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DESIGN GAP ANALYSIS OF EPILEPSY SEIZURE ALERT MOBILE APPLICATIONS FOR BYSTANDER SUPPORT

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Abstract

Seizure alert mobile applications were created as a solution to improve emergency response for People With Epilepsy (PWE). However, existing applications mostly focus on notifying remote caregivers, leaving a critical gap in on-site bystander support. This study presents a comparative analysis and design gap identification of four seizure alert mobile applications, such as Aura: Seizure First Aid, Epicentr, SeizAlarm, and SeizureAlert – MyMedicWatch from the perspectives of both primary users (PWE) and secondary users (bystanders as helpers). Using a feature comparisons framework grounded in Human-Computer Interaction (HCI) principles, this study identifies the design gaps across activation method, user focus, interaction output, and bystander guidance. Findings reveal that even though Epicentr, SeizAlarm, and SeizureAlert have adopted automatic heart rate-based activation, none provides guidance for bystanders, making PWE face the challenges of not being able to get proper help during a seizure. Aura: Seizure First Aid is the only app focused on bystander guidance during the critical five minutes yet remains limited by its dependence on manual activation by the PWE. This study concludes that the integration of automatic seizure detection with on-site bystander guidance represents the most critical unaddressed design gap in current seizure alert application development.

Keywords: Comparative Analysis; Epilepsy First Aid; Human-Computer Interaction; People With Epilepsy (PWE); Seizure Alert App

INTRODUCTION

The term "epilepsy" derives from the Greek word *epilepsia* (seized or snatched). This condition is characterized by seizures, behavioral changes, and/or loss of consciousness that occur suddenly due to abnormal electrical surges in the brain (Hawari, 2022). Epilepsy is a condition that affects people regardless of age, race, or gender (Harsono, 2021). According to data from the World Health Organization (2024), 50 million people worldwide suffer from epilepsy. Data on the incidence of epilepsy in Indonesia remains limited. Many cases of epilepsy go undetected and unreported. The estimated number of people with epilepsy in Indonesia is 1.5 million, with a prevalence of 0.5–0.6% of the Indonesian population (Menteri Kesehatan Republik Indonesia, 2026).

This condition is one of the most common neurological disorders in the world (GBD 2016 Epilepsy Collaborators, 2019). Triggers for epileptic seizures vary, including

certain types of light (photosensitive epilepsy), menstruation, lack of sleep, hunger, stress, cold, and heat. The central nervous system in the brain of people with epilepsy is disrupted, preventing the nervous system from sending signals to the sensory system. Before an epileptic seizure occurs, some people may experience unusual sensations or feelings; these pre-seizure signs are called auras.

Based on a survey conducted in 2026 among 23 members of the Indonesian Epilepsy Community and the Indonesian Epilepsy Community (KOMPI) in the Jabodetabek area who experience auras, it was found that 34.8% of PWE immediately had a seizure without having time to warn those around them, and 47.8% of PWE "sometimes" managed to warn those around them. The majority of PWE experience seizures with short duration (less than 1 minute to 5 minutes) after sensing an aura, so some sustain injuries from falling, and some do not receive assistance when the seizure occurs.

U.S. Centers For Disease Control and Prevention (2024) stated that a person experiencing a seizure who does not receive immediate proper assistance, especially if the seizure lasts longer than 5 minutes, may be at risk due to oxygen deprivation, injuries, and the possibility of Sudden Unexpected Death in Epilepsy (SUDEP). This risk is further compounded by the high mortality rate from epilepsy in Indonesia, which currently stands at 2.8 per 100,000 people annually (Menteri Kesehatan Republik Indonesia, 2026). From the survey, 87% of PWE reported not receiving proper first aid during a seizure, thus increasing the urgency of the need for easily accessible seizure first aid guidance.

