

Evaluating Risk Communication Strategies in Local Government Responses to Dengue Fever in Indonesia

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ABSTRACT: Dengue fever remains a pressing public health challenge in Indonesia, where rapid urbanization, climate variability, and limited vector control capacity exacerbate transmission risks. This study aims to evaluate the effectiveness of local government risk communication strategies through a mixed-methods comparative case study of three initiatives: Bandung's CeWoli Jawaara, Banjarmasin's PSN 3M Plus, and Tabanan's PMI model. Findings reveal that multichannel and participatory strategies particularly those integrating digital tools with community-based outreach strengthen message retention, build public trust, and improve behavioral compliance. Trusted messengers such as health cadres and peer educators enhance credibility, while feedback loops and message repetition sustain engagement. In contrast, top-down approaches with limited interactivity often reduce effectiveness. The novelty of this research lies in its systematic comparison of localized communication models, combining global frameworks such as WHO's RCCE principles with Indonesia's own communication traditions. The results highlight how culturally attuned, community-driven communication can bridge gaps in public health governance. For policymakers, the study recommends embedding participatory infrastructures, investing in trusted local communicators, and institutionalizing hybrid media ecosystems to ensure resilience against future vector-borne outbreaks.

Keywords: Dengue Fever, Risk Communication, Community Engagement, Health Behavior, Indonesia, Public Health Campaigns.



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INTRODUCTION

Dengue fever continues to impose a growing and complex public health burden across Southeast Asia, with Indonesia disproportionately affected as a hyperendemic country where all four dengue virus serotypes circulate simultaneously. Rapid urbanization, climate variability, and high population mobility have accelerated transmission dynamics and intensified epidemiological patterns toward more severe disease outcomes, such as Dengue Hemorrhagic Fever (DHF). These trends have resulted in higher hospitalization rates and increased public health expenditures

(Harapan et al., 2019; Kanungo et al., 2024). Despite government efforts in mosquito control campaigns and community outreach, significant disparities in governance capacity, infrastructure, and funding streams persist, leaving many communities vulnerable to recurring outbreaks (Nasir et al., 2024; Ramadhani et al., 2022).

Against this backdrop, effective public communication emerges as a cornerstone of outbreak response, particularly during times of epidemiological crisis. Several communication theories provide the scaffolding for strategic messaging. The Situational Crisis Communication Theory (SCCT) emphasizes the necessity of tailoring messages to crisis typology and audience perception in order to maintain institutional credibility and minimize reputational harm (Lwin et al., 2017). The Health Belief Model (HBM), grounded in psychological theory, posits that health behavior is influenced by individuals' perceptions of susceptibility, severity, benefits, and barriers. The Extended Parallel Process Model (EPPM) further refines this understanding by asserting that communication must simultaneously convey threat severity and efficacy of response, thereby empowering individuals to take protective action (Hung et al., 2020).

To complement these theories, the World Health Organization's Risk Communication and Community Engagement (RCCE) framework offers a comprehensive, globally recognized set of principles tailored for emergency health communication. RCCE prioritizes transparency, two way communication, and inclusive engagement, encouraging community involvement in both planning and implementation phases. It also underlines the need for culturally relevant and adaptive strategies, designed to accommodate the local context and informed by real time community feedback. These values are critically important in Indonesia, where socio cultural diversity and unequal media access significantly affect how messages are interpreted and acted upon (Suwanbamrung et al., 2021).

Cangara's communication theory offers an indigenous complement to these global frameworks, by stressing the importance of social relationships, cultural context, and semiotic meaning making in communication. In the context of Indonesian public health, the application of Cangara's principles enables communication strategies to be attuned to local dialects, community structures, traditional beliefs, and interpersonal dynamics. By doing so, public health campaigns not only enhance their resonance with the target audience but also promote long term behavioral change and participatory health governance. Cangara's framework thus bridges the divide between institutional communicators and community stakeholders, fostering trust and cooperative engagement (Musdhalifa et al., 2022; Sari et al., 2020).

