

Community-based psychoeducation for disaster preparedness: Improving resilience in rural West Sumatra

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ABSTRACT

Previous disaster preparedness studies in rural, disaster-prone areas have largely prioritized structural mitigation and early warning systems, leaving a critical gap in community-based health interventions that address psychosocial readiness. This study introduces a culturally contextualized psychoeducational intervention as a public health strategy to strengthen disaster preparedness in District of X Koto, Tanah Datar Regency, West Sumatra, Indonesia. The objective was to enhance community preparedness through an intervention emphasizing psychosocial health, risk perception, and self-efficacy as core components of disaster health interventions. A participatory intervention design was implemented over nine months (March–November 2024), involving 69 community members. The intervention comprised situational analysis, group-based psychoeducational sessions, disaster simulations, and pre- and post-test assessments. Results demonstrated a substantial improvement in overall preparedness scores, increasing from a mean of 12.54 to 37.64 after the intervention. Beyond cognitive gains, participants exhibited improved emotional regulation, heightened awareness of disaster risks, and stronger behavioral intentions to engage in adaptive response actions. These outcomes align with established psychosocial health theories, underscoring the effectiveness of community-centered learning in enhancing resilience. The intervention was particularly beneficial for participants with limited formal education, indicating its inclusivity and scalability. Integrating psychoeducational health interventions into disaster preparedness frameworks may strengthen public health resilience and support sustainable disaster risk reduction in rural and urban disaster-prone settings.

ABSTRAK

Studi-studi sebelumnya mengenai kesiapsiagaan bencana di wilayah pedesaan rawan bencana sebagian besar menitikberatkan pada mitigasi struktural dan sistem peringatan dini, sehingga menyisakan kesenjangan penting dalam intervensi kesehatan berbasis komunitas yang berfokus pada kesiapan psikososial. Penelitian ini memperkenalkan intervensi psikoedukasi yang dikontekstualisasikan secara budaya sebagai strategi kesehatan masyarakat untuk memperkuat kesiapsiagaan bencana di Kecamatan X Koto, Kabupaten Tanah Datar, Sumatera Barat, Indonesia. Tujuan penelitian ini adalah meningkatkan kesiapsiagaan masyarakat melalui intervensi kesehatan yang menekankan kesehatan psikososial, persepsi risiko, dan efikasi diri sebagai komponen utama intervensi kesehatan kebencanaan. Desain intervensi partisipatif dilaksanakan selama sembilan bulan (Maret–November 2024) dengan melibatkan 69 anggota masyarakat. Intervensi meliputi analisis situasi, sesi psikoedukasi berbasis kelompok, simulasi bencana, serta penilaian pra dan pascaintervensi. Hasil penelitian menunjukkan peningkatan yang signifikan pada skor kesiapsiagaan, dari rata-rata 12,54 menjadi 37,64 setelah intervensi. Selain peningkatan kognitif, peserta juga menunjukkan perbaikan dalam regulasi emosi, peningkatan kesadaran terhadap risiko bencana, serta niat perilaku yang lebih kuat untuk melakukan respons adaptif. Temuan ini sejalan dengan teori kesehatan psikososial yang telah mapan dan menegaskan efektivitas pembelajaran berbasis komunitas dalam meningkatkan ketangguhan. Intervensi ini memberikan manfaat yang lebih besar bagi peserta dengan tingkat pendidikan formal yang terbatas, sehingga menunjukkan sifatnya yang inklusif dan berpotensi untuk direplikasi. Integrasi intervensi kesehatan psikoedukatif ke dalam kerangka kesiapsiagaan bencana berpotensi memperkuat ketangguhan kesehatan masyarakat dan mendukung pengurangan risiko bencana yang berkelanjutan di wilayah pedesaan maupun perkotaan rawan bencana.

