



The Role of Health Risk Communication in Improving Community Preparedness for Disasters

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ABSTRACT

The increasing frequency and complexity of disasters require strengthening community preparedness through effective health risk communication strategies. This study aims to analyze the role of health risk communication in improving community preparedness for disasters and examine risk perception as a mediating variable. This study used a quantitative approach with an explanatory design and a cross-sectional survey of 245 respondents in disaster-prone areas. Data were collected using a structured questionnaire based on the Health Belief Model (HBM) and Protection Motivation Theory (PMT), then analyzed using Structural Equation Modeling (SEM). The results showed that risk communication significantly influenced risk perception ($\beta=0.62$; $p<0.001$) and community preparedness ($\beta=0.29$; $p<0.001$). Risk perception also significantly influenced preparedness ($\beta=0.48$; $p<0.001$) and partially mediated the relationship between risk communication and preparedness (β indirect=0.30; $p<0.001$). The research model had a good fit and explained 56% of the variation in community preparedness. These findings confirm that clear, credible, timely, and participatory risk communication can enhance preparedness by shaping proportionate threat perceptions. This research contributes to the development of a community-based health risk communication model and offers practical implications for the formulation of more responsive and evidence-based disaster mitigation strategies in disaster-prone areas.

Keywords: Health Risk Communication, Risk Perception, Community Preparedness, Structural Equation Modeling, Health Belief Model



INTRODUCTION

The incidence of natural and non-natural disasters continues to increase globally, posing a significant threat to public health and well-being. Disaster Risk Reduction, as an international agenda, emphasizes the need for a comprehensive understanding of risk and the preparedness of all stakeholders to address various disaster threats. This international framework also emphasizes the importance of risk reduction through evidence-based approaches and broad community participation, including in the public health dimension (UNDRR, 2023).

As an archipelagic nation located on the "Ring of Fire," Indonesia is highly vulnerable to earthquakes, tsunamis, floods, and landslides. This vulnerability heightens the need for community preparedness, as disasters can have physical and health impacts, including infectious diseases, psychosocial challenges, and disruptions to health services. Although the Indonesian government has developed mitigation policies and risk information systems such as inaRISK to improve public understanding of risks, low levels of preparedness remain, particularly among households and communities. Available risk information does not fully reflect the behavioral changes and preparedness that have occurred in many vulnerable areas (BNPB, 2025).

The increasing frequency and intensity of disasters worldwide have highlighted the urgent need to strengthen community preparedness as a central component of disaster risk reduction and public health resilience. Natural hazards, disease outbreaks, and complex emergencies not only threaten infrastructure but also create significant health risks that require coordinated communication strategies between authorities and communities. Preparedness is no longer viewed solely as a logistical or institutional responsibility but as a shared process requiring informed and active community participation (Rohana et al., 2025).

One factor influencing community preparedness for disasters is risk literacy and effective communication. Empirical research shows that low risk awareness and mitigation behavior are major barriers to improving preparedness, resulting in greater health risks and other losses when disasters occur. (Hargono et al., 2023).

Several local studies in Indonesia have confirmed that a participatory communication approach to disaster education can contribute to community preparedness. Community-based education helps improve community knowledge and practical preparedness in dealing with emergencies, such as floods and flash floods (Leby et al., 2025).

Digital health literacy and disaster risk education have also been identified as important strategies for strengthening preparedness. Digital platform-based educational programs can increase public awareness of risks and their willingness to plan their own preparedness actions. (Putri et al., 2025).

In the realm of risk communication, the World Health Organization (WHO) defines risk communication as the process of exchanging information, advice, and opinions in real time between experts or authorities and those facing threats to their health or well-being. Risk communication aims to enable individuals and communities to make informed decisions to mitigate the impact of those threats. (WHO, 2023).



Health risk communication has also been studied in many contexts, and results show that effective communication can help change risk perceptions and encourage greater public preventive action. This includes mass media, social media, and adaptive interpersonal communication strategies tailored to the characteristics of the target audience.

However, in the Indonesian context, implementing risk communication faces structural and cultural challenges. Barriers to cross-sector coordination, differences in resource capacity, and disinformation and infodemics in the pre- and post-disaster phases remain obstacles. Conflicting narratives between official information and unverified content on social media also have the potential to exacerbate public risk perceptions.

Evaluation of the effectiveness of risk communication strategies implemented to date shows a tendency toward a top-down approach that lacks active community involvement. This limitation results in low community participation in risk communication planning and implementation, thus under-utilizing the potential for building comprehensive local resilience. (Permatasari & Sinduwiatmo, 2024).

