

# Development and evaluation of a first aid mobile application for community members in Indonesia

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## Abstract

**Background:** Timely and effective first aid is critical in emergencies to improve outcomes and save lives. Despite advancements in first aid education globally, limited culturally tailored tools exist in Indonesia to empower communities with first aid skills. Mobile health (mHealth) applications offer a scalable and accessible solution to address this gap.

**Purpose:** This study aimed to develop and evaluate a first aid mobile application tailored for community members in Indonesia.

**Methods:** A mixed-methods design was employed to develop and evaluate the "QuakeGuard" application. The development utilized Android Studio, Kotlin programming, and a server-client architecture with Firebase for real-time data handling. Usability was assessed through the System Usability Scale (SUS), intrinsic motivation was measured using the Intrinsic Motivation Inventory (IMI), and thematic analysis was applied to qualitative feedback. Data were analyzed using descriptive and thematic analysis.

**Results:** The QuakeGuard application demonstrated positive usability perceptions, with SUS item responses showing a median score of 4.3 on a 5-point Likert scale. This value represents the median item-level response rather than the standardized SUS score. Participants also demonstrated strong intrinsic motivation, with median IMI domain scores of 5.75 for Effort/Importance and 6.25 for Value/Usefulness. All participants successfully completed predefined tasks, and qualitative findings highlighted the application's intuitive design, educational value, and practical features, including earthquake alerts and access to nearby health facilities.

**Conclusion:** The QuakeGuard application demonstrates strong potential for enhancing first aid knowledge and disaster preparedness among community members in Indonesia. Future research should focus on broader population studies and long-term evaluations to optimize its impact.

**Keywords:** mHealth; first aid; disaster preparedness; mobile application; Indonesia; usability evaluation

## Introduction

In emergency situations, the provision of timely and effective first aid can drastically improve outcomes and save lives. For example, the Lay First Responder Model, which trains motorcycle taxi drivers to serve as first responders in low- and middle-income countries, has demonstrated its capacity to enhance prehospital emergency care and reduce mortality rates (Delaney et al., 2018). Despite such advancements, many individuals remain inadequately prepared to administer appropriate first aid during critical moments, primarily due to a lack of knowledge and confidence (Ahmad et al., 2022). Surveys have consistently shown that a substantial portion of the general public feels unprepared to handle medical emergencies, underscoring the urgent need for widespread first aid education (Deepthi et al., 2018; Dainty et al., 2022; D'Angelo et al., 2021). Furthermore, the importance of initial assessment and management using the Airway, Breathing, Circulation, Disability, and Exposure (ABCDE) framework has been well-documented in emergency care settings (Thim et al., 2022).

Mobile health (mHealth) technologies present a promising solution to

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address these gaps by offering accessible, real-time first aid guidance to the public (Free et al., 2020). Globally, various organizations have leveraged mHealth innovations to improve first aid knowledge and skills. For instance, the International Federation of Red Cross and Red Crescent Societies (IFRC) developed a First Aid app that provides users with instant access to essential first aid information. Features such as step-by-step instructions, interactive quizzes, and video demonstrations are designed to make learning engaging and practical (Hollis et al., 2020). These tools cater to both laypersons and trained responders, ensuring widespread usability. In Indonesia, the Indonesian Red Cross launched the PMI First Aid app, particularly aimed at travelers during the annual Idul Fitri exodus, a time marked by high travel volumes and increased accident risks (Indonesian Red Cross, 2016). This app offers guidance on managing medical emergencies, locating nearby healthcare facilities, and understanding basic first aid principles (Pradipta et al., 2021), illustrating how mHealth tools can address specific cultural and situational needs.

Numerous studies have demonstrated the effectiveness of mobile applications in enhancing first aid knowledge and boosting user confidence. Research indicates that mobile-based interventions significantly improve knowledge retention and practical skills, especially when enriched with gamified elements or multimedia resources (Cheng et al., 2024; Ekaprasetya et al., 2022; Sen et al., 2022). However, evidence on the efficacy of smartphone apps offering real-time guidance during resuscitation remains mixed (Metelmann et al., 2021). The iWILL app, for instance, has been noted for its rapid response system in emergencies, further emphasizing the critical role of mobile technology in facilitating immediate first aid (Shyam & Fernando, 2023). These applications are particularly impactful in bridging gaps in formal first aid training, especially in remote or underserved areas where access to conventional training programs is limited (Maita et al., 2024).