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INTRODUCTION

Indonesia, as an archipelagic nation located along the Pacific Ring of Fire, is highly exposed to multi-hazard disasters, including earthquakes, volcanic eruptions, floods, and landslides. West Sumatra is consistently identified as one of the most disaster-prone provinces, and Tanah Datar Regency embodies a dual status as both a culturally significant area and a geographically vulnerable setting (BNPB, 2023). The lahar flood (galodo) on May 11, 2024, triggered by the eruption of Mount Marapi, resulted in casualties and displacement and highlighted persistent deficits in preparedness, particularly psychological readiness among residents living near high-risk and tourism-linked zones (Yola & Ahmad, 2024). These realities position disaster preparedness not only as a technical concern but also as a community health priority, where psychosocial well-being, coping capacity, and behavioral readiness are integral components of disaster risk reduction (DRR).

Globally, disaster risk is increasingly shaped by urban expansion into hazard zones and compounded by climate change and environmental degradation, which amplify hazard frequency and intensity and increase exposure to floods and other shocks (Rentschler et al., 2023; Imamura, 2022; Tabari et al., 2021). Vulnerability remains particularly pronounced in rural settings where poverty, limited education, constrained livelihoods, and weak social networks reduce adaptive capacity, requiring place-based DRR that integrates local knowledge, inclusive governance, and attention to social dynamics such as gender and marginalization (Munyai et al., 2021; Ismail-Zadeh, 2021; Đinh et al., 2023; Zhou et al., 2021; Kamarudin et al., 2022; Khalid et al., 2021). Conceptual advances emphasize spatiotemporal assessment of hazard, exposure, and vulnerability to guide targeted interventions and sustainable risk reduction in rural contexts (Reimuth et al., 2023; Cuaton & Su, 2020; Imperiale & Vanclay, 2021). Within this discourse, psychoeducational strategies are increasingly recommended to strengthen resilience and adaptive behavior, aligning preparedness with mental health promotion and community-based health interventions (Pamungkas et al., 2023a; Teja, 2023).

Despite repeated disaster exposure, communities in X Koto District, Tanah Datar Regency, have limited access to structured, culturally responsive preparedness programs, resulting in low psychosocial readiness and persistent distress from past events (Ryan et al., 2020). Although multidimensional preparedness frameworks such as the LIPI-UNESCO/ISDR model emphasize knowledge, early warning, emergency planning, policy support, and resource readiness, their implementation often fails to translate into community-centered and emotionally attuned interventions for rural populations (Nick et al., 2009; Margarena et al., 2023). Consequently, preparedness efforts inadequately integrate psychosocial components as a disaster health intervention, leaving gaps in emotional regulation, risk perception, and self-efficacy essential for effective response. The literature points to participatory, community-based psychoeducational interventions as a general solution to strengthen coping skills, preparedness behaviors, and collective agency, thereby enhancing resilience in disaster-prone rural settings (Imperiale & Vanclay, 2021; Pamungkas et al., 2023a; Teja, 2023).

Psychoeducation is widely recognized as an evidence-based approach to improve mental health literacy and promote behavioral change by integrating cognitive and emotional learning. In disaster contexts, it helps individuals understand hazards, manage stress reactions, and adopt proactive coping mechanisms, consistent with psychosocial support guidelines in emergencies (Benedek et al., 2007; IASC, 2007). Through strengthening self-efficacy and risk processing, psychoeducation enhances preparedness at both individual and collective levels (Bandura, 1997; Norris et al., 2008). Recent studies further position psychoeducation as a pathway to improve disaster health literacy and reduce fear-driven avoidance by linking mental well-being with practical response skills and multi-hazard awareness, in line with the Sendai Framework's emphasis on education (Shaw et al., 2021; Yang et al., 2025).

At the same time, community-based disaster risk reduction/management (CBDRR/CBDRM) underscores local participation, social learning, and collective action, aligning with people-centered DRR approaches (Chandra et al., 2020; Wambede & Tweheyo, 2022). Evidence shows that participatory methods, such as simulations and role-playing, can improve risk perception,

preparedness, and resilience, particularly when psychoeducational modules are culturally adapted and inclusive of vulnerable groups (Wu et al., 2022; Winarta et al., 2021). However, many DRR interventions in rural Indonesia remain focused on structural measures or basic awareness, with limited attention to psychosocial readiness and long-term mental health impacts of recurrent disasters (Pamungkas et al., 2023a; Teja, 2023). As a result, a clear gap persists: culturally grounded psychoeducational preparedness interventions for rural, high-risk communities like X Koto remain insufficiently developed and evaluated, despite strong theoretical, empirical, and policy support (Bandura, 1997; Norris et al., 2008; Imperiale & Vanclay, 2021).