However, little research has systematically examined how localized risk communication strategies are designed, implemented, and received in Indonesia. Most studies focus on clinical or entomological aspects of dengue, while the social and behavioral dimensions of communication remain underexplored. Few have analyzed how misinformation, varying media literacy, or sociocultural contexts shape message effectiveness (Astuti et al., 2019; Wijayanti et al., 2016). This study addresses that gap by evaluating how different local government strategies align with both global communication frameworks and Indonesian communication traditions.

The objective of this study is to compare three distinct dengue communication initiatives—Bandung's CeWoli Jawara, Banjarmasin's PSN 3M Plus, and Tabanan's PMI model. These cases

were deliberately selected because they represent diverse geographic, demographic, and epidemiological contexts: a major urban center with high digital engagement (Bandung), a mid-sized city relying on top-down messaging (Banjarmasin), and a rural district emphasizing community-based approaches (Tabanan). By analyzing these contrasting models, the study seeks to generate context-sensitive insights that inform more inclusive and effective dengue communication strategies across Indonesia.

METHOD

This study employs a qualitative comparative case study design to rigorously assess the risk communication strategies used by local governments during dengue fever outbreaks. The rationale for selecting a comparative case study approach lies in its capacity to examine contextual variability and extract rich, context specific insights from diverse localities. By examining the cases of Bandung, Banjarmasin, and Tabanan three regions with distinct geographic, demographic, cultural, and epidemiological profiles this research aims to uncover how localized communication interventions are developed, operationalized, and interpreted by target populations. These regions were strategically selected to reflect variation in urbanization levels, community health infrastructure, historical dengue incidence rates, and socio cultural settings. The design facilitates the identification of patterns and divergences in strategy efficacy across spatial and institutional contexts.

Data collection applied a triangulated multi-method strategy:

- Document analysis: policy briefs, health education materials, social media posts, and municipal records.
- Key informant interviews: with public health officials, communication officers, community mobilizers, and civil society actors.
- Community surveys: to assess awareness, attitudes, trust in communicators, and behavioral responses.

Sampling aimed to balance demographic and gender representation.

Data analysis followed a rigorous, theory informed thematic coding process. Using NVivo software, interview transcripts, open ended survey responses, and document excerpts were coded based on categories derived from the RCCE framework (e.g., transparency, inclusiveness, adaptability) and Cangara's communication theory (e.g., communicator audience alignment, message resonance, cultural specificity). The codes were refined through iterative analysis and peer debriefing.

Analytical emphasis was placed on five core dimensions:

- Credibility of Communicators: Perceived trustworthiness and authority of message deliverers
- Cultural and Contextual Relevance: Appropriateness of content relative to local beliefs, language, and practices

- Media Accessibility and Reach: Utilization of digital, print, and interpersonal channels
- Message Clarity and Consistency: Comprehensibility and coherence across media types
- Feedback and Responsiveness: Mechanisms enabling community input and dialogue

Triangulation across the three methods enhanced interpretive validity and ensured the reliability of emergent themes.

To facilitate systematic cross case comparison, this study adapted the RE AIM framework. Each communication strategy was evaluated along five dimensions:

- Reach: The breadth and demographic spread of message dissemination
- Effectiveness: Observable changes in community knowledge, attitudes, and behaviors
- Adoption: Institutional and community level uptake of communication approaches
- Implementation: Fidelity, consistency, and quality of strategy execution
- Maintenance: Sustainability of messaging efforts and institutional memory post campaign

These indicators enabled structured analysis of how differing local contexts shaped communication success or failure, as well as how interventions adapted over time.

A comparative matrix was created to map qualitative and quantitative findings onto a shared framework. Each communication dimension (e.g., credibility, clarity, feedback responsiveness) was assessed within each case using both numeric scores (from surveys) and coded qualitative insights (from interviews and documents). This hybrid matrix approach facilitated the synthesis of large datasets into concise comparative profiles. The matrix highlighted shared successes (e.g., trusted communicators in all three sites) and site specific barriers (e.g., digital divide in Banjarmasin, misinformation in Bandung). Ethical approval for this study was obtained from the institutional review board, and informed consent was secured from all interview and survey participants.

