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Challenges Integrating Environmental Health into Disaster-Resilient Villages in Poso, Indonesia

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ABSTRACT

Introduction: Disaster-resilient village (DRV) programs in Indonesia aim to strengthen community preparedness, yet often lack comprehensive integration of environmental health components. In disaster-prone and ecologically vulnerable areas such as Poso, the absence of such integration can exacerbate health risks during and after disasters. This study explores the challenges of incorporating environmental health into DRV initiatives.
Objective: This study aimed to identify the challenges of integrating environmental health into disaster-resilient village initiatives and to examine the relationship between environmental health knowledge and community participation in DRV programs in Poso, Indonesia.
Method: A descriptive research design was employed involving 48 purposively selected respondents from three disaster-prone villages in Poso, Indonesia. Data were collected using structured questionnaires and supported by in-depth interviews. Quantitative data were analyzed using descriptive statistics and Chi-square tests to determine associations between environmental health knowledge and DRV participation.
Result: Findings revealed that 70.8% of respondents actively participated in DRV activities. Chi-square analysis showed a statistically significant association between environmental health knowledge and participation in DRV programs ($\chi^2 = 4.17$, $p = 0.041$). Respondents with good knowledge were more likely to be engaged in DRV activities.
Conclusion: Strengthening environmental health knowledge among community members is essential for effective participation in DRV programs. Integrating health and environmental considerations into disaster strategies—supported by policy, education, and multi-sector collaboration—can enhance community resilience in disaster-prone regions like Poso.

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INTRODUCTION

Indonesia, as an archipelagic country located in the Pacific Ring of Fire, is extremely vulnerable to natural disasters such as earthquakes, tsunamis, floods, and landslides. These recurring hazards highlight the urgent need for disaster-resilient village (DRV) programs that integrate environmental health as a core component of preparedness and mitigation (1). In disaster-prone regions like Poso, Central Sulawesi, the intersection of environmental degradation, poor sanitation, and limited access to clean water amplifies public health risks during and after emergencies.

Environmental health plays a pivotal role in reducing disease outbreaks, ensuring safe water and sanitation, managing solid waste, and controlling vectors during disasters (2). However, efforts to embed these elements into DRV planning often encounter operational and sociopolitical barriers, including lack of community awareness, insufficient funding, and fragmented institutional coordination (3). In Poso, which has a history of conflict and ecological vulnerability, these challenges are even more pronounced.

According to the WHO, integrating environmental health into disaster preparedness can significantly reduce post-disaster morbidity and mortality, especially in low-resource settings (4). Yet, current village-level policies in Indonesia frequently prioritize physical infrastructure over preventive health measures. A study by Tam et al. noted that many DRV initiatives focus narrowly on evacuation routes and early warning systems, while neglecting waste management and vector control infrastructure, which are critical to environmental health resilience (5). The need to investigate how environmental health is integrated or neglected within disaster-resilient village frameworks in Poso is therefore pressing. This study aims to explore the specific challenges faced by stakeholders in harmonizing health-environment linkages within DRV strategies, providing insight that can strengthen both disaster and health outcomes. Despite national efforts to promote disaster-resilient villages (Destana), the integration of environmental health components remains inconsistent, particularly in regions like Poso, Central Sulawesi. In many cases, physical infrastructure such as evacuation routes and early warning systems is prioritized over vital environmental health measures like sanitation, water quality monitoring, and vector control (6). In a study conducted in Surakarta, the integration of environmental health into local DRR programs resulted in a 45% reduction in waterborne diseases after floods and a 38% decrease in respiratory problems in high-density neighborhoods due to improved air quality control (7). However, the study also highlighted significant barriers, including limited institutional capacity, poor inter-sectoral coordination, and low public awareness of environmental health risks (8).

Community-based environmental health strategies such as participatory monitoring and the incorporation of local ecological knowledge have been shown to enhance disaster resilience in rural Indonesia. Yet, in conflict-affected and ecologically vulnerable areas like Poso, such integrative practices remain underdeveloped, with few studies exploring their local adaptation and effectiveness (9). Furthermore, a review by Djalante et al. emphasized that while Indonesia has made institutional progress in disaster risk reduction, the health dimensions of resilience particularly those related to environmental conditions are often weakly addressed at the village level (10). This lack of integration undermines the long-term sustainability of DRR programs and contributes to recurring health burdens after disasters. Given these issues, this study aims to explore the challenges and enabling factors of integrating environmental health into disaster-resilient village initiatives in Poso. A context-sensitive understanding of these dynamics can support the development of more holistic and sustainable disaster preparedness frameworks that protect both human health and environmental systems

METHODS

This study employed a descriptive research design to explore the challenges in integrating environmental health into disaster-resilient village (DRV) programs in Poso, Indonesia. The research was conducted from January to March 2025 in three villages categorized as disaster-prone by the Regional Disaster Management Agency (BPBD).