This study addresses that gap by implementing a culturally contextualized psychoeducational disaster preparedness intervention tailored to the socio-cultural realities of Tanah Datar. The novelty lies in positioning psychoeducation explicitly as a community health intervention within disaster preparedness—integrating risk perception, self-efficacy, emotional preparedness, and simulation-based practice through participatory delivery—to strengthen resilience beyond knowledge gains alone (Benedek et al., 2007; IASC, 2007; Winarta et al., 2021; Saifudin, 2023). The objective of the study is to evaluate the effectiveness of this psychoeducational program in improving disaster readiness among residents of X Koto District, thereby offering an implementable and replicable model for disaster-prone rural regions in Indonesia and comparable settings (Chandra et al., 2020; Wambede & Tweheyo, 2022; Dales et al., 2021).

METHODS

This community service initiative employed a structured and comprehensive methodology aimed at enhancing disaster preparedness among residents in Kecamatan X Koto, Kabupaten Tanah Datar, West Sumatra—a region highly susceptible to natural disasters such as floods, landslides, and galodo (volcanic debris floods). The program was conducted over a nine-month period (March–November 2024) and was organized into three consecutive phases: planning, implementation, and evaluation.

A mixed-methods approach was adopted to obtain a holistic understanding of the intervention's impact. The study population comprised residents from multiple disaster-affected communities within the district. A total of 69 participants were selected using proportional sampling to ensure balanced representation. Quantitative data were collected using structured pre- and post-test questionnaires to assess changes in disaster preparedness knowledge and behavior. Simultaneously, qualitative data were gathered through focus group discussions (FGDs), in-depth interviews with residents, local disaster management officials (BPBD), and families with disaster experience. Field notes and photographic documentation were also obtained to support contextual interpretation.

Figure 1
Intervention process with participants



Table 1
Characteristics of respondents

Variabel	Frequency	Percent
Gender		
Female	32	46.4
Male	37	53.6
Level of Education		
Elementary school	11	15.9
Junior high school	30	43.5
High school	19	27.5
College / university	9	13
Occupation		
Not Working	10	14.5
Farmer/Laborer	32	46.4
self-employed	15	21.7
ASN/ABRI/Private Employee	12	17.4
Length of Stay		
Less than 1 Year	11	15.9
1-5 Years	18	26.1
More than 5 Years	10	14.5
Since Birth	30	43.5

The intervention utilized a psychoeducational training module titled Psikoedukasi Masyarakat Siaga Bencana (Community Psychoeducation for Disaster Preparedness), which was adapted to local cultural and linguistic contexts (See [Figure 1](#)). This module comprised five sequential stages: (1) identification of shared concerns, (2) group exploration of problem-solving strategies, (3) participatory simulation and role-playing exercises, (4) ongoing formative evaluation, and (5) summative assessment using both process and outcome indicators. These stages were aligned with the five preparedness dimensions as proposed by the LIPI-UNESCO/ISDR framework: knowledge and attitude, disaster warning systems, emergency planning, policy and guidelines, and resource mobilization.

The planning phase involved situational analysis, including field assessments, stakeholder consultations, and coordination with village authorities to ensure relevance and local acceptance. The implementation phase included three group-based psychoeducational sessions facilitated in accessible venues such as village halls and homes. These sessions combined didactic presentations, participatory discussions, Q&A forums, and practical disaster simulations. The final evaluation phase comprised reflection meetings and post-intervention assessments.

Data collection tools included the psychoeducational module, printed educational leaflets, structured questionnaires, and observational guides. Quantitative data were analyzed using descriptive statistics—mean, standard deviation, and confidence intervals—and inferential statistics through paired-sample t-tests to evaluate differences in pre- and post-test scores. Thematic analysis was applied to qualitative data to extract behavioral and perceptual shifts regarding disaster preparedness and resilience. Informed consent was obtained from all participants, ensuring confidentiality and adherence to ethical research standards.

