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Design of a Conceptual Mobile Electronic Medical Record Prototype for Disaster Emergencies at Sumber Waras Hospital

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Abstract

Research Objective: This study aimed to identify disaster-emergency documentation requirements and develop a conceptual mobile electronic medical record prototype for Sumber Waras Hospital, Cirebon. **Methodology:** An exploratory qualitative case study was conducted using one purposively selected key informant, the Head of the Medical Record Unit. Data were collected through an in-depth interview, direct observation, and document review. Method triangulation was applied by comparing findings across the three data-collection methods. Data were analyzed using the Miles and Huberman interactive model, translated into functional and non-functional requirements, and developed into a high-fidelity Figma prototype using a design thinking approach. **Results:** The analysis identified requirements for disaster-specific registration, rapid triage documentation, temporary identification of unidentified patients, simplified emergency clinical recording, offline data capture, role-based access control, reporting, and proposed synchronization with the hospital information system. These requirements were represented in the conceptual E-Merge prototype, which includes login, dashboard, disaster-patient registration, emergency documentation, patient search, reporting, and disaster-map modules. Technical implementation, interoperability testing, and multidisciplinary usability evaluation were not conducted. **Conclusion:** E-Merge provides a preliminary conceptual design for disaster-specific mobile medical record documentation. Its usability, security, offline synchronization, and interoperability with the hospital information system and SATUSEHAT require further multidisciplinary testing before implementation.

Keywords: *disaster emergency; electronic medical record; mobile application; prototype; user interface design*

INTRODUCTION

Digital transformation in health services has become an essential part of modern hospital management. In Indonesia, Minister of Health Regulation Number 24 of 2022 requires every healthcare facility to implement electronic medical records (EMR), making digital documentation not only a technical innovation but also a regulatory obligation (Kementerian Kesehatan Republik Indonesia, 2022). For hospitals that provide emergency services, EMR implementation is expected to improve data availability, documentation accuracy, clinical coordination, reporting, and patient safety, particularly in high-pressure situations.

Disaster emergencies create a specific challenge for medical record systems. During mass casualty incidents, healthcare workers must perform rapid triage, document essential clinical data, identify unknown patients, and maintain continuity of information from the disaster site to the emergency department. Paper-based or general-purpose forms may be inefficient because they require longer documentation time and are vulnerable to loss, damage, incompleteness, and delayed reporting. These limitations can affect the quality of triage, communication between providers, and decision-making during disaster response.

Sumber Waras Hospital is a private hospital in Cirebon Regency, West Java, and functions as a referral hospital with emergency services. A preliminary study found that the hospital had not yet developed a specific disaster patient form or a mobile EMR application for disaster emergencies. The surrounding area also has a history of landslide risk, indicating the need for a stronger Hospital Disaster

Plan. In this context, a mobile-based application could support documentation outside the usual hospital workstation environment, especially when patient volume increases rapidly and network conditions are unstable.

Mobile applications provide portability and can support field-based health documentation when static computers are not practical. In addition, user interface and user experience design are important to ensure that an application can be used quickly, clearly, and safely under stressful conditions (Johnson, 2020; Shneiderman et al., 2016). A prototype approach allows researchers and stakeholders to translate user needs into an early visual design that can be evaluated before full system development (Marantoh & Harahap, 2023). Figma is widely used for user interface and prototype development because it supports collaborative and interactive design processes (Agus Muhyidin et al., 2020; Leli Safitri et al., 2024).

The research gap addressed in this study is the lack of a disaster-specific mobile EMR design model that combines triage documentation, temporary patient identification, offline recording, role-based access, and integration with existing hospital information systems. Therefore, this study aimed to design a mobile-based electronic medical record prototype for disaster emergencies at Sumber Waras Hospital on Android and iOS platforms. The research question was: how can a mobile EMR prototype be designed to support disaster emergency documentation at Sumber Waras Hospital?

METHODS

This study used a qualitative case study design with a system design and prototyping orientation. The qualitative approach was selected to explore user needs, workflow problems, and documentation requirements in depth. The study was conducted at Sumber Waras Hospital, located at Jl. Urip Sumoharjo No. 5, Ciwaringin, Cirebon Regency, West Java. The research process was planned and conducted during the October 2025-February 2026 period, with field data collection focused around January 2026.

The research subject was selected using purposive sampling. The key informant was the head of the medical record unit at Sumber Waras Hospital, who was chosen because of her role in medical record management, emergency department documentation, and hospital information system implementation. The research object was the existing emergency department medical record workflow and the documentation elements required for disaster patients.