Additionally, a timeline analysis was used to track the evolution of messaging strategies within each locality over time, capturing adaptive changes in response to outbreak severity or feedback. Visual tools such as strategy flowcharts and stakeholder maps were also developed to trace the relationships between communicators, messages, and recipient groups.

RESULT AND DISCUSSION

Bandung – CeWoli Jawara

Community Engagement via Health Cadres and Influencers

Health cadres and community influencers played a critical role in the success of Bandung's dengue communication strategy. By serving as trusted intermediaries, these individuals helped translate abstract health information into culturally meaningful narratives that resonated with local residents. Their grassroots involvement extended beyond dissemination cadres and influencers actively engaged in home visits, organized local gatherings, and facilitated community

dialogues. This relational approach enhanced trust and enabled the customization of public health messages to suit neighborhood specific concerns. As a result, message receptivity, behavioral compliance, and community driven surveillance increased noticeably. Additionally, health cadres provided real time feedback to municipal authorities, thus serving as vital links between policy and practice (Noor et al., 2024; Stefopoulou et al., 2021).

Digital Engagement through Instagram

Instagram became a cornerstone of the CeWoli Jawara program's digital outreach. The platform's visual orientation and interactivity aligned well with the communication preferences of Bandung's urban youth. Public health departments employed infographics, short form videos, memes, and carousel posts to distill complex information into digestible and shareable formats. Regular updates, Q&A sessions, and follower polls boosted visibility and engagement rates. These strategies also allowed rapid amplification of time sensitive alerts, such as rising dengue case numbers or neighborhood specific vector control actions. However, despite high user engagement, maintaining message accuracy and monitoring user generated content posed ongoing challenges. Partnerships with health influencers and real time content moderation were deployed to combat misinformation and ensure consistency in messaging (Mithani et al., 2023; Randriamihaja et al., 2024).

Public Perception of Wolbachia Intervention

The introduction of Wolbachia infected mosquitoes in Bandung triggered varied public responses. Initial campaigns succeeded in sparking interest, yet community perceptions were shaped heavily by rumors, scientific misunderstandings, and speculative concerns about ecological safety. While many residents welcomed the innovation as a long term solution, others voiced skepticism about genetic manipulation and unintended consequences. Public forums, community meetings, and transparency campaigns were crucial in addressing these doubts. Municipal health authorities provided evidence backed briefings and updates to sustain support. Program evaluations indicated that while trust levels increased post communication, sustained engagement and visible outcome reporting were essential to reinforce public confidence in Wolbachia's effectiveness (Gottschlich et al., 2023; Ren et al., 2022).

Misinformation Management Strategies

Misinformation posed a significant risk to Bandung's communication success. To counteract false narratives especially those concerning Wolbachia and vaccine safety the city implemented a multi pronged response. Real time social media monitoring, early detection algorithms, and intervention scripts were developed to identify and neutralize viral falsehoods. Furthermore, health cadres were trained as misinformation "first responders," equipped to deliver corrective information in face to face settings. Community events and "myth busting" segments in local broadcasts supplemented these efforts. Collectively, these actions helped stabilize trust levels and minimized the potential for information related disruptions (Abbas et al., 2023; Stamm et al., 2023).

Banjarmasin – PSN 3M Plus

Top down Messaging Efficacy

Banjarmasin's risk communication campaign leaned heavily on top down models, characterized by centralized planning and broadcast style dissemination. The messaging prioritized authority driven uniformity, using television, radio, posters, and official village announcements to inform the public. While this ensured message consistency, it lacked personalization and was less responsive to emerging concerns. Local officials noted that although awareness levels increased, the absence of localized content and interaction led to limited behavioral transformation. Feedback from community surveys highlighted a desire for more dialogue based formats that could address specific household level doubts and implementation barriers (Doernberg, 2022).