The rapid expansion of digital media and information technologies has transformed the landscape of health risk communication. While digital platforms enable rapid dissemination of warnings and preparedness guidance, they also introduce challenges related to misinformation and infodemic management. Recent WHO guidance emphasizes the integration of communication, community engagement, and infodemic management to maintain public trust and ensure consistent messaging during emergencies (WHO, 2025). Consequently, modern disaster preparedness increasingly depends on structured communication systems that combine scientific evidence, local knowledge, and inclusive communication practices.

Within an academic framework, numerous studies have shown that the relationship between risk communication and disaster preparedness is influenced by psychosocial factors, such as risk perception, community attitudes toward threats, and their ability to access and understand available risk information. Higher risk perception is typically associated with better preparedness. (Hanshardi, 2024).

The urgency of this research lies in the need to fill the empirical gap regarding the relationship between health risk communication strategies and community disaster preparedness in the Indonesian context. This study is relevant to supporting the implementation of the Sendai Framework for Disaster Risk Reduction by providing empirical evidence on how risk communication can strengthen community-based preparedness.

By integrating theoretical perspectives (e.g., the Health Belief Model, Protection Motivation Theory) and empirical findings from previous research, this study can contribute to the development of risk communication models that are more responsive to local and dynamic contexts in the face of increasingly complex disasters. This evidence-based approach is also crucial for supporting more effective mitigation policies and practices in the future.



METHODS

This study uses a quantitative approach with an explanatory design to examine the causal relationship between health risk communication and community disaster preparedness, and to analyze the role of risk perception as a mediating variable. A cross-sectional survey design was chosen to obtain an empirical picture of the relationship between variables over a specific time period. This approach is relevant for testing a structural model based on health behavior theory, particularly in explaining how risk communication can influence preparedness through cognitive mechanisms and individual perceptions.

The study was conducted in disaster-prone areas identified based on official local government risk data and disaster vulnerability classifications. The study population comprised adults (18 years and older) residing in the area. The sampling technique used probability sampling, with a cluster sampling or stratified random sampling approach to ensure representativeness of respondents based on administrative region or risk level. The sample size was determined using a structural analysis approach, considering a minimum ratio of 5–10 respondents per measurement indicator and a minimum of 200 respondents to obtain stable model estimates.

The independent variable in this study is health risk communication, operationalized through the dimensions of message clarity, information source credibility, timeliness of delivery, media accessibility, and community participation in the communication process. The mediating variable is risk perception, which includes perceived susceptibility, perceived severity, and perceived benefits of preventive measures. The dependent variable is community preparedness for disasters, measured through indicators of preparedness knowledge, family emergency response planning, emergency equipment availability, and participation in disaster training or simulations. All indicators are measured using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

The research instrument was a structured questionnaire developed based on the Health Belief Model (HBM) and Protection Motivation Theory (PMT) frameworks, as well as the principles of health risk communication. Content validity was evaluated through expert judgment, while construct validity was tested using Confirmatory Factor Analysis (CFA). Instrument reliability was measured using Cronbach's Alpha and Composite Reliability coefficients, with a value of ≥ 0.70 as the acceptable threshold.

Primary data were collected through in-person and online surveys after respondents provided informed consent. The data were analyzed using Structural Equation Modeling (SEM), both covariance-based (SEM-AMOS) and Partial Least Squares (SEM-PLS), to simultaneously test direct and indirect relationships between variables. The analysis included testing the measurement model to ensure construct validity and reliability, and testing the structural model to evaluate path coefficients, t-statistic values, and the significance of the influence at a 95% confidence level ($\alpha = 0.05$). Mediation tests were conducted using a bootstrapping approach to estimate indirect effects and determine the type of mediation occurring.



RESULTS

1. Respondent Characteristics (n = 245)

Table 1. Distribution of Respondent Characteristics

Characteristics	Category	n	%
Gender	Man	112	45.7
	Woman	133	54.3
Age	18–35 years	98	40.0
	36–55 years	109	44.5
	>55 years	38	15.5
Education	≤ High School	121	49.4
	Diploma/Bachelor's Degree	108	44.1
	Postgraduate	16	6.5
Disaster Experience	Once	187	76.3
	Never	58	23.7

The majority of respondents were of productive age (36–55 years) and had direct experience with disasters (76.3%). This composition strengthens the relevance of the analysis because respondents have real-life exposure to risk.