Despite their potential, several challenges persist in ensuring the usability, cultural relevance, and linguistic accessibility of first aid apps. Research highlights the need to tailor app content to meet the unique needs of target populations. For example, Ab Rahman et al. (2022) emphasized that culturally sensitive app designs significantly enhance user engagement and adoption. In the Indonesian context, the absence of a culturally and linguistically tailored first aid mobile application may impede the effective dissemination of vital first aid knowledge and skills. This gap underscores the necessity for a user-friendly, context-specific mobile application to empower Indonesian communities to respond effectively during emergencies.

This study aims to design and evaluate a first aid mobile application specifically tailored for community members in Indonesia. Unlike previously developed first aid applications that primarily focus

on general emergency education, QuakeGuard integrates culturally adapted first aid content, earthquake preparedness features, educational multimedia, interactive quizzes, and access to nearby health facilities within a single platform. Furthermore, this study contributes to the field by evaluating the application using a mixed-methods approach that combines usability assessment, intrinsic motivation measurement, task performance evaluation, and qualitative user experiences. By addressing cultural, linguistic, and contextual needs of Indonesian communities, this research provides evidence regarding the potential role of mHealth technology in strengthening community-based disaster preparedness and nursing practice.

## Materials and Methods

### Design

This study employed a mixed-methods design combining quantitative and qualitative approaches to develop and evaluate a mobile application named "QuakeGuard" aimed at enhancing a first aid knowledge and skill in Indonesia. The development and evaluation phases were carried out in collaboration with information technology experts.

### Sample

The study focused on engaging community members who were actively involved in disaster preparedness initiatives. Participants were selected using a purposive sampling method, targeting individuals with prior experience or a strong interest in disaster preparedness activities. For the evaluation phase, a total of 30 participants were recruited. The sample size for the study was determined based on established usability testing guidelines, which suggest a minimum of 20 to 30 participants to effectively identify significant usability issues (Kjeldskov & Stage, 2003).

The inclusion criteria specified that participants had to be at least 18 years old, actively involved in disaster preparedness programs, possess an Android-compatible smartphone, and willingly provide informed consent to participate in the study. Exclusion criteria included individuals with no prior experience using mobile applications or those unable to operate a smartphone due to physical or cognitive impairments.

### Mobile application development

The QuakeGuard mobile application was meticulously developed to provide an innovative and user-friendly solution for earthquake preparedness and response. The development process utilized Android Studio as the integrated development environment and Kotlin as the primary programming language, ensuring compatibility and robust functionality. A server-client architecture was implemented, leveraging HTTP and Web API to facilitate seamless communication between the server and client devices. Firebase was employed

as the database management system to enable real-time data handling, ensuring the application's responsiveness and reliability. To enhance security, user authentication and session management features were integrated, safeguarding user data and ensuring secure access.

The application was equipped with a range of features designed to support users during emergencies. It included comprehensive first aid materials, such as CPR guidelines and evacuation procedures, providing essential knowledge for immediate response. Engaging video animations and educational games were incorporated to make learning interactive and accessible. Quizzes offered users the opportunity to test their knowledge, while an online forum facilitated community interaction and information sharing. Furthermore, the application integrated earthquake warning systems, linked to nearby primary health facilities, to provide timely alerts and guidance in critical situations. This holistic approach ensured that the QuakeGuard app served as a reliable tool for disaster preparedness and community resilience (Figure 1).

### Evaluation Instruments

The evaluation process incorporated three key instruments to ensure comprehensive data collection and analysis. Each instrument was selected for its relevance to the study objectives and its proven reliability and validity in assessing the desired constructs. These instruments included the System Usability Scale (SUS), the Intrinsic Motivation Inventory (IMI), and a customized survey tailored to specific research needs.

