilience assessment components that have difficulties to realize but have very high benefits. The results of the study in the form of the distribution of hazard type and health risks due to disasters are presented in the form of maps, the results of the village resilience assessment are presented in the form of tables, the QoDU analysis for component priorities is presented in the form of images, and narratives for easy understanding. All respondents were given an explanation of the objectives, benefits, and procedures of the study before filling out the questionnaire, and were asked to sign an informed consent as a form of agreement to participate in the study.

Results

Figure 1 presents a map of the distribution of hazard types in each disaster-resilient village studied. Of the 32 disaster-resilient villages, six (18.7%) are located in lowland areas, with floods as the most common hazard. Meanwhile, 26 (81.3%) are located in highland areas, with landslides as the most common hazard, followed by tornadoes and forest and land fires. Furthermore, only one (Bedagung Village) has a flash flood as the most common hazard.

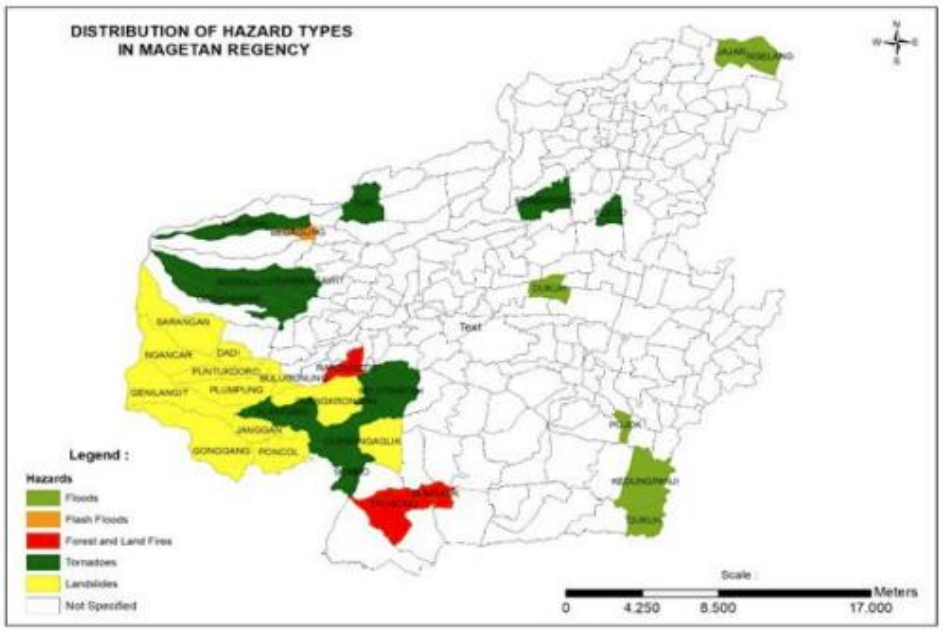

Figure 1. Map of the Distribution of Hazard types in 32 Disaster Resilient Villages in Magetan Regency

Table 1. Present village resilience scores based on the five main resilience components. Of the 32 villages/sub-districts assessed, 17 (53.1%) were classified as primary resilience, 12 (37.5%) as intermediate resilience, and 3 (9.4%) as primary resilience. The three villages in the primary category and the focus of resilience improvement are Dadi Village with a score of 54.8, Janggan Village with a score of 56.2, and Sumbersawit Village with a score of 20. Overall, disaster-resilient villages/sub-districts in Magetan Regency are in the intermediate category with an average score of 80.06. Of the five components assessed, the recovery preparedness component received the lowest average score of 69.94, followed by the prevention and mitigation component with a score of 70.75, based on a 20–100 scale.

Table 1. Scores for Each Resilience Component of 32 Villages/Sub-districts

No	Village	Resilience Components					Average Score	Category
		Basic Services	Disaster Management Regulations and Policies	Prevention and Mitigation	Emergency Preparedness	Recovery Preparedness		
1	Ngelang	87	100	87	97	100	94.2	Main
2	Jajar	87	100	87	100	100	94.8	Main
3	Alastuwo	96	100	72	87	95	90	Main
4	Randugede	84	88	73	93	85	84.6	Main
5	Dukuh	90	96	40	83	63	74.4	Middle
6	Pojok	89	84	72	87	40	74.4	Middle
7	Bungkuk	94	96	72	97	95	90.8	Main
8	Trosono	93	100	76	100	100	93.8	Main
9	Sombo	99	88	76	76	80	83.8	Main
10	Ngaglik	89	100	74	67	50	76	Middle
11	Turi	87	88	47	63	85	74	Middle