Human civilizations are now shaped by a visual culture driven by digital mechanisms (Nuno & Sugiharto, 2026). In this context, the emergence of mobile health apps has opened new possibilities for seizure management. Some seizure alert applications have been developed to improve the safety and quality of life for PWE, ranging from manual alert systems to automatic seizure detection such as motion and heart rate-based sensors using wearable technology. However, the design focus of these apps varies widely, some prioritize automatic detection and notification for the remote caregivers, while the needs of on-site responders as a critical user group have been addressed by only one app, and even that app still faces some accessibility challenges. The importance of this issue has been highlighted by Nuno and Sugiharto (2026), stating that accessibility must remain a top priority so that design innovations continue to address existing technology gaps.

From the perspective of Human-Computer Interaction (HCI), the effectiveness of health emergency applications doesn't only depend on the technical capabilities but also on how well the features are to fulfill the needs of all users in the real case of emergency conditions (Caroll, 2014). Feature comparison and gap analysis between the existing seizure alert applications are essential to identify the unaddressed design opportunities and inform the development of more comprehensive solutions.

This study addresses this gap by conducting systematic comparative feature analysis of four seizure alert applications, Aura: Seizure First Aid, Epicentr, SeizAlarm, and SeizureAlert - MyMedicWatch, while also identifying design gaps from both primary user (PWE) and secondary user (bystander) perspectives. The findings of this study contribute to HCI and mobile health application literature by providing a structured framework to evaluate seizure alert applications and highlighting the most critical design needs for on-site bystander support.

LITERATURE REVIEW

A. Epileptic Seizures and The Need for Help from Bystander Support

Epileptic seizures can vary among People With Epilepsy (PWE). One of the most common epilepsy syndromes known to the public is generalized tonic-clonic epilepsy, characterized by a full-body seizure that begins with stiffness followed by convulsions, loss of consciousness, foaming at the mouth, rolling of the eyes, and sometimes urine leakage (Harsono, 2021). When a seizure occurs in public places, bystanders are often the only source of help available, thus making the knowledge and ability to help appropriately during a seizure occurrence determine factors for PWE's safety (Epilepsy Foundation Health Communications, 2020).

Public awareness for proper seizure first aid is still low in many countries, including Indonesia, where the negative stigma about epilepsy has hindered public education (Hawari, 2022). Improper help during a seizure such as holding the body or putting something in PWE's mouth (i.e. spoon, a finger, or handkerchief) still happens and could lead to a serious injury. This highlights the need for easily accessible seizure first aid guidelines that are designed for helpers without medical background.

B. Mobile-Based Seizure Alert Application

Seizure alert app is a tool that focuses on humans, thus must prioritize comfort, safety, convenience, and the human user experience. Information should be presented in a way that helps users easily absorb and understand the content (Norman, 2013). The development of seizure alert mobile applications has grown rapidly in recent years, driven by the advancement of wearable censor technology and mobile health applications. Stirling et al. (2021) demonstrated the effectiveness of non-invasive wearable technology for predicting seizures, specifically through heart rate monitoring devices such as the Apple Watch and Fitbit. Lentini (2022) further explores user experience considerations in epilepsy management app, identifying the needs and pain points from the perspective of caregivers managing children with epilepsy.

However, the existing study mainly focused on the accuracy of seizure detection and caregiver notification, with limited attention to the interaction design and user experience from the helper (on site by-stander) as secondary user. A systematic

comparison of existing applications from the helper perspective has not been conducted, which is a critical gap that this study addresses.

C. HCI Framework for Application Comparison

Human-Computer Interaction (HCI) provides a comprehensive framework for evaluating the design and usability of interactive applications across various dimensions (Carroll, 2014). In HCI, Interaction Design emphasizes that effective products must also consider not only the technical functionality, but also about specific context, needs, and limitations of all user groups (IxDF – Interaction Design Foundation, 2016). Previous research has shown that interface quality and user behavior jointly have a significant impact on the overall user experience, particularly when users are under pressure or encountering an unfamiliar system for the first time (Adriyanto et al., 2025). This underscores the importance of evaluating interaction design not only for from a technical perspective, but also in relation to contextual constraints and the specific behavioral patterns of its users. For seizure alert applications, this means evaluating the features not only from the PWE's perspective as primary user, but also from the perspective of the helper as the secondary user that must act quickly and appropriately under the high cognitive and emotional pressure in emergency situation.