RESULTS AND DISCUSSION

Implementation of the Disaster Preparedness Community Psychoeducation program in the disaster-prone area of Kecamatan X Koto, Kabupaten Tanah Datar, which was carried out for 9 months (March-November 2024) with 69 community respondents.

Table 2

Improvement of the community's ability to deal with disasters after disaster preparedness psychoeducation

Variable		f	Mean	SD	MD	SE	p
Disaster preparedness	Pre-Intervention	69	12.54	2.349	25.101	0.283	0.001
	Post-Intervention	69	37,64	1.15		0.138	

Table 1 shows that the majority of people who participated in the Community Guidance activities in improving their ability to face disasters were male (53.6%), had junior high school education (43.5%), worked as Farmers / Laborers (46.4%) and lived in X Koto sub-district since birth (43.5%).

Table 2 illustrates that the most prominent outcome was a marked increase in disaster preparedness, not merely in terms of factual knowledge, but also deeper aspects of perception, emotional readiness, and proactive behavioural intent. Quantitatively, the preparedness score increased from a pre-intervention mean of 12.54 (SD. 2,349) to a post-intervention mean of 37.64 (SD. 1,150), representing a 66.68% increase. While such statistical gains are noteworthy, the more profound discovery lies in the cognitive-behavioural mechanisms that underpinned these results. The intervention, structured around participatory psychoeducation and simulation-based learning, activated processes central to experiential learning theory and social cognitive frameworks. Participants did not just acquire information, they reconstructed their mental models of risk, emergency action, and personal agency.

This phenomenon can be explained through Bandura's self-efficacy theory, which posits that perceived competence directly influences behavioural outcomes. The role-play simulations in the intervention served as mastery experiences, enhancing participants' confidence in their ability to manage disaster-related situations (Ismayadi & Harahap, 2024; Tang et al., 2024). This shift was observed in participants' ability to articulate specific emergency response actions, their enhanced recognition of environmental risk cues, and their ability to plan and mobilize community resources.

Moreover, the intervention demonstrated a capacity to recalibrate risk perception, a psychological construct that governs how individuals interpret and respond to potential hazards. Risk perception is often dominated by intuitive, emotion-laden judgments rather than analytical processing (Mawardi et al., 2021; Simanjuntak et al., 2025). Before the intervention, many participants exhibited fatalistic beliefs, perceiving disasters as acts of fate beyond human control. Post-intervention, however, participants displayed an increased tendency to adopt analytical thinking, indicating a cognitive shift from passive to active risk interpretation. This change represents a critical element of community resilience.

This study demonstrates that context-adapted psychoeducation can function as an effective community health intervention to strengthen disaster preparedness and disaster literacy in rural, disaster-prone settings. A central scientific contribution is the evidence that psychoeducational content grounded in local language, culture, and delivery practices can reduce inequities in access to preparedness knowledge. Participants with low formal education—who initially presented the lowest preparedness scores—showed the greatest post-intervention gains, indicating that culturally responsive approaches may “democratize” disaster literacy across demographic boundaries. This finding reinforces the argument that inclusive disaster education must be designed around literacy levels and socio-cultural context to ensure effectiveness and equity (Ayuningtyas et al., 2021; Pamungkas et al., 2023b).

Beyond cognitive gains, the intervention also produced meaningful psychosocial benefits, highlighting psychoeducation's emotional buffering effect. Observations during role play and group discussions indicated that participants experienced reduced helplessness and anxiety and were more willing to imagine and rehearse adaptive responses. Such findings are consistent with evidence that structured psychoeducation in disaster-prone communities can decrease psychological distress after disasters and strengthen coping and resilience (Brebahama et al., 2019; Mohamad Azhar et al., 2022). Importantly, these results emphasize that the emotional dimension of preparedness, often overlooked in conventional education models, is not merely complementary but foundational to readiness. Communities may understand hazards cognitively, yet remain behaviorally inert without emotional

regulation, self-efficacy, and confidence to act under stress, underscoring the need to position psychoeducation explicitly within disaster health interventions.