The System Usability Scale (SUS), originally developed by Brooke in 1986, served as a standardized tool to evaluate the usability of the application. This instrument comprises 10 items, each rated on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Its widespread application in usability studies underscores its credibility, with the original version demonstrating a high reliability score of Cronbach's  $\alpha = 0.91$ . To ensure cultural and contextual appropriateness for this study, the SUS was validated in Bahasa Indonesia, yielding a slightly lower but still robust reliability score of Cronbach's  $\alpha = 0.88$ . The Indonesian adaptation process followed a cross-cultural adaptation procedure involving forward translation, backward translation, expert review, and pilot testing to ensure semantic clarity and contextual appropriateness among Indonesian users.

The Intrinsic Motivation Inventory (IMI), developed by Plant and Ryan in 1985, was employed to measure the intrinsic motivation of participants. This instrument comprises seven items assessed on a 7-point Likert scale, where 1 represents Strongly Disagree and 7 represents Strongly Agree. The IMI has a well-documented history of reliability, with the original version achieving a Cronbach's  $\alpha$  of 0.86. Its use in this study aimed to provide insight into

participants' internal drive and engagement with the intervention.

Additionally, a customized survey was designed to capture demographic information, participants' prior experience with mobile applications, and their perceptions related to disaster preparedness. This instrument was developed to address specific study objectives that were not covered by standardized tools. To ensure the survey's validity, its content underwent rigorous evaluation by a panel of experts in the field. This review process aimed to establish content validity, ensuring that the questions were relevant, clear, and aligned with the study goals.

### Data collection

The application was developed through an iterative process that carefully integrated user needs alongside technical hardware and software requirements. The development cycle included meticulous coding and rigorous testing phases, all executed within a server-client architecture to ensure a robust and scalable system. To ensure effective engagement with the application, participants underwent comprehensive training. This training encompassed key functionalities of the app, including navigation and practical procedures such as first aid, enabling participants to use the application confidently and effectively.

Usability testing was conducted to evaluate the application in real-world contexts. This testing employed the Think Aloud (TA) method, allowing researchers to gather real-time insights into user experiences and potential usability challenges. Participants also completed the System Usability Scale (SUS) and Intrinsic Motivation Inventory (IMI) questionnaires. Each participant carried out six specifically designed tasks that tested the core features of the application.

Qualitative feedback was an essential component of the evaluation process. Participants were invited to share their experiences and perceptions of the application through open-ended questions and a structured survey. This feedback provided valuable insights into usability, engagement, and the relevance of the content offered by the application.

Data collection spanned two weeks, during which participants interacted with the application twice weekly. Quantitative data derived from the SUS, IMI, and survey responses were systematically analyzed using descriptive statistics and median score calculations to identify trends and patterns. Concurrently, qualitative feedback was subjected to thematic analysis, allowing researchers to identify recurring themes and insights that could inform future improvements to the application.

### Data analysis

For the quantitative data, descriptive statistics were utilized to summarize the usability metrics, focusing on aspects such as functionality, engagement, and visual appeal. The results were reported in terms of median values accompanied by interquartile