Data were collected using in-depth interview, observation, and documentation review. The interview guide explored the current disaster patient documentation flow, obstacles in emergency documentation, essential patient data, mobile application needs, offline capability, identification of unknown patients, access rights, system integration, and user interface expectations. Observation focused on the emergency department workflow, current medical record form use, internet availability, mobile device availability, and reporting flow. Documentation review included available forms, hospital procedures, and relevant policies.

Data validity was strengthened through source and technique triangulation. Interview findings were compared with observation results and available documentation. Data processing included transcription, data organization, coding of system needs, classification into functional and non-functional requirements, and editing of irrelevant information. Data were analyzed using the Miles and Huberman interactive model consisting of data collection, data reduction, data display, and conclusion drawing (Sugiyono & Erlisya, 2020). The resulting needs were translated into a prototype using a design thinking approach, particularly empathize, define, ideate, prototype, and test-oriented preparation.

The study was conducted with attention to research ethics, including institutional permission, confidentiality, voluntary participation, informed consent, and protection of sensitive information. The informant was informed about the purpose and procedures of the study and had the right to refuse or withdraw. Personal information was treated confidentially and used only for research purposes.

RESULTS

Characteristics of the study site and informant

Sumber Waras Hospital is a private hospital in Cirebon Regency, West Java. The hospital was formally opened in 2005 and later developed into a class B general hospital. The study involved one key informant, the head of the medical record unit. The informant was female, had a background in Medical Record and Health Information, and was directly involved in managing medical records and implementing the hospital information system.

Current documentation flow and main problems

The current disaster patient documentation flow begins with triage officers assigning a disaster patient number or triage tag number and categorizing the patient according to emergency severity. Registration officers then document the general condition, arrival time, and triage number, and connect this information to a new or existing medical record number in the hospital information system. The patient is then directed to the emergency department register using a special disaster code.

Several documentation barriers were identified. The hospital did not yet have a mature standard operating procedure or special disaster form for mass casualty situations. Human resources were still focused on routine daily services, and no dedicated disaster documentation team was available. Unknown patient identities were common, while unstable internet and limited mobile devices made real-time data capture difficult. Observation also showed that emergency department documentation still relied on general forms and routine workflow without a specific separation for disaster emergency patients.

Table 1. Main Needs Identified from Interview, Observation, and Documentation Review

Need category	Identified need	Design implication
Disaster patient identification	Unknown patients require temporary identification using triage tag number, estimated age, sex, physical characteristics, and finder information.	Provide disaster registration form with temporary identity fields and photo upload.
Rapid triage documentation	Triage status must be recorded quickly using red, yellow, green, and black categories.	Use large triage buttons and color-coded severity categories.
Clinical emergency data	Initial vital signs, brief anamnesis, diagnosis, injury, and emergency actions must be documented immediately.	Create simplified emergency department medical record input with dropdowns and essential fields.
Offline capability	Disaster locations may have weak or absent internet signals.	Enable offline data entry with automatic synchronization when connection returns.
Access control	Different users require different permissions according to professional roles.	Use role-based access for medical record officers, nurses, physicians, administrators, and managers.
Reporting and integration	Post-disaster data should enter the hospital information system and support SatuSehat reporting.	Prepare reporting, recapitulation, and synchronization functions.

Prototype design of the E-Merge application

The prototype was named E-Merge. It was designed as a mobile EMR application for Android and iOS platforms to support disaster emergency documentation. The design was developed using Figma and followed the emergency department workflow at Sumber Waras Hospital. Compared with general emergency department EMR documentation, the prototype added disaster-specific data

elements, including type of disaster, location where the patient was found, triage category, temporary identification, and field reporting needs.

Table 2. E-Merge Prototype Modules and Functions

Prototype module	Function
Login and account creation	Allows users to enter the system using username, password, and professional role such as physician, nurse, or medical record officer.
Dashboard	Shows active disaster status and provides access to patient registration, emergency medical record input, patient list, reports, and disaster map.
Disaster patient registration	Records triage number, patient name if known, sex, estimated age, location and time found, and identity of the person who brought or found the patient.
Emergency department medical record input	Records triage category, diagnosis, health worker, patient photo, anamnesis, initial clinical data, and medical actions.
Patient search and patient list	Supports retrieval of registered disaster patients by medical record number, patient identification, or name.
Reports and recapitulation	Displays total patients, treated patients, recovered patients, and triage distribution based on a selected reporting period.
Disaster map	Displays disaster points and type of disaster, such as flood, landslide, or strong wind, using map-based indicators.
Use case and activity workflow	Describes system actors, access levels, login validation, data input, data validation, report generation, and data integration.