RESEARCH METHOD

This study employed a qualitative comparative analysis approach to systematically evaluate and compare four seizure alert apps. In design research, comparative analysis is an appropriate method for identifying differences and similarities among research subjects to generate findings that can serve as the basis for design recommendations (Soewardikoen, 2021). The apps selected for comparison are Aura: Seizure First Aid, Epicentr, SeizAlarm, and SeizureAlert – MyMedicWatch, which were identified through literature review and app store searches as the most relevant and most cited seizure alert apps available on either iOS or android platforms.

The comparison framework was developed based on HCI principles and structured around four main dimensions: activation method, main user focus, interaction output, and bystander guidance. These dimensions were selected to capture the most critical aspects of seizure alert application design from the perspective of both primary and secondary users. Each application is evaluated based on these dimensions through hands-on testing and cross-referencing with existing literature.

A gap analysis was then conducted by comparing the findings across the four apps to identify unmet design needs, particularly from the perspective of on-site bystander assistance. The findings were validated through triangulation with questionnaire data collected from 23 PWE and life role-play simulations involving six participants as secondary users.

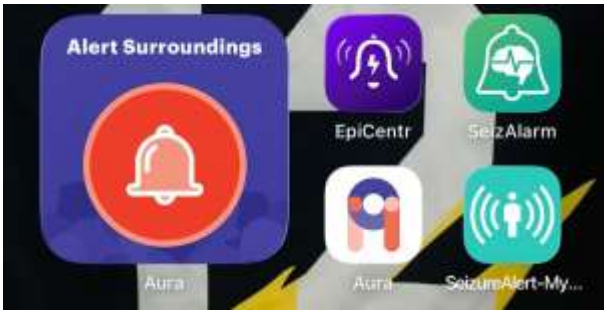

Figure 1. Four Seizure Alert Applications
Source: Firdaus, 2026

RESULT AND DISCUSSION

Findings

A. Comparative Feature Analysis

Table 1. Comparative Feature Analysis of Seizure Alert Applications

No.	Name	Activation Method	User Focus	Interaction Output	Bystander Guidance
1	Aura: Seizure First Aid	Manual	On-site bystander (secondary user) and remote caregiver	Audio alert, step-by-step first aid guidance (audio, text, and GIF), and caregiver notification	Full step-by-step guidance
2	Epicentr	Manual and Automatic (heart rate)	Remote caregiver	Audio alert and GPS location to caregiver via SMS	None
3	SeizAlarm	Manual and Automatic (heart rate and motion censor)	Remote caregiver	Optional Audio Alert, GPS location to caregiver via SMS and "Help is on the way" notification for PWE	None
4	SeizureAlert - MyMedicWatch	Manual and Automatic (heart rate	Remote caregiver	Optional Audio Alert, Caregiver notification	None, only "I can help" button by

	and motion censor)	and "I can help" option button for by caregiver	the on-site bystander

Source: Firdaus, 2026

B. Gap Analysis

Based on a feature comparison analysis, three critical design gaps were identified in existing seizure alert applications.

Gap 1: No Application Combines Automatic Detection with On-Site Helper Guidance

The most significant design gap identified is the absence of applications that combine automatic seizure detection with comprehensive seizure first aid guidance for the on-site helpers. As shown in Table 1, apps with automatic seizure detection (Epicentr, SeizAlarm, and SeizureAlert – MyMedicWatch) focus exclusively on notifying remote caregivers, while the only app that provides a seizure first aid guidance for on-site helpers (Aura: Seizure First Aid) fully depends on manual activation by the PWE (after they feel an aura). This creates a critical gap on emergency response coverage, when the PWE cannot activate the alert manually, the people around them cannot get any guidance, and when an automatic detection is available, the alert mostly reaches remote caregiver, not for the on-site bystanders.