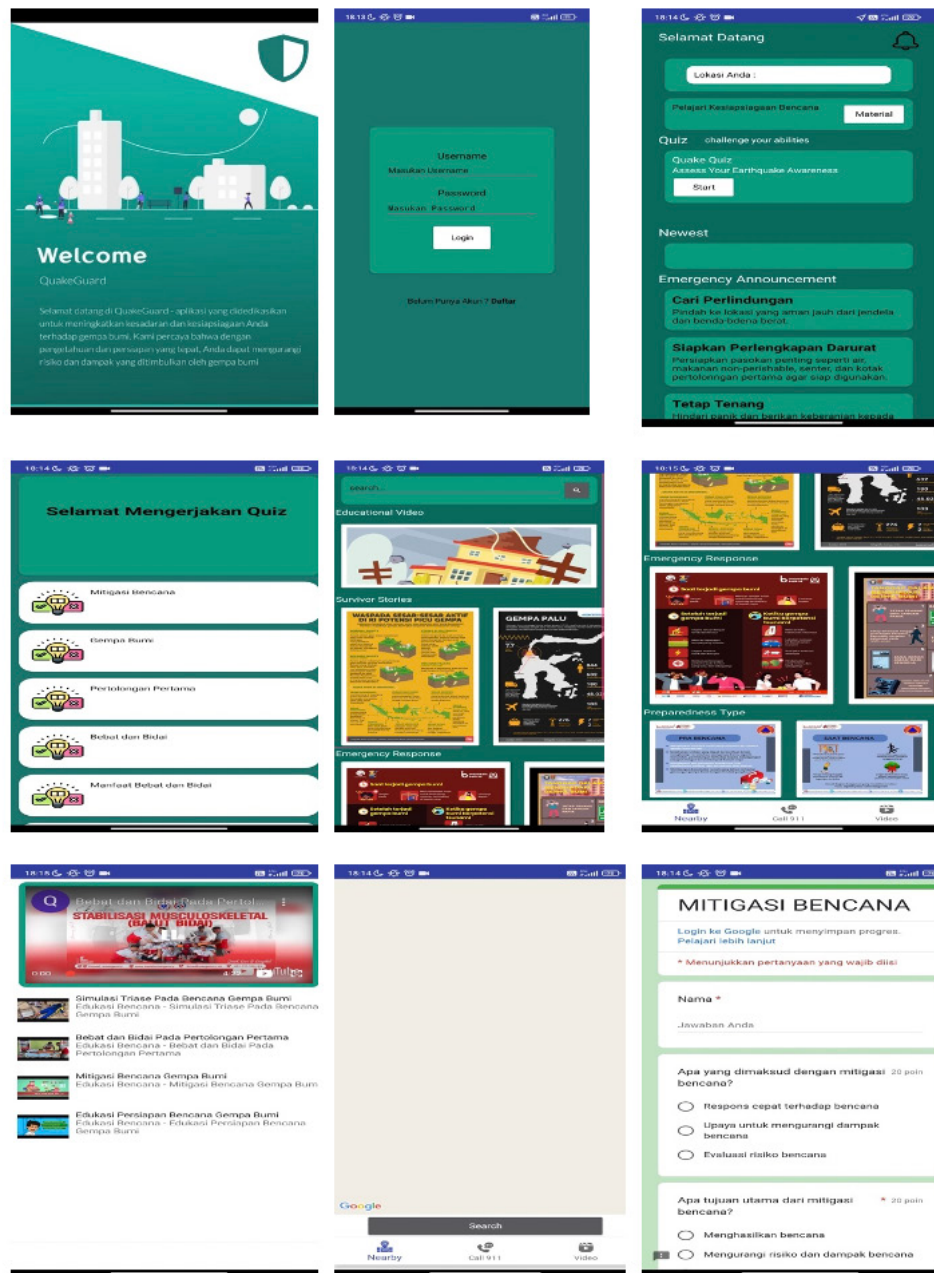


Figure 1. QuakeGuard mobile application

ranges (IQR) to provide a clear understanding of the data distribution. For the qualitative data, a thematic analysis was conducted to examine user feedback obtained through the Think Aloud method and responses to open-ended survey questions. This approach allowed for the identification of recurring patterns and themes in user experiences, offering deeper insights into their interactions with the system. All data analyses were carried out using SPSS software, Version 26, ensuring accuracy and reliability in processing both quantitative and qualitative datasets.

### Ethical consideration

Ethical approval for the study was granted by

the Institutional Review Board (IRB) at STIKes Sukabumi (ETIK.012/III/2024). Prior to participation, all individuals provided informed consent, ensuring their understanding of the study's purpose, procedures, and their rights as participants.

## Results

### Demographic Characteristics of Participants

The study included 30 participants actively involved in disaster preparedness programs. The majority were female (63.3%), with a median age of 35 years (IQR = 28–43). Most participants held a bachelor's

**Table 1. Demographic Characteristics of Participants**

| Variable                   | n (%)      |
|----------------------------|------------|
| Gender                     |            |
| Male                       | 11 (36.7%) |
| Female                     | 19 (63.3%) |
| Age (years)                |            |
| Median (IQR)               | 35 (28–43) |
| Education Level            |            |
| High School                | 6 (20.0%)  |
| Bachelor's Degree          | 18 (60.0%) |
| Master's Degree            | 6 (20.0%)  |
| Prior Experience with Apps |            |
| Yes                        | 26 (86.7%) |
| No                         | 4 (13.3%)  |