12	Sidomulyo	96	100	72	73	65	81.2	Middle
13	Selotinatah	91	100	76	100	65	86.4	Main
14	Dadi	76	32	73	73	20	54.8	Primary
15	Puntukdoro	91	100	76	100	100	93.4	Main
16	Sarangan	99	84	76	97	85	88.2	Main
17	Ngancar	91	88	73	80	95	85.4	Main
18	Genilangit	87	100	84	100	100	94.2	Main
19	Gonggang	90	92	84	100	100	93.2	Main
20	Plangkrongan	83	84	84	100	100	90.2	Main
21	Janggan	72	72	40	77	20	56.2	Primary
22	Kedungpanji	91	96	72	100	85	88.8	Main
23	Bedagung	93	100	72	83	70	83.6	Main
24	Kleco	87	92	83	97	40	79.8	Middle
25	Getasanyar	87	84	83	77	20	70.2	Middle
26	Cileng	84	64	87	80	20	67	Middle
27	Sumbersawit	20	20	20	20	20	20	Primary
28	Kembangan	83	100	74	100	100	91.4	Main
29	Ngiliran	89	92	76	73	50	76	Middle
30	Bulugunung	90	92	40	100	70	78.4	Middle
31	Poncol	91	96	72	97	60	83.2	Middle
32	Plumpung	69	80	71	67	60	69.4	Middle
Average		86.09	87.75	70.75	85.75	69.94	80.06	

Description: Main category > 83.33, Middle category 58.33-83.33, Primary category < 58.33

Figure 2 shows the distribution of disaster-related health risks in 32 disaster-resilient villages in Magetan Regency, East Java Province. Residents living in disaster-resilient villages in highland areas are predominantly at risk of experiencing health problems in the form of physical trauma due to landslides and tornadoes, as well as acute respiratory infections triggered by forest and land fires. Meanwhile, residents living in lowland areas prone to flooding are at risk of experiencing health problems in the form of skin diseases.

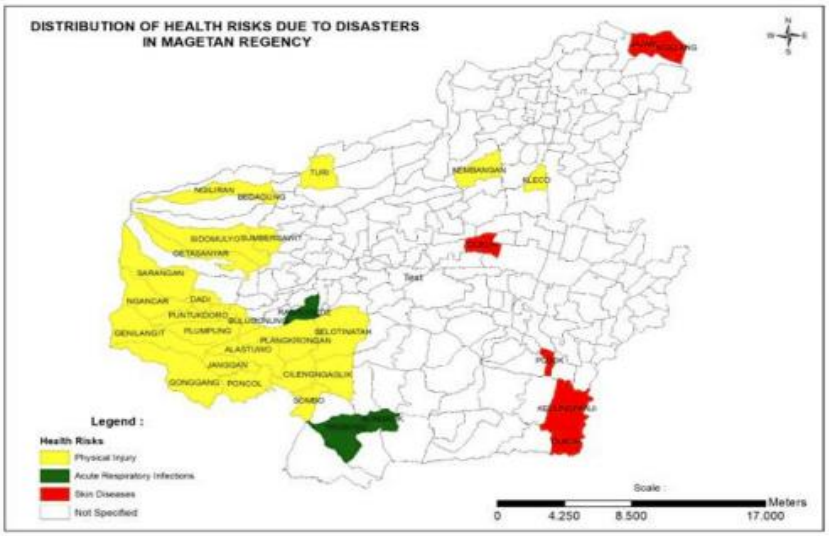

Figure 2. Map of the Distribution of Health Risks due to Disasters in 32 Disaster Desilient Villages in Magetan Regency

Figure 3. Presents a composite analysis of the five components of village resilience in dealing with public health crises due to disasters using the Quadrant of Difficulty-Usefulness (QoDU) approach. The prevention and mitigation component is designated as the top priority because it is in quadrant I. Meanwhile, the preparedness component in post-disaster recovery is ranked as the next priority because it is in quadrant II.