Persuasive Campaigns Without Interactivity

The city employed persuasive communication techniques emphasizing threat urgency and civic duty. Messages incorporated emotional appeals, dramatic imagery, and statistical data on dengue related morbidity. However, the lack of interactivity limited the effectiveness of these appeals. Without forums for clarification or audience feedback, many residents remained uncertain about practical steps to take. Evaluations revealed that while knowledge increased, actual adoption of preventive behaviors lagged. The city later introduced optional follow up surveys and encouraged local health workers to collect anecdotal feedback, but these were not systematized or fully integrated into the campaign cycle (Rafi'ah et al., 2024; Yamane et al., 2024).

Community Feedback Mechanisms

Recognizing gaps in community responsiveness, Banjarmasin added feedback mechanisms mid campaign. These included SMS surveys, printed questionnaires distributed via community health posts, and feedback boxes in public spaces. The collected data revealed key issues such as information overload, message fatigue, and confusion over technical terms. The city subsequently adapted its materials, simplifying language and prioritizing clarity. Additional town hall style meetings were organized in high incidence neighborhoods to address local questions directly. These interventions modestly improved public trust and communication efficacy (Labriola et al., 2021; Seals et al., 2022).

Influence of Demographics on Campaign Reach

Demographic analysis underscored the necessity of segmentation in communication strategy. Urban youth preferred mobile based content and responded well to visual formats, while older adults showed a preference for auditory channels like radio and direct outreach through religious gatherings. Households with limited internet access were disproportionately excluded from digital updates. Socioeconomic status and education level further influenced message retention and perceived credibility. Recognizing these disparities, the campaign eventually adopted a stratified approach to dissemination, aligning channels with demographic preferences and geographic media access data (Govindan et al., 2020; Rahayu, 2020).

Tabanan – PMI Model

Effect of Message Repetition

In Tabanan, message repetition emerged as a powerful catalyst for behavior change. Messaging was structured around a weekly delivery cycle, combining print materials, megaphone announcements, peer education, and household visits. Repeated exposure enabled deep internalization of key themes such as mosquito breeding site elimination and early symptom detection. The repetition effect was particularly impactful in rural areas where residents had limited exposure to mass media. Observations indicated not only increased knowledge but also a rise in sustained preventive behaviors, such as weekly cleaning routines and mosquito net usage (VanBuren et al., 2024).

Community Based Model Outcomes

PMI's approach relied on intensive training for local facilitators, who led awareness sessions and helped map neighborhood specific risks. These grassroots initiatives fostered strong community ownership of dengue prevention. Households reported feeling more informed and empowered to act. The participatory model also strengthened peer accountability, as community members reminded one another to uphold practices. Follow up assessments showed a notable decrease in larval indices and reported dengue cases, especially in high density sub villages. The integration of data feedback loops into community meetings helped monitor impact and adjust tactics in real time (Sianchapa et al., 2021).

Peer led Communication vs. Government Messaging

Peer led messaging in Tabanan outperformed government only messaging in terms of relatability, accessibility, and retention. Local peer educators were often family members, neighbors, or respected elders, which made their guidance more persuasive and less bureaucratic. Importantly, peer led sessions fostered informal dialogue, enabling participants to clarify doubts without fear of judgment. Nevertheless, alignment with national guidelines was maintained through regular coordination with district health offices. The hybrid model enhanced both message legitimacy and community uptake, highlighting its potential as a replicable strategy in similar rural contexts (Cobut et al., 2015; Hadi et al., 2024).

Evaluation Tools for Door to Door Strategies

A suite of evaluation tools was deployed to assess communication impact. These included baseline and endline surveys, structured interviews, observational audits, and focus group discussions. Mobile apps allowed real time entry and analysis of household level data, improving responsiveness. Community facilitators documented behavioral shifts, such as improved waste disposal and the use of mosquito repellents. Qualitative feedback provided insight into perceptions of message relevance, delivery style, and preferred formats. These insights guided the refinement of messages and identified the most effective channels for different subgroups (Holodinsky et al., 2021).