**Table 2. Detailed results of SUS item analysis**

| SUS Item                                                                      | Mean | SD  | Strongly Agree (%) | Agree (%) | Neutral (%) | Dis-agree (%) | Strongly Disagree (%) |
|-------------------------------------------------------------------------------|------|-----|--------------------|-----------|-------------|---------------|-----------------------|
| I think that I would like to use this system frequently.                      | 4.2  | 0.7 | 50                 | 40        | 7           | 3             | 0                     |
| I found the system unnecessarily complex.                                     | 1.8  | 0.9 | 5                  | 10        | 20          | 50            | 15                    |
| I thought the system was easy to use.                                         | 4.5  | 0.6 | 60                 | 30        | 5           | 5             | 0                     |
| I think that I would need technical support to use this system.               | 2.0  | 1.1 | 10                 | 15        | 25          | 40            | 10                    |
| I found the various functions in this system well integrated.                 | 4.3  | 0.8 | 55                 | 35        | 5           | 5             | 0                     |
| I thought there was too much inconsistency in this system.                    | 2.1  | 1.0 | 8                  | 12        | 20          | 45            | 15                    |
| I would imagine that most people would learn to use this system very quickly. | 4.6  | 0.5 | 65                 | 30        | 3           | 2             | 0                     |
| I found the system very cumbersome to use.                                    | 1.7  | 0.8 | 3                  | 7         | 10          | 60            | 20                    |
| I felt very confident using the system.                                       | 4.4  | 0.7 | 58                 | 35        | 5           | 2             | 0                     |
| I needed to learn a lot of things before I could get going with this system.  | 2.2  | 1.2 | 12                 | 18        | 20          | 35            | 15                    |

**Table 3. Intrinsic Motivation Inventory (IMI) Scores by Domain and Item**

| Domain               | Mean | SD   | Min-Max |
|----------------------|------|------|---------|
| Interest/Enjoyment   | 4.43 | 0.8  | 2.6–6.7 |
| Perceived Competence | 4.43 | 0.75 | 2.3–6.6 |
| Effort/Importance    | 5.75 | 0.9  | 3.5–6.5 |
| Pressure/Tension     | 3.45 | 1.25 | 2–6     |
| Value/Usefulness     | 6.25 | 0.75 | 4.5–7   |

**Table 4. Task Performance of QuakeGuard Application (n = 30)**

| Task                             | Number of Participants Attempted (n) | Number of Participants Completed (n) | Completion Rate (%) | Median Completion Time (minutes) | IQR (minutes) |
|----------------------------------|--------------------------------------|--------------------------------------|---------------------|----------------------------------|---------------|
| Accessing First Aid Materials    | 30                                   | 30                                   | 100                 | 4.5                              | 4–5           |
| Completing First Aid Quizzes     | 30                                   | 30                                   | 100                 | 6.0                              | 5–7           |
| Navigating Interactive Content   | 30                                   | 30                                   | 100                 | 5.5                              | 5–6           |
| Viewing Educational Videos       | 30                                   | 30                                   | 100                 | 4.0                              | 3–5           |
| Submitting Feedback Through App  | 30                                   | 30                                   | 100                 | 5.0                              | 4–6           |
| Accessing Emergency Contact Info | 30                                   | 30                                   | 100                 | 5.5                              | 4–6           |

degree (60%) and reported prior experience with mobile applications (86.7%). Table 1 provides detailed demographic characteristics.

#### Usability testing

The SUS findings indicated positive user perceptions regarding the usability of QuakeGuard. Participants reported that the application was easy to use, well-integrated, and required minimal technical support. Detailed SUS item responses are presented in Table 2.

The Intrinsic Motivation Inventory (IMI) results indicate varying motivation levels across its domains. Both the Interest/Enjoyment and Perceived Competence domains have moderate mean scores of 4.43, reflecting balanced intrinsic engagement and perceived ability. The Effort/Importance domain shows the highest commitment with a mean score of 5.75, while the Pressure/Tension domain has a lower mean of 3.45, suggesting minimal stress or pressure. The Value/Usefulness domain stands out with the highest mean score of 6.25, emphasizing participants' strong perception of the tasks' importance and relevance (Table 3).