The intervention's structure also provides empirical support for comprehensive preparedness models. The five preparedness dimensions applied—knowledge and attitudes, warning systems, emergency planning, policy understanding, and resource mobilization—appeared synergistic and mutually reinforcing rather than independent. Improvement in one domain likely catalyzed engagement in others; for example, strengthened knowledge and attitudes may increase attentiveness to warning systems, while enhanced planning can motivate resource mobilization. This interdependence suggests that fragmented, single-aspect approaches may be less effective in rural communities facing recurrent hazards. The observed synergy resonates with the multidimensional preparedness framework proposed by LIPI-UNESCO/ISDR (2006), further validating its relevance and applicability within Indonesian community settings, particularly when operationalized through culturally grounded and participatory learning modalities (LIPI-UNESCO/ISDR, 2006).

A key mechanism connecting these outcomes is the social architecture of the intervention. The group-based format facilitated peer-to-peer learning, shared sense-making, and communal problem-solving, supporting the view that disaster education is not solely an individual cognitive process but also a collective cultural transformation. When communities co-construct meaning around risk, preparedness becomes embedded in shared identity and social narratives, thereby strengthening social cohesion and collective efficacy. This aligns with prior work suggesting that resilience is strengthened when learning is community-anchored and socially reinforced (Ayuningtyas et al., 2021; Ma et al., 2023). In this regard, the intervention did not simply transmit information; it cultivated a learning environment in which participants collectively rehearsed response roles, normalized preparedness behaviors, and reinforced mutual support—factors that are essential for coordinated action during emergencies.

These findings also converge with the broader literature on community-based disaster risk reduction and participatory learning. Participatory approaches translate local knowledge and lived experience into actionable DRR practices, enabling communities to co-create strategies rather than passively receive guidance (Sutton et al., 2020; Ross et al., 2023). Through participatory action research, citizen input and reflective learning foster empowerment, trust, and collective efficacy—recognized drivers of resilience in hazard contexts (Sunarto et al., 2024). Narrative and social-learning methods, including storytelling and stakeholder engagement, facilitate transformative learning that can shift preparedness from reactive responses to proactive readiness (Sutton et al., 2020; Gray et al., 2021; Kingsbury & Reyes, 2024). Participatory tools such as mapping, games, and youth-led initiatives can broaden risk literacy and strengthen social networks needed for coordinated response and recovery (Avendaño-Urbe et al., 2022; Yumagulova et al., 2020). Importantly, inclusive participatory learning that explicitly considers vulnerable groups—women, youth, and persons with disabilities—can improve equity and psychosocial outcomes, reinforcing preparedness as a public health intervention rather than solely a technical DRR activity (Gray et al., 2021; Rumambi et al., 2023).

Comparatively, the observed outcomes are consistent with evidence from other high-risk contexts demonstrating that participatory disaster drills improve evacuation readiness and that social cohesion developed through collective learning can enhance recovery trajectories. For instance, community-based drill initiatives in hazard-exposed settings have been shown to increase practical readiness, while post-disaster studies have documented the role of social cohesion in improving recovery outcomes (AchutaRao et al., 2023; Hoffmann et al., 2018). Collectively, this body of evidence supports the proposition that effective disaster preparedness must extend beyond formal instruction to include experiential learning, emotional preparedness, and social reinforcement—precisely the components emphasized in the present intervention.