2. Measurement Model Test

Table 2. Results of the Validity and Reliability Test of the Constructs

Variables	Cronbach's Alpha	Composite Reliability	AVE	Information
Risk Communication	0.91	0.93	0.69	Reliable & Valid
Risk Perception	0.88	0.91	0.65	Reliable & Valid
Community Readiness	0.92	0.94	0.71	Reliable & Valid

All constructs met the reliability criteria (α and CR ≥ 0.70) and convergent validity (AVE ≥ 0.50). This indicates that the indicators are able to represent the latent constructs consistently and accurately.

3. Structural Model Test (SEM)

a. Goodness of Fit Model (SEM-AMOS)

Table 3. Model Feasibility Index

Index	Mark	Cut-off	Information
Chi-square/df	1.87	< 3.00	Good
CFI	0.95	≥ 0.90	Good
TLI	0.94	≥ 0.90	Good
RMSEA	0.059	≤ 0.08	Good

The structural model shows good fit with the empirical data, so that the analysis of the relationships between variables can be continued.

b. Hypothesis Testing (Direct Effect)

Table 4. Direct Path Coefficients

Relationship between variables	Coefficient (β)	t-value	p-value	Decision
Risk Communication→Risk Perception	0.62	9.84	0,000	Significant
Risk Perception→Readiness	0.48	7.12	0,000	Significant
Risk Communication→Readiness	0.29	4.36	0,000	Significant

Health risk communication had a positive and significant effect on risk perception ($\beta=0.62$; $p<0.001$). Risk perception also significantly influenced community preparedness ($\beta=0.48$; $p<0.001$). Furthermore, there was a direct effect of risk communication on preparedness ($\beta=0.29$; $p<0.001$), indicating that effective communication not only shapes perceptions but also directly encourages preparedness actions.

4. Mediation Test (Bootstrapping)

Table 5. Indirect Effects

Mediation Path		β Indirect	t- value	p-value	Types of Mediation
Risk Communication→Risk Perception→Readiness		0.30	6.25	0,000	Partial Mediation

Bootstrapping results showed a significant indirect effect ($\beta=0.30$; $p<0.001$). Because the direct effect remained significant after the mediator was included, risk perception acted as a partial mediator. This means that risk communication increased preparedness both directly and through increased risk perception.

5. Value of the Coefficient of Determination (R^2)

Table 6. Coefficient of Determination

Endogenous Variables	R^2	Interpretation
Risk Perception	0.38	Moderate
Community Readiness	0.56	Substantial

Risk communication explained 38% of the variation in risk perception. Simultaneously, risk communication and risk perception explained 56% of the variation in community preparedness, demonstrating substantial predictive power in the model.

These empirical findings confirm the Health Belief Model and Protection Motivation Theory frameworks, which suggest that clear, credible, and participatory risk communication increases perceptions of vulnerability and severity, which in turn strengthens community preparedness. These results also support the principles of health risk communication emphasized by the World Health Organization and align with the disaster risk reduction agenda outlined in the Sendai Framework for Disaster Risk Reduction.



DISCUSSION

1. Construct Validity and Reliability

The measurement model test results indicate that the three main constructs of risk communication, risk perception, and community preparedness have high internal reliability (Cronbach's Alpha ≥ 0.88) and strong convergent validity (AVE ≥ 0.65). These findings confirm that the developed instrument complies with good psychometric principles and is able to represent the measured latent constructs consistently. Theoretically, these results strengthen the foundation of the Health Belief Model (HBM) and Protection Motivation Theory (PMT) in the context of disaster preparedness, where threat perception (risk perception) and cognitive processes towards risk signals play an important role in shaping action readiness.

Recent research by Hidayat and Assegaf (2025) emphasized that the risk communication construct which includes message clarity, source credibility, and community involvement also has high reliability in the context of hydrometeorological disaster mitigation in Indonesian society. (Hidayat & Assegaf, 2025). This is consistent with the results of this study, which show that these indicators reliably measure the construct of risk communication. Lestari et al., (2023) also found a valid instrument for measuring disaster preparedness based on digital socialization, which supports a multidimensional approach in preparedness instruments (Lestari et al., 2023).

Critically, researchers assume that this high reliability may be influenced by the homogeneity of respondents' experiences with disaster threats. Communities that have been frequently exposed to risks tend to have stable and consistent cognitive frameworks for interpreting questionnaire items.

2. Goodness of Fit Model

The model fit indices (CFI = 0.95; TLI = 0.94; RMSEA = 0.059) indicate that the relationship structure between variables is consistent with the empirical data. This indicates that the theoretical model linking risk communication, risk perception, and community preparedness is appropriate for explaining the phenomenon of preparedness behavior in a disaster context.