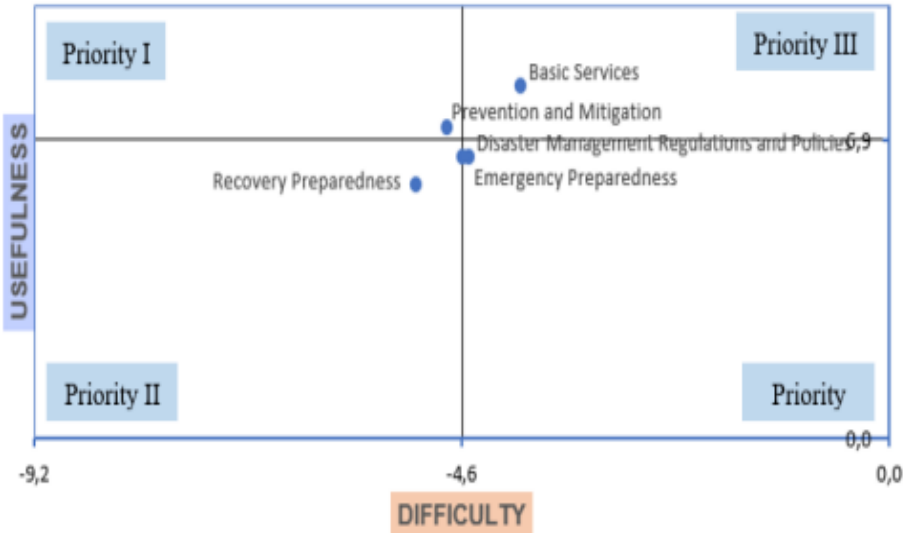

Figure 3. Results of the Priority Analysis of the Five Components of Village Resilience in a Composite Manner using the QoDU Approach

Figure 4. Presents the results of the analysis of the prevention and mitigation sub-components using the QoDU approach. The main priorities for immediate implementation in realizing public health resilience are the disaster health crisis management program, and the availability of evacuation routes and final evacuation sites. Meanwhile, Figure 5. Shows that the priority programs for the post-disaster recovery preparedness sub-component are capacity building activities in providing post-disaster public health services and ensuring the availability of post-disaster recovery plan documents.

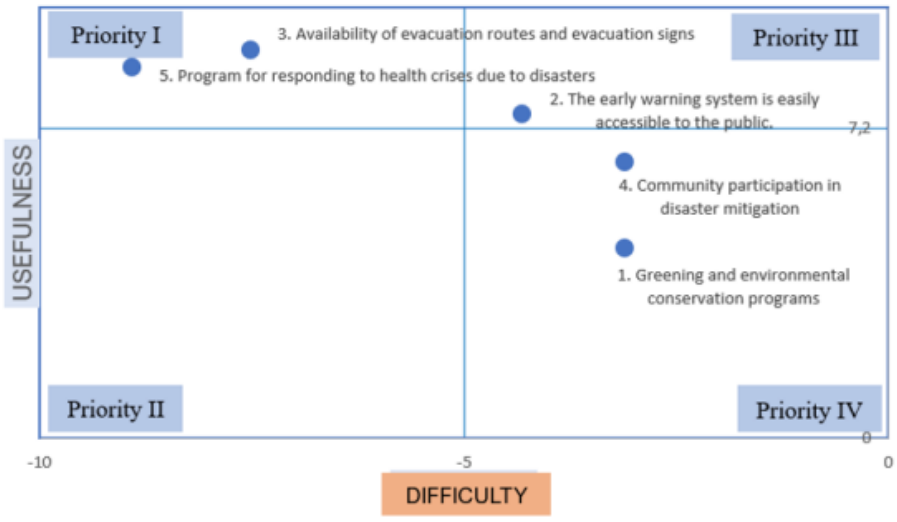

Figure 4. The Results of the Analysis of the Priority Sub-components of Prevention and Mitigation using the Quadrant of Difficulty and Usefulness (QoDU) Approach