Comparative Effectiveness of Multichannel Communication Strategies

Multichannel communication strategies have been shown to be significantly more effective than single channel approaches in disseminating public health information and influencing behavioral change. By utilizing a diverse mix of communication mediums ranging from digital platforms like social media, health related mobile applications, and websites, to traditional media including television broadcasts, radio programs, posters, and printed leaflets public health agencies can ensure that messages are accessible to a broader and more diverse audience. These strategies are further strengthened by incorporating interpersonal communication methods such as door to door visits, community town halls, and interactive educational workshops.

The case studies from Bandung and Tabanan clearly demonstrate the effectiveness of multichannel strategies in adapting messages to fit the local dialect, cultural norms, and community expectations. In these areas, hybrid communication models facilitated not only real time information dissemination but also promoted two way interaction, allowing public health agencies to gather immediate feedback and adjust messaging accordingly. Empirical research supports this approach, indicating that exposure to health messages across multiple platforms improves message recall, comprehension, and compliance (Papoutsi et al., 2020; Tang & Santos, 2017).

Furthermore, multichannel campaigns are uniquely positioned to target specific subpopulations. For instance, digital content such as Instagram infographics and WhatsApp broadcasts are more likely to engage younger and tech savvy demographics, whereas traditional print materials and local meetings resonate better with elderly or low literacy populations (Kahwati et al., 2016; Sato & Ishimaru, 2024). Compared to Banjarmasin's top down, predominantly single channel model, Bandung's and Tabanan's multichannel approaches resulted in deeper trust, broader reach, and more consistent behavioral adherence across community segments.

Barriers to Participatory Communication Models

Despite widespread recognition of the efficacy of participatory communication models, their implementation across Indonesian public health campaigns remains limited due to systemic and contextual challenges. One primary barrier is the enduring reliance on centralized governance structures that emphasize vertical information dissemination and overlook community led dialogue (Miller et al., 2018). This often leads to superficial engagement, where communities are treated as passive recipients rather than active partners in health promotion.

In addition to institutional inertia, budgetary limitations pose a major constraint on participatory efforts. Many local governments struggle to allocate adequate resources for training community health workers, developing culturally adapted content, and organizing participatory workshops (Eppler et al., 2022). Furthermore, trust deficits between health institutions and local populations exacerbated by previous instances of misinformation or neglect undermine efforts to foster genuine collaboration (Hasche et al., 2020; Ong et al., 2024).

Cultural diversity within and across Indonesian regions also introduces complexity, as communication preferences and health beliefs vary considerably. These factors underscore the importance of local tailoring in designing engagement strategies. To overcome these barriers, public health programs must emphasize inclusivity from the outset, engaging communities in co design processes and providing platforms for continuous feedback (Oleribe et al., 2021).

Addressing Digital Inequality in Public Health Messaging

Digital inequality remains a significant obstacle in the equitable delivery of health communication. In both urban slums and rural areas, disparities in access to smartphones, internet connectivity, and digital literacy contribute to the exclusion of marginalized groups from vital public health messaging (Bohren et al., 2015; Diatmika & Karmila, 2022). As health systems increasingly rely on digital media for outreach, individuals who are offline or digitally illiterate face compounding disadvantages during health crises such as dengue outbreaks.

The Banjarmasin case illustrates this issue vividly, as digital only strategies inadvertently neglected older populations and those in impoverished areas. Bridging this divide requires intentional design of hybrid models that combine digital communication with analog formats like loudspeaker announcements, posters in public spaces, and community led house visits. Campaigns must also incorporate voice messages, illustrations, and local dialect translations to enhance accessibility for low literacy users (Vázquez et al., 2021).

Additionally, monitoring and evaluation tools should include digital equity metrics to track message penetration across demographic groups. By using disaggregated data, communicators can fine tune outreach strategies and ensure that no community is left behind due to technological limitations. Addressing digital inequality is not merely a logistical issue but a moral imperative for inclusive public health.