Access rights and workflow model

The use case model identified several actors: administrator, user or field officer, and management. The administrator has full access to login, manage data, manage user accounts, view reports, print reports, and logout. Users or officers have limited access to login, input and edit certain data, view reports, and logout. Management has access to login, view reports, print reports, and logout without modifying medical data. The activity workflow begins with login validation. If the username and password are valid, the system displays the dashboard according to user access level. Users can register patients, perform triage, input medical data, make follow-up decisions, and generate reports. Data entered into the system are validated before storage and integration.

DISCUSSION

Mobile EMR as a response to disaster documentation needs

The findings show that disaster emergency documentation requires a system different from routine emergency department documentation. While Sumber Waras Hospital already uses a hospital information system, the absence of a disaster-specific SOP, form, and mobile documentation flow can delay data capture during mass casualty situations. These results are consistent with the concept that disaster patient records must contain specific elements such as disaster type, location where the patient was found, triage category, mass casualty identification number, and the identity of the person who found or brought the patient (Rosarini et al., 2023).

The E-Merge prototype addresses this need by prioritizing rapid registration, triage documentation, and initial clinical recording. Integration of triage tag numbers with medical record numbers is particularly important because disaster victims may arrive without complete identity information. Temporary identification supported by physical characteristics and photo documentation can improve continuity of care and facilitate later family tracing or identity updating.

User interface design for high-pressure clinical situations

The prototype adopts a simple and direct interface because disaster response is performed under time pressure. The informant emphasized the need for minimal typing, large buttons, single-screen forms, high-contrast triage colors, voice input, and gesture-based navigation. These preferences are aligned with general user interface principles stating that systems should reduce cognitive load, support recognition rather than recall, and make critical actions visually clear (Johnson, 2020; Nielsen & Norman, 2021; Shneiderman et al., 2016).

The dashboard structure also supports efficient navigation by placing key modules on the first screen. Disaster patient registration and emergency medical record input are separated but connected through patient search and patient list functions. This structure allows the application to support both field documentation and hospital-based continuation of care.

Offline resilience, security, and integration

Unstable internet connectivity was one of the strongest findings of the study. Offline data entry followed by automatic synchronization is therefore a central non-functional requirement. In disaster situations, the inability to access a network should not stop patient identification and emergency documentation. A local draft or offline queue can preserve data until connection returns, reducing the risk of data loss and delayed reporting.

Security was addressed through role-based access control. The separation of access rights among administrators, medical record officers, nurses, physicians, and management supports confidentiality, accountability, and integrity of medical record data. This design is consistent with Indonesian personal data protection principles and EMR regulatory expectations regarding confidentiality, integrity, and data availability (Republik Indonesia, 2022; Kementerian Kesehatan Republik Indonesia, 2022).

The expected integration with the hospital information system and SatuSehat is also important. Disaster documentation should not remain isolated in a mobile device. Post-disaster synchronization can reduce duplicate data entry, strengthen institutional reporting, and support national interoperability goals. The SatuSehat emergency module direction emphasizes structured emergency documentation and data exchange to support real-time clinical and administrative decisions (Kementerian Kesehatan RI, 2024).

Implications and limitations

The practical implication of this study is that Sumber Waras Hospital can use the E-Merge prototype as an initial reference for developing a disaster-specific EMR module within its Hospital Disaster Plan. The design may also serve as a learning case for Medical Record and Health Information students on how qualitative needs analysis can be translated into health information system prototypes. However, the study was limited to a qualitative design with one key informant and a prototype stage. The prototype has not yet undergone usability testing with physicians, nurses, medical record officers, and disaster field teams. Future studies should conduct broader user testing using standardized instruments such as the System Usability Scale and evaluate technical performance, offline synchronization, interoperability, and data security in simulated disaster scenarios.

CONCLUSION

This study designed a mobile-based electronic medical record prototype for disaster emergencies at Sumber Waras Hospital. The needs assessment showed that disaster documentation requires rapid triage recording, temporary identification of unknown patients, simplified clinical data input, offline capability, role-based access, reporting, and integration with existing hospital information systems. The E-Merge prototype includes login and account management, dashboard, disaster patient registration,

emergency department medical record input, patient search, reports and recapitulation, disaster map, and workflow models through use case and activity diagrams. The prototype can serve as an initial design model to support faster, more complete, and more secure disaster emergency documentation. Further development should include user testing, technical validation, interoperability design, and implementation evaluation before routine use.

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Ethical Approval Statement: This study was conducted in accordance with ethical principles involving human participants. Ethical approval was obtained from the Ethics Committee of from Poltekkes Kemenkes Tasikmalaya.

Informed Consent Statement: Informed consent was obtained from the informant involved in the study before data collection.

Data Availability Statement: The data presented in this study are available from the corresponding author upon reasonable request. The data are not publicly available due to ethical and privacy considerations related to hospital documentation and informant confidentiality.

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