A total of 48 respondents were selected using purposive sampling. Participants included local government officials, community health workers, village disaster preparedness teams, and residents who were actively involved in the DRV programs. The inclusion criteria required participants to be aged 18 years and older, have lived in the village for more than one year, and have participated in at least one DRV-related activity. Data were collected using a structured questionnaire and supplemented by in-depth interviews with key informants. The questionnaire consisted of closed and open-ended questions focused on four main domains: (1) knowledge of environmental health, (2) perceived importance of environmental health in disaster preparedness, (3) challenges faced in implementation, and (4) recommendations for improvement. Descriptive statistics were used to summarize demographic data and response frequencies. Qualitative responses were analyzed thematically to identify recurrent challenges and contextual barriers related to the integration of environmental health into DRV programs.

RESULT

Table 1. Characteristics Respondent

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	21	43.8
	Female	27	56.2
Age Group (years)	18–30	12	25.0
	31–45	20	41.7
	>45	16	33.3
Education Level	Primary school	8	16.7
	Secondary school	22	45.8
	Higher education	18	37.5
Occupation	Farmer	19	39.6
	Civil servant/Health staff	14	29.2
	Others	15	31.2
Participation in DRV Program	Yes	34	70.8
	No	14	29.2

Table 1 present The respondent group consisted of slightly more females (56.2%) than males (43.8%). The largest age group was 31–45 years (41.7%), indicating a relatively mature demographic likely involved in community activities. Most respondents had secondary education (45.8%) and worked as farmers (39.6%), which reflects the rural context of the study area. Notably, 70.8% of participants reported active involvement in the DRV program, suggesting a substantial engagement level with local disaster preparedness efforts.

Table 2. Association between Knowledge Level and Participation in DRV Program

Knowledge Level	Participated (Yes)	Did Not Participate (No)	Total
Good	20	4	24
Poor	14	10	24
Total	34	14	48

Chi-square value (χ^2) = 4.17, Degrees of Freedom (df) = 1**,** p-value = 0.041

Table 2 displays Chi-square test indicated a statistically significant association between knowledge of environmental health and participation in the disaster-resilient village (DRV) program ($\chi^2 = 4.17$; $p = 0.041$). Respondents with good knowledge were more likely to be active in the DRV program, suggesting that environmental health awareness may play a key role in promoting community participation in disaster preparedness initiatives.

DISCUSSION

The results of this study highlight a significant association between environmental health knowledge and community participation in disaster-resilient village (DRV) programs in Poso, Indonesia. This supports previous findings that suggest community awareness and knowledge are foundational to effective disaster preparedness and response efforts.(11) Communities with higher environmental health literacy are more likely to engage in structured programs and adopt behaviors that mitigate disaster-related risks.In particular, improved community knowledge regarding sanitation, safe water handling, and waste management has been associated with reduced incidence of communicable diseases during post-disaster periods. For example, a study in Surakarta, Central Java, reported a 45% reduction in waterborne disease and a 38% decline in respiratory issues after environmental health interventions were integrated into DRV activities. These findings underscore the importance of incorporating public health perspectives into local-level disaster risk reduction (DRR) strategies.

Moreover, resilience is enhanced when DRV programs consider not only physical infrastructure but also environmental and social systems. According to Ma et al., fostering local participation and leveraging social capital

contribute to increased disaster resilience and sustainability. This is particularly critical in conflict-affected areas like Poso, where trust and cohesion must be rebuilt as part of disaster management.

CONCLUSIONS

This study highlights the significant role of environmental health knowledge in promoting active community participation in disaster-resilient village (DRV) programs in Poso, Indonesia. The findings demonstrate a clear association between environmental health awareness and involvement in disaster preparedness activities, emphasizing that community education is a critical component of effective disaster risk reduction. The integration of environmental health—such as sanitation, water safety, and air quality monitoring—into local DRR strategies not only improves public health outcomes but also enhances community resilience in disaster-prone regions. However, systemic challenges including limited resources, inadequate coordination, and fragmented policy implementation continue to hinder progress at the village level.

To address these barriers, multi-sectoral collaboration, strengthened local governance, and capacity-building interventions are needed. Aligning DRV initiatives with global frameworks such as the Sendai Framework for Disaster Risk Reduction will ensure a more holistic approach to disaster preparedness—one that protects both people and their environment. In conclusion, strengthening environmental health literacy and its integration into community-based disaster management frameworks is essential for building sustainable, inclusive, and health-centered resilience in vulnerable regions like Poso.

CONFLICTS OF INTEREST

All Author Declare No. conflict of interest

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