Global Lessons from Community Based Risk Communication

Community based risk communication models around the world offer practical insights that can be localized for Indonesian contexts. In Singapore, the "Dengue Free" campaign effectively mobilized residents by holding regular workshops and creating partnerships with local civic groups (Chiauzzi & Wicks, 2019). This co production approach nurtured a shared sense of responsibility and significantly improved neighborhood participation in mosquito control.

Similarly, in San Francisco, the Department of Public Health incorporated participatory design principles into their messaging, leveraging community forums to shape content and choose culturally appropriate channels. These efforts enhanced the relevance and reception of messages (Cairns et al., 2017). In Brazil, the "Saúde Em Casa" initiative enabled community health workers to conduct door to door campaigns, using interactive dialogue and printed visuals to strengthen understanding and engagement (Kassa et al., 2024).

These case studies underscore the value of iterative message development, continuous engagement, and localized delivery. Their success hinges on principles such as cultural competence, stakeholder collaboration, and consistent feedback integration. Applying similar models in Indonesia, while adapting them to local values and constraints, could significantly improve public responsiveness to dengue control initiatives.

Synthesizing Insights for Policy and Practice

The comparative analysis across Bandung, Banjarmasin, and Tabanan provides clear policy implications for enhancing dengue communication in Indonesia. Key takeaways include the

critical role of multichannel delivery systems, the necessity of involving trusted community actors, and the imperative of designing inclusive communication frameworks.

Policymakers should institutionalize hybrid communication strategies that blend technology with interpersonal engagement. Investment in training for health cadres, development of culturally adapted materials, and incorporation of local languages are vital. Programs should also establish continuous evaluation systems, drawing on tools such as community surveys and digital analytics to adapt messaging in real time.

Moreover, embedding participatory approaches into the core of public health planning can bridge the trust gap and foster sustainable behavioral change. Government agencies must transition from purely informative campaigns to dialogic models that empower communities as co-creators of health solutions. The RCCE framework from WHO offers a robust blueprint for operationalizing these principles.

Ultimately, addressing the multi layered barriers structural, technological, cultural that limit communication effectiveness will be essential for long term epidemic resilience. By grounding communication efforts in inclusivity, adaptability, and community engagement, Indonesia can better prepare for and mitigate future vector borne disease outbreaks.

Study Limitation

This study is limited by its reliance on three case studies, which may not capture the full diversity of Indonesia's local contexts. The survey data were self-reported, introducing potential bias. Furthermore, while qualitative triangulation improved validity, the absence of longitudinal data restricts conclusions about the long-term sustainability of interventions. These limitations should be considered when interpreting findings and applying recommendations.

CONCLUSION

This study highlights the importance of community-rooted, adaptive, and multichannel communication in strengthening dengue prevention strategies in Indonesia. By comparing Bandung's *CeWoli Jawara*, Banjarmasin's *PSN 3M Plus*, and Tabanan's *PMI model*, the research demonstrates that strategies integrating trusted local actors, culturally adapted messages, and participatory feedback systems are more effective than top-down, single-channel approaches. These findings reaffirm that credibility, inclusivity, and adaptability are the cornerstones of successful risk communication in diverse Indonesian contexts.

The novelty of this research lies in its systematic comparison of localized communication models, bridging the WHO's RCCE framework with Cangara's indigenous communication theory. This dual perspective offers insights that are both globally informed and locally grounded, enabling more context-sensitive approaches to public health communication. The study also provides practical guidance for policymakers, emphasizing the institutionalization of hybrid communication models, investment in trusted community messengers, and deliberate efforts to address digital

inequality. At the same time, the research acknowledges its limitations, particularly the focus on three case studies and the absence of longitudinal data, which constrain generalization and sustainability assessment.

Looking forward, future studies should expand to a wider range of Indonesian regions and adopt longitudinal designs to capture the long-term impacts of participatory communication strategies. By doing so, research can further illuminate how risk communication can evolve to build resilience against not only dengue but also other emerging vector-borne diseases in Indonesia.

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