Table 2. Gap 2: Automatic Detection vs On-Site Bystander Helper Guidance Matrix

No.	Application	Automatic Detection	On-Site Bystander Guidance
1	Aura: Seizure First Aid	No	Yes
2	Epicentr	Yes	None
3	SeizAlarm	Yes	None
4	SeizureAlert - MyMedicWatch	Yes	None
	Ideal Application	Yes	Yes

Source: Firdaus, 2026

Gap 2: Minimal or No Interaction with Helpers in Three of the Four Apps

Three out of four applications that were evaluated do not provide any meaningful interaction support for the on-site bystanders. SeizureAlert – MyMedicWatch offers a minimal "I can help" button for the caregiver with the same app that can assist, it provides no guidance on what the on-site bystanders should do. This reflects a systemic design assumption in existing apps that the primary response to

a seizure should be notifying the remote caregiver, rather than empowering the people who are physically present to provide proper seizure first aid.

Table 3. Level on Helper Support on Each Application

No.	Application	Level of Support for Helper	Description
1	Aura: Seizure First Aid	High	Full step-by-step guidance via audio, text, and GIF
2	Epicentr	None	No interaction or guidance provided for helper
3	SeizAlarm	None	No interaction or guidance provided for helper
4	SeizureAlert - MyMedicWatch	Minimal	A "I can help" button for caregiver with the same app without guidance

Source: Firdaus, 2026

Gap 3: No Application Provides Seamless Smartwatch-Smartphone Integration for Helper Guidance

Although Epicentr, SeizAlarm, and SeizureAlert – MyMedicWatch provide smartwatch integration for automatic detection and caregiver notifications, but none of them extend this integration to provide guidance for the helper. Aura: Seizure First Aid provides smartwatch integration, but only through a QR Code mechanism that must be scanned by the helper on-site using smartphone, a process that life role-play simulation data in this study revealed is impractical during an active seizure due to involuntary PWE hand movements. This represents a gap in the technical architecture shared by all four apps: none implements a mechanism that automatically triggers comprehensive helper guidance on the nearest smartphone when a seizure is detected.

Table 4. Smartwatch Integration Capabilities in Every Application

No.	Application	Smartwatch Detection	Triggers Caregiver Notification	Triggers Helper Guidance
1	Aura: Seizure First Aid	QR Code Only	Yes	Needs QR Code
2	Epicentr	Automatic	Yes	No
3	SeizAlarm	Automatic	Yes	No

4	SeizureAlert - MyMedicWatch	Automatic	Yes	No
	Ideal Application	Automatic	Yes	Automatic

Source: Firdaus, 2026

C. Life Role-Play Simulation

Through life role-play simulations that have been conducted using two devices (a smartphone and a smartwatch) in three different places and involving six participants aged 19-40 (early adulthood), the customer's journey and the challenges they faced during interaction were observed (Iacucci, 2000). The seizure management simulations were conducted by the researcher at three different locations under different conditions, in public and non-public settings, such as boarding house, a café, and Open Library Telkom University Bandung. Since the lead researcher is also a person with epilepsy who served as the seizure subject in this simulation, journal entries were kept throughout the research process as a measure to maintain objectivity. The result of this simulation show that all participants had little difficulty using smartphones, but experienced significant difficulty when using the QR Codes from smartwatch.

D. Questionnaires

A questionnaire was distributed to the Indonesian Epilepsy Community and the Indonesian Epilepsy Community (KOMPI) in the Jabodetabek area to learn about their experiences during seizures (with a consent form).

Figure 2. Pie chart of PWE who have aura

Source: Firdaus, 2026

Based on a questionnaire administered to 23 members of the epilepsy community, it was found that although 69.6% of respondents experienced auras, their ability to inform someone near them or manually trigger an alarm is very low. A total of 34.8% of people with epilepsy experienced a seizure immediately without having time to give a warning, and 47.8% were only "sometimes" able to call for help.

Figure 3. Pie chart of PWE who didn't get proper help during seizure
Source: Firdaus, 2026

The main obstacle was the extremely short time window; 30.4% had less than 1 minute and 34.8% had 1–5 minutes between the aura and the seizure. Physical constraints during a seizure made manual interaction with the device impossible. As a result, 87% of people with epilepsy did not receive proper first aid, which increases the risk of serious injury and Sudden Unexpected Death in Epilepsy (SUDEP).