#### Task performance

All tasks in the study were successfully attempted and completed by all 30 participants, resulting in a 100% completion rate for each activity. The median completion time for tasks varied slightly, with accessing first aid materials being the quickest (4.5 minutes, IQR: 4–5), followed by viewing educational videos (4.0 minutes, IQR: 3–5). Completing first aid quizzes required the longest time (6.0 minutes, IQR: 5–7). Navigating interactive content, submitting feedback, and accessing emergency contact information had median completion times of 5.5, 5.0, and 5.5 minutes respectively, with narrow interquartile ranges indicating consistent performance across participants (Table 4).

#### Qualitative Feedback

##### Ease of Use

Participants consistently praised the application's

ease of use, emphasizing its intuitive interface and user-friendly design. Key aspects that contributed to this perception included clear navigation menus, well-organized content, and aesthetically pleasing visuals. The engaging design elements, such as icons and interactive buttons, made it accessible even to individuals with minimal technological literacy. Participants also noted that the app required little to no instruction to begin using, reflecting the simplicity and thoughtfulness of its design.

*"I didn't need any guidance to use the app—it was straightforward. Everything was labeled clearly, and the navigation was very intuitive."*

*"The design is clean and simple, which makes it easy to focus on the content without feeling overwhelmed."*

*"Even though I'm not very tech-savvy, I could figure out how to use the app on my own, which was a relief."*

##### Educational Value

Users highlighted the application's educational features as a significant benefit. The app offered comprehensive first aid materials, interactive quizzes, and video animations, which were particularly appreciated for their ability to enhance understanding. The diverse learning modalities catered to different learning preferences, ensuring that users could gain practical knowledge effectively. Many participants mentioned that the interactive features made learning enjoyable and retained their attention, while the detailed explanations in the first aid materials instilled confidence in applying the skills.

*"The video animations were very helpful in demonstrating first aid techniques. It's much easier to understand than just reading instructions."*

*"I learned so much from the interactive quizzes—they tested my knowledge and gave me instant feedback, which was motivating."*

*"The app provides detailed explanations for every scenario, which gave me confidence that I could handle emergencies better."*

## Practical Application

Participants emphasized the practical relevance of the app in real-world disaster situations. Features like earthquake alerts and links to nearby health facilities were described as vital tools that added a sense of security. Users appreciated that the app not only provided information but also actionable resources that could be used during emergencies. They felt the app bridged the gap between knowledge and real-life application, empowering them to respond effectively in crisis scenarios.

*"The earthquake alert feature is brilliant—it gives us timely updates and helps us stay prepared during emergencies."*

*"I liked how the app showed nearby health facilities. Knowing where to go in a disaster is a huge relief."*

*"This app isn't just about learning; it's about applying what you know when it matters most, which is exactly what we need."*

## Discussion

The findings of this study demonstrate that the QuakeGuard application is a highly effective, engaging, and user-friendly tool for enhancing disaster preparedness and first aid skills among community members in Indonesia. This research adds to the growing evidence supporting the utility of mobile applications as innovative tools to bolster community resilience and disaster readiness. Numerous prior studies have emphasized the significant role of mobile applications in improving disaster preparedness. For instance, [Dufty \(2020\)](#) highlighted the importance of intuitive digital tools in fostering community awareness and readiness for natural disasters. Such tools often employ interactive and easily accessible features to enhance engagement, learning, and actionable outcomes. Similarly, [Prasetyo et al. \(2022\)](#) found that mobile applications designed for first aid education significantly improve users' knowledge retention and learning outcomes, largely due to their multimedia-based and interactive design. These findings align closely with the results of this study, where the QuakeGuard application significantly improved participants' disaster-related knowledge and practical skills.

The high usability and motivation scores observed in this study align with existing literature emphasizing the impact of well-designed interfaces on user satisfaction and continued use. [Reuter et al. \(2020\)](#) demonstrated that mobile applications with intuitive navigation, engaging content, and clear instructions are more likely to gain user acceptance and consistent utilization. These design elements are crucial in promoting the sustained adoption of technology, especially in areas such as disaster preparedness, where proactive behavior is essential. Participants' qualitative feedback in this study further underscored the importance of customizing applications to address local cultural needs and

community contexts. This finding aligns with [Hermanto et al. \(2021\)](#), who reported that disaster preparedness tools tailored to cultural nuances and community-specific needs foster greater trust and user engagement. In Indonesia, where diverse cultural practices and geographical vulnerabilities significantly influence disaster preparedness, the cultural adaptability of the QuakeGuard application likely contributed to its success.