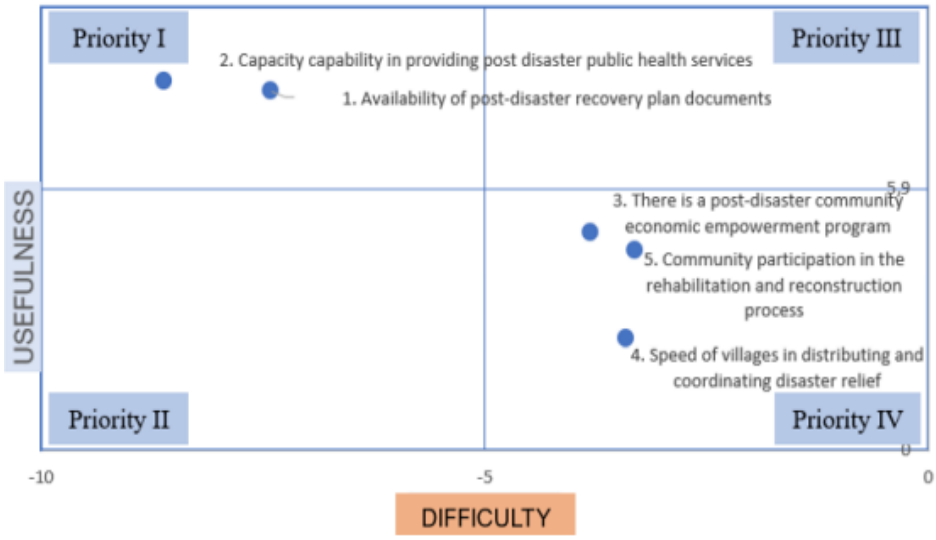

Figure 5. The Results of the Priority Analysis of Sub-components of Post-disaster Recovery Preparedness using the Quadrant of Difficulty and Usefulness (QoDU) Approach

Discussion

The resilience levels of the villages/sub-districts studied showed significant variation (Table 1). These differences were influenced by several factors, including government commitment, disaster management budget availability, institutional strength, facilities and infrastructure, basic service availability, resource capacity, number of vulnerable populations, level of community participation in disaster risk reduction activities, pentahelix collaboration, availability of early warning systems, routine response simulations, and the geographic and topographical conditions of the area [9]. These variations directly impact the ability of villages/sub-districts to maintain and improve the health of their communities. Several villages/sub-districts that have demonstrated resilience in maintaining public health stability include Ngelang and Jajar Villages in Kartoharjo District, Genilangit and Alastuwo Villages in Poncol District, Kedungpanji Village in Lembeyan District, and Bedagung Village in Panekan District. Meanwhile, other villages that are still in the primary and intermediate resilience categories still require further assistance to increase their capacity to protect public health in their areas from the threat of disasters.

Disaster-resilient villages with *madya* (intermediate) and *pratama* (basic) levels of resilience, based on observations and secondary data review, still face various weaknesses in preparedness. These shortcomings include limited collaboration in basic service components, disaster risk assessment documents and disaster management plans that are already outdated, the absence of regional risk maps, the lack of evacuation and contingency plans, infrequent emergency response simulations, and the absence of post-disaster recovery plans. This condition is generally caused by several factors, such as limited human resources and budget, low institutional capacity at the village level in managing documents and planning, insufficient technical assistance from relevant stakeholders, as well as the lack of awareness among village disaster risk reduction forums and communities regarding the importance of regularly updating data and conducting preparedness exercises.

The differences in health problems between lowland and highland areas can be explained by the characteristics of the dominant hazards in each region (Figure 1). In flood-prone lowland areas, prolonged standing water triggers high humidity and skin contact with contaminated water, resulting in more frequent skin diseases.

Conversely, in highland areas, the hazards of landslides, tornadoes, and forest and land fires pose a direct risk of physical trauma from falling material and wind exposure, as well as an indirect risk of acute respiratory infections from exposure to fire smoke. These findings align with similar studies in disaster-prone areas of Central Java and West Sumatra, which showed that flooding is more correlated with environmental-based diseases such as skin diseases and diarrhea, while forest fires and landslides cause more physical trauma and respiratory disorders [10]. This confirms that the dominant type of hazard in a region significantly determines the health risk profile of its population (Figure 2).

Field observations indicate that each village or sub-district has vulnerable community groups, such as the elderly, pregnant women, children, and people with disabilities. Therefore, a comprehensive mitigation approach is needed to reduce their vulnerability to health risks that may arise from disasters. Possible steps include: identifying the number and location of vulnerable groups, developing risk maps for vulnerable groups, educating and providing outreach regarding independent evacuation, and providing ongoing routine health services. Vulnerable groups, including people with disabilities, must be actively involved in the process of developing disaster management policies, including conducting emergency response simulations for health crises [11].

All of these approaches need to be integrated into disaster management plans and contingency plans at the village or sub-district level. Thus, mitigation efforts not only serve to reduce the physical impact of disasters but also serve as a key strategy in preventing health crises from the pre-disaster stage. The ultimate goal of this approach is to create more resilient and independent vulnerable groups in maintaining their health during crises [12]. However, the current challenge is that many disaster-resilient villages or sub-districts have not updated their disaster management plans and do not have specific contingency plans for disaster-related health crises. Furthermore, limited capacity to prepare documents and prioritize appropriate activities to protect vulnerable groups is also a significant obstacle to implementing this strategy.