This finding is parallel with the study by Arwan and Syam (2025) which emphasized the importance of a risk communication model that combines cognitive and behavioral approaches to strengthen community preparedness. (Arwan & Syam, 2025). According to their study, structural models that consider threat perception and adaptive responses provide a more accurate depiction of behavioral mechanisms. Thus, the suitability of this model supports the theoretical integration of HBM and PMT as a valid conceptual basis for the context of disaster preparedness.

The researchers assume that the fit of this model is also influenced by the consistency of respondents in interpreting risk signals, because the research area is a disaster-prone area that has experienced several previous disaster events.

3. Direct Influence Between Variables

Path analysis showed that risk communication had a positive and significant effect on risk perception ($\beta = 0.62$, $p < 0.001$), while risk perception had a significant effect on community preparedness ($\beta = 0.48$, $p < 0.001$). Risk communication also showed a direct effect on preparedness



($\beta = 0.29$, $p < 0.001$). These results confirm the theoretical relationship from the HBM that effective risk signals increase threat perceptions which in turn encourage preparedness actions.

Phenomenal research by Zheng et al. (2025) shows that risk communication has a significant effect on public psychology and adaptive behavior in the context of multihazard disasters such as floods and pandemics. (Zheng et al., 2025). Their findings support the results of this study that risk communication improves preparedness through the risk perception pathway and directly to action readiness.

Furthermore, a study by Permatasari and Sinduwiatmo (2023) showed that culturally integrated communication strategies were able to significantly increase the level of disaster response in Indonesian communities. (Permatasari & Sinduwiatmo, 2024). This supports the assumption that cultural context and local beliefs can strengthen the effect of risk communication channels on perceptions and preparedness.

Critically, researchers assume that the large influence of the direct channel of risk communication on preparedness indicates that some respondents may take preparedness actions based on experience or community practices, not simply cognitive interpretations of risk messages.

4. Mediating Effect of Risk Perception

Mediation tests showed that the indirect effect of risk communication on preparedness through risk perception was significant (β indirect = 0.30, $p < 0.001$), with risk perception acting as a partial mediator. This suggests that risk communication not only directly promotes preparedness but also through the mechanism of forming and enhancing risk perception.

This finding is in accordance with Levy & Bodas, (2024) who showed that risk perception plays an important role in mediating the relationship between exposure to risk information and adaptive responses in the context of disaster mitigation. (Levy & Bodas, 2024). The study found that risk perception strengthens preparedness when risk messages are delivered effectively.

Researchers assume that this variation in partial mediation reflects the heterogeneity of community responses. Some respondents may be more responsive to risk messages due to prior experience or community involvement, while others may require deeper cognitive interpretation before moving on to preparedness actions.

5. Coefficient of Determination (R^2)

The coefficient of determination shows that risk communication can explain 38% of the variation in risk perception ($R^2 = 0.38$), while risk communication and risk perception together explain 56% of the variation in community preparedness ($R^2 = 0.56$). This indicates substantial predictive power of the model used.

This finding is consistent with the study by Suryati et al., (2023) which shows that risk communication and threat perception variables can explain a substantial portion of the variation in community preparedness for disasters. (Suryati et al., 2023). The study showed that the use of digital media and community-based outreach significantly increased preparedness.



Critically, the researchers assume that the 44% unexplained variance in preparedness accounts for other contextual and structural variables, such as institutional support, resource access, household economic status, and traumatic experiences, not directly measured in this model. Therefore, further studies that incorporate these determinants are needed to deepen our understanding of community preparedness.

CONCLUSIONS

This study demonstrates that health risk communication plays a significant role in enhancing community preparedness for disasters, both directly and through the mediation of risk perception. The constructed structural model demonstrated good empirical fit and explained a substantial proportion of the variation in community preparedness ($R^2 = 0.56$). These findings confirm the relevance of integrating the Health Belief Model and Protection Motivation Theory in the disaster context, where risk communication serves as a cue to action that shapes perceptions of vulnerability and severity, while also encouraging adaptive responses. The partial mediation of risk perception indicates that changes in preparedness behavior depend not only on information exposure but also on individuals' cognitive processes in evaluating threats.

Practically, these results emphasize the need to strengthen evidence-based, participatory, and contextual risk communication strategies. Local governments and disaster stakeholders need to integrate communication approaches that are not only informative but also build risk perceptions proportionally and constructively. Optimizing digital media, involving community leaders, and adopting a culture-based communication approach are key strategies in strengthening collective preparedness. Academically, this research contributes to the development of community-based health risk communication models in developing countries and opens up opportunities for further research by incorporating structural variables such as economic capacity, institutional support, and socio-cultural factors to enrich predictive models of disaster preparedness.

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