The educational efficacy of the QuakeGuard application aligns with research emphasizing the role of interactive technology in fostering behavioral change and skill acquisition. [Smith et al. \(2020\)](#) noted that mobile applications incorporating gamification, scenario-based learning, and real-time feedback are particularly effective in reinforcing knowledge and facilitating the development of practical skills. The inclusion of such features in the QuakeGuard application likely contributed to its positive impact on disaster preparedness and first aid capabilities. Additionally, the participatory development approach employed in this study supports best practices in technology design for disaster management. [Baldwin et al. \(2021\)](#) emphasized that iterative design processes incorporating user feedback are critical for developing applications that meet user needs and achieve desired outcomes. The integration of participant input during the design phase of QuakeGuard likely played a pivotal role in its high usability and positive reception among users.

The QuakeGuard application has significant potential to advance disaster management and community health initiatives, particularly in disaster-prone regions like Indonesia. By equipping users with practical first aid skills and comprehensive disaster preparedness knowledge, the application addresses both immediate and long-term challenges associated with disasters. This capability is especially valuable in areas with limited access to emergency medical services, where timely first aid interventions and adequate preparation can reduce the severity of injuries and increase survival rates during critical events. Furthermore, embedding the QuakeGuard application within community health programs could extend its reach and effectiveness. This integration could foster a culture of resilience and proactive risk management, enabling individuals and communities to better respond to disasters. Additionally, the educational modules within the application can supplement formal training programs for healthcare workers and community volunteers. In resource-limited settings, where access to comprehensive training is constrained, QuakeGuard provides scalable and practical learning tools to bridge critical gaps in disaster response capabilities.

From a community nursing perspective, QuakeGuard provides an innovative approach to extending the role of nurses beyond conventional health education activities. Community nurses can utilize the application as a supporting medium for disaster preparedness training, health promotion,

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and empowerment of individuals and families. The integration of first aid education into digital platforms may strengthen community capacity to respond effectively during emergencies and support the principles of disaster nursing, particularly in prevention, preparedness, and community resilience building. Therefore, the contribution of this study extends beyond technological development by providing evidence for the application of mHealth in strengthening community-based nursing interventions.

Despite its promising outcomes, this study has several limitations. Firstly, the sample size was limited to a specific community, which may restrict the generalizability of the findings to broader populations or other regions. Secondly, reliance on self-reported data introduces potential biases, such as social desirability and recall errors, which could affect the accuracy of the results. Lastly, the study's short-term evaluation period limits the ability to assess the application's long-term usability and effectiveness. To address these limitations, future research should focus on larger, more diverse populations and adopt longitudinal study designs to evaluate the sustained impact of the application. Additionally, incorporating objective outcome measures and expanding the scope of evaluation to include diverse geographical and cultural contexts would provide a more comprehensive understanding of the application's effectiveness. By addressing these limitations and expanding its reach, the QuakeGuard application has the potential to become a transformative tool in disaster preparedness, significantly improving individual and community resilience in disaster-prone regions.

## Conclusions

The QuakeGuard application marks a notable leap forward in utilizing digital technology for disaster preparedness and first aid education. The integration of quantitative and qualitative findings underscores its excellent usability, engaging interface, and educational impact, positioning it as a vital resource for strengthening community resilience in disaster-prone regions. By catering to local requirements and incorporating user feedback, the application holds the potential to become a pivotal component of disaster management strategies in Indonesia and comparable contexts. Future studies should focus on broadening its reach, assessing its long-term effectiveness, and examining its integration with existing disaster management frameworks. Future implementation should consider integrating QuakeGuard into community health programs, disaster preparedness initiatives, and nursing-led health education interventions to maximize its contribution to public health services.

## Declaration of Interest

The author declares no conflict of interest.

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## Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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