One approach to addressing these issues is an analysis of the five main components of village resilience using the Quadrant of Difficulty-Usefulness (QoDU) method [13, 14]. The analysis using this method found that the prevention-mitigation and recovery preparedness components are the components with the highest level of utility, but the most difficult to implement (Figure 3). Within the prevention and mitigation components, the most urgent subcomponents requiring immediate implementation are the disaster health crisis management program, as well as the provision of evacuation routes and final evacuation locations. Both activities can be implemented through facilitation or assistance in the preparation of the Disaster Health Crisis Contingency Plan and Evacuation Plan documents. As a follow-up, facilitation is needed in the form of training in preparing operational plans followed by simulations, in order to ensure community preparedness and the effectiveness of the established health crisis response system (Figure 4).

Meanwhile, within the emergency response and recovery component, subcomponents that require immediate implementation include increasing the capacity of public health services during disasters and developing a Post-Disaster Recovery Plan (Figure 5). Implementation of these activities is the responsibility of the Disaster Risk Reduction Forum (FPRB) at the village or sub-district level. As a local capacity building platform, the forum must encourage active community participation in all activities, ensuring that every step taken aligns with the principles of community-based disaster risk reduction [15].

Activities that can be undertaken include training health cadres and village volunteers in first aid and triage for disaster victims, establishing a disaster preparedness health team at the village level, and developing standard operating procedures (SOPs) for minimum basic health services during a crisis. Furthermore, the development of the Post-Disaster Recovery Plan can be facilitated through a participatory mentoring process involving facilitators, the community, the village government, the local government (Regional Disaster Management Agency), and the health sector. This activity is then followed by a simulation to ensure preparedness and the effectiveness of the health response during a disaster.

These findings provide important implications that community-based disaster risk reduction (CBDRM) is crucial in enhancing community resilience to health threats during disasters [16]. Building village resilience cannot rely solely on administrative or regulatory achievements, but must also emphasize strengthening technical and participatory aspects. Similar research has reported that developing Disaster Resilient Villages through CBDRM can improve overall community preparedness, including in health aspects [11, 17]. Furthermore, a study on Disaster Preparedness Villages confirms that a community-based approach is an effective policy instrument in building a resilient and inclusive local response system. The CBDRM guidelines developed by the Indonesian Disaster Management Society (MPBI) also emphasize the importance of best practices derived directly from communities, such as risk mapping, community involvement in planning, and strengthening local capacity. As a follow-up, the Participatory Action Research (PAR) approach can be used to facilitate priority activities by encouraging active [18].

Various studies have shown similar patterns in addressing the challenges of building community health resilience. A study in Chile revealed that, while older adults have strategies for coping with crises in their daily lives, they still face limitations in their preparedness for large-scale disasters. Meanwhile, studies in Sierra Leone, India, and Kenya emphasize the importance of strong grassroots networks with cross-sectoral support to address disaster-induced health crises, although resource constraints and weak coordination remain major obstacles [19]. In Indonesia, the Participatory Action Research (PAR) approach has proven effective in increasing community capacity and preparedness through active involvement in developing contingency plans, designing simulated operational plans, conducting disaster-induced health crisis simulations, and mapping areas vulnerable to health crises [20]. This cross-study comparison reinforces the relevance of the finding that strengthening technical and participatory aspects of community participation is a key element in achieving sustainable village resilience.

The follow-up to the research findings was a six-day training program. This training is a strategic approach to building community health resilience to disaster-related crises. The training was designed using the Participatory Action Research method, emphasizing active community involvement in every stage of the activity [21]. Over the six days, participants, including village Disaster Risk Reduction Forum (FPRB) administrators, health cadres, volunteers, representatives from youth organizations, community leaders, community protection members, and village officials, were facilitated in developing disaster health crisis contingency plans, drill operations plans, evacuation plans, and post-disaster recovery plans. Furthermore, the training also covered technical materials such as first aid, triage of disaster victims, and the development of minimum standard operating procedures (SOPs) for basic health services during a crisis.

The total duration of the six-day training is approximately 48 hours, with approximately

eight hours allocated per day for both theory and practice. Practical activities can be conducted in a structured manner or independently. Each session combines theory, group discussions, local case studies, worksheet completion, and field practice, including simulations or drills as a form of preparedness testing. This approach not only equips participants with technical knowledge and skills but also strengthens community capacity in designing and implementing contextual and sustainable emergency response systems [22, 23] . Thus, this training serves as an important foundation for building health-based village resilience in a participatory and integrated manner.