DISCUSSION

Comparative feature analysis and gap analysis reveal that existing seizure alert apps have been developed with a caregiver-centered design approach, prioritizing remote monitoring and notifications over empowering on-site responders. This design orientation reflects a broader assumption in mobile health app development that most critical response to a seizure is remote, professional, or family-based care, rather than immediate assistance from the those physically present. This finding aligns with Lentini's (2022) research, which found that existing epilepsy management apps focus on remote monitoring by parents or the trained caregivers, rather than people who happen to be at the scene of a seizure. However, unlike Lentini (2022) that only focused on one application from the perspective of a single user group, this study reveals that a design orientation centered on remote caregivers is a systemic pattern that applies in nearly all currently available seizure alert apps.

From HCI perspective, this represents a fundamental misalignment between app design and real-world user needs. Questionnaire data from this study revealed that 87% of PWE have experienced a seizure without receiving proper first aid, a finding that indicates the current caregiver-centered design model is unable to address the safety

needs of people with epilepsy in public spaces, where family members or medical professionals are rarely immediately present. This finding aligns with Naradova's (2025) narrative review, which concluded that existing digital tools for epilepsy management largely lack therapeutically active components and comprehensive platforms that combine seizure tracking with direct action guidance. This study extends the finding by demonstrating that gaps exist not only in PWE self-management features, but also in direct interaction guidance for on-site bystanders, a dimension that has not been addressed in prior literature.

Further gap analysis reveals that the solution does not require entirely new technology, the core components already exist in various applications. Heart rate-based automatic seizure detection has already been implemented in Epicentr, SeizAlarm, and SeizureAlert – MyMedicWatch, while comprehensive first aid guidance is already available in Aura: Seizure First Aid. What is missing is the integration of these two capabilities into a single, seamlessly functioning system, one that can automatically detect seizures and simultaneously provide guidance to on-site bystander without requiring manual interaction from the PWE. This contrasts with the more advanced emergency application in other medical contexts. Research on PulsePoint, a mobile application that automatically notifies nearby CPR responders, has demonstrated that a location-based bystander approach significantly increases bystander involvement rates in cases of out-of-hospital cardiac arrest (OHCA) (Hwang, 2026). The success of this model shows that integrating automatic detection with on-site bystander guidance is technically possible, yet no implementation has been found in the existing seizure alert applications.

These findings have significant implications for the future development of seizure alert apps. The smartwatch-smartphone integration model, in which a smartwatch detects abnormal heart rate patterns and automatically triggers first-aid guidance on the bystander's smartphone, would address all three critical design gaps in this study simultaneously, representing the single most impactful improvement available to seizure alert app developers. This approach also fills the gaps identified across the existing literatures, from Lentini (2022) who identified the limitations in design oriented toward parents or trained caregivers, to Narodova (2025) who highlighted the absence of direct-action guidance features, and Hwang et al. (2026) who demonstrated the effectiveness of location-based bystander approach in other emergency medical contexts, making this integration a novel and previously unimplemented design contribution in the context of epileptic seizure response.

CONCLUSION

Overall, this study identified three critical design gaps in the four seizure alert apps evaluated: none of the apps combined automatic seizure detection with on-site bystander guidance; three of the four apps lacked interactive support for bystander;

and there was no seamless smartwatch-smartphone integration for the automatic delivery of guidance. Taken together, these findings reinforce and expand upon what previous studies have begun to uncover, that existing digital tools for epilepsy and emergency response have consistently overlooked the needs of on-site bystanders as a distinct and critical user group. While prior research has touched on caregivers facing limitations and the lacked active guidance components in epilepsy applications, and while bystander-based models have proven possible in other emergency medical contexts, no existing solution has yet brought these insights together into an automatically triggered on-site bystander system for seizure response. This gap positions smartwatch-smartphone integration based on automatic heart rate detection as a novel design contribution, one that has not been implemented in the current development of seizure alert apps. Further research is recommended to focus on developing and testing prototypes that implement this integration from the perspective of interaction design and user experience of both PWE and the on-site bystander in near-realistic emergency conditions.

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