From an implementation perspective, the results indicate that psychoeducation is well suited to rural service delivery because it is potentially scalable and low-cost, particularly when delivered through brief, modular formats and task-sharing models. Emerging evidence suggests psychoeducational interventions can expand reach via digital delivery, self-guided modules, and brief formats while maintaining meaningful outcomes for anxiety, depression, and resilience (Gutiérrez

et al., 2024; Schleider et al., 2021; Selaskowski et al., 2023). Digital platforms, telemedicine, and AI-enabled tailoring may further enhance cost-effectiveness and geographic access, which is especially relevant for underserved and disaster-prone rural areas (Gherman et al., 2025; Ghoman et al., 2021). Additionally, psychoeducation can generate benefits beyond direct participants—such as caregivers and families—by improving preparedness and reducing psychosocial burden, supporting broader community-level diffusion effects (Li et al., 2025; Bilgin & Özdemir, 2022). Nevertheless, the literature also highlights the need for more rigorous designs to estimate effect sizes, identify mediators, and determine which delivery modalities maximize scalability in real-world, resource-limited environments (Jain et al., 2020; Brandt et al., 2025).

A primary strength of this study is its context-adapted, participatory delivery, which enhanced inclusivity for participants with low formal education and operationalized preparedness as an integrated disaster health intervention encompassing cognitive, emotional, and social dimensions (Ayuningtyas et al., 2021; Pamungkas et al., 2023b; Brebahama et al., 2019; Mohamad Azhar et al., 2022). The use of a multidimensional preparedness framework also strengthens interpretability by situating outcomes within a recognized structure of preparedness domains (LIPI-UNESCO/ISDR, 2006). However, the study has limitations. The pre–post design without a control group limits causal inference, and improvements may partly reflect testing effects or concurrent exposure to disaster-related information. The sample size and single-district setting constrain generalizability to other rural regions with different socio-cultural profiles. In addition, outcomes were primarily measured shortly after the intervention, limiting conclusions about long-term retention and sustained behavior change.

CONCLUSION

This community service program provides evidence that localized psychoeducation is an effective health intervention to strengthen disaster preparedness and psychosocial resilience in high-risk rural settings. Implemented in Kecamatan X Koto, Kabupaten Tanah Datar, the intervention enhanced disaster-related knowledge, risk perception, and emotional readiness, enabling participants to shift from reactive responses toward more proactive preparedness behaviors. These outcomes support the relevance of Bandura's self-efficacy framework and Slovic's risk perception model in explaining how participatory learning approaches—particularly simulation and structured group discussion—can translate health education into adaptive action in disaster contexts. The integration of five preparedness dimensions (knowledge, early warning systems, emergency planning, policy awareness, and resource mobilization) functioned as a coherent package, reinforcing the view that multi-component interventions are more likely to generate meaningful and holistic resilience than fragmented, single-focus efforts.

From the perspective of health intervention scholarship, this study contributes by positioning disaster preparedness psychoeducation as a practical public health strategy that simultaneously targets disaster health literacy, mental well-being, and collective capacity to respond. The program's inclusive and culturally grounded delivery was especially beneficial for residents with limited formal education, indicating its potential to reduce inequities in preparedness and to serve as a scalable, community-centered model for rural health empowerment. Such interventions are particularly relevant for rural settings where access to formal services is constrained and where disaster exposure can intensify psychosocial distress, disrupt livelihoods, and widen health disparities. Integrating culturally adapted psychoeducation into local disaster risk reduction programming and routine community health promotion may therefore strengthen preparedness as a preventive health measure, complementing structural mitigation and early warning investments. Future research should evaluate longitudinal impacts through extended follow-up, test broader implementation across diverse rural and peri-urban contexts, and examine hybrid delivery models that incorporate digital tools to improve continuity, cost-effectiveness, and reach. Overall, the findings reinforce tailored psychoeducation as a strategic pillar for disaster preparedness and rural public health interventions, with clear implications for strengthening community resilience and reducing health risks associated with recurrent hazards.

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AUTHORS' CONTRIBUTION

Renidayati Renidayati: conceptualization; project administration; methodology; investigation; data curation; writing original draft. Nurlelasari Harahap: Investigation; formal analysis; Writing, review & editing. Verra Widhi Astuti: Investigation; Validation; Writing—review & editing. N. Rachmadanur: methodology; resources; writing, review & editing. Darwel Darwel: investigation (field implementation and documentation); visualization; writing, review & editing

COMPETING INTEREST

The author(s) declare no potential conflict of interest with respect to the research, authorship, or publication

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