The advantage of the Quadrant of Difficulty-Usefulness (QoDU) approach lies in emphasizing the difficulty aspect after first considering the level of usefulness of a component or subcomponent. In other words, the primary focus of the analysis is to identify components or subcomponents that have a high level of usefulness but are difficult to implement. This allows for the formulation of more strategic and impactful intervention priorities. Readers can immediately understand the position of each component through the points located in the four quadrants in the QoDU visualization. Components and subcomponents located in Quadrant I (top left) and Quadrant II (bottom left) are considered the top and second priorities, respectively, because they both demonstrate high usefulness, albeit with different implementation challenges.

In the context of strengthening village resilience in public health, the Quadrant of Difficulty-Usefulness (QoDU) approach offers a significant new state-of-the-art contribution. The main advantage of this approach lies in its ability to map intervention priorities based on two key dimensions: level of benefit and level of implementation difficulty. By placing the benefit aspect as the starting point of analysis, QoDU enables the identification of components or subcomponents that are highly beneficial but difficult to implement, thus becoming the primary focus in strategic planning. The four-quadrant visualization also makes it easier for readers or policymakers to intuitively identify intervention priorities. Components in Quadrant I (high benefit, high difficulty) and Quadrant II (low benefit, but high difficulty) automatically become the top and second priorities in strengthening [14, 24].

This approach has not been widely used in previous studies, particularly in the context of community-based public health resilience mapping in rural/urban areas. Therefore, the application of QoDU in this study not only provides a practical and contextual framework but also enriches the methodological repertoire in community-based disaster health crisis risk reduction studies. This approach bridges the gap between local perceptions and technical needs and encourages more participatory and evidence-based decision-making. This study has several limitations, including the limited coverage of 32 villages in Magetan Regency. Data collection was conducted through a structured questionnaire with a high I-CVI, facilitated by focus group discussions (FGDs), which limited the depth of qualitative exploration of local social and cultural dynamics. Nevertheless, this study still provides an important contribution to strategic and participatory decision-making to strengthen village resilience, grounded in public health.

Conclusion

This study shows that the level of resilience of Disaster Resilient Villages/Sub-districts in Magetan Regency still varies, although most have achieved the Main resilience category. Key strengths lie in the provision of basic services, the existence of disaster management regulations, and emergency preparedness, which arise from the villages/sub-districts being frequently affected by disasters. However, aspects of prevention, mitigation, and health recovery preparedness still require

strengthening, while the capacity of the village Disaster Risk Reduction Forum (FPRB) is not optimal in prioritizing assessment recommendations due to the lack of available guidelines. Using the Quadrant of Difficulty and Usefulness (QoDU) approach, resilience components and sub-components within Priority Quadrants I and II have been identified, with a primary focus on disaster health crisis management programs, providing final evacuation routes and locations, increasing health service capacity during disasters, and developing post-disaster recovery plan documents. The follow-up to this research is mentoring of the disaster risk reduction forum in the form of training for 6 days, 8 hours each day or equivalent to 48 hours of training.

Conflict of Interest

There is no conflict of interest with anyone in writing this article.

Acknowledgments

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Ethical Approval

This research has received ethics approval from the Health Research Ethics Committee of the Surabaya Ministry of Health Polytechnic, under number EA/3177/KEPK-Poltekkes_Sby/V/2025. All respondents received an explanation of the research objectives, benefits, and procedures before participating in the research activities, and were asked to sign an informed consent form as a sign of their willingness to participate in the research.

Data Availability

The data used in this study are available upon reasonable request to the corresponding author.

Author Contributions

- **Sunarto:** (Lead author and corresponding author): Contributed to the research idea and design, conducted field data collection, primary data analysis, and wrote the initial draft of the manuscript.
- **Heru Santoso Wahito Nugroho:** Responsible for field data collection, ensuring the quality and completeness of the research data, QoDU analysis, and interpreting the research results.
- **Sulikah:** Conducted a literature review and contributed to the development of the discussion section, including linking the research results to national policies on village resilience in facing health crises caused by disasters.
- **Suparji:** Involved in the development of the research methodology, instrument validity testing, and cross-sector coordination.
- **Aries Prasetyo:** Critically reviewed the entire manuscript, provided substantive input on the interpretation of the results, map creation, and approved the final version for publication.
- **Setya Haksama:** Contributed to data visualization and assisted in the preparation of the results and conclusions sections of the research.

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