Development and Usability Evaluation of an IT-Based Disaster Medical Record System in South Kalimantan, Indonesia

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Article Info	ABSTRACT
	Indonesia, as a disaster-prone region, requires a resilient health information system. Conventional paper-based medical records are vulnerable to damage and inefficient in emergency response, making the development of an electronic disaster medical record crucial. This study aims to design and test the usability of a web-based electronic disaster medical record prototype. This study used a prototyping method involving 32 medical records staff from hospitals in South Kalimantan. System usability evaluation was conducted using the System Usability Scale (SUS) questionnaire through usability testing with a disaster documentation task scenario. Statistical analysis was performed by calculating the SUS score using a standard formula that yields a score of 0-100. The results showed an average SUS score of 79.31, which is classified as grade B (good) on the acceptability scale, indicating that the system is acceptable and meets basic usability aspects well. This finding proves that the electronic disaster medical record prototype is feasible and has the potential to improve victim data management, although there is still room for refinement of certain elements to achieve an excellence level. The implementation of this system is expected to be integrated with the national health platform to support more effective disaster response.

INTRODUCTION

Indonesia is geographically highly vulnerable to various types of natural disasters, such as earthquakes, tsunamis, volcanic eruptions, floods, and landslides. The number of natural disasters in Indonesia increases annually (Badan Nasional Penanggulangan Bencana, 2023). When a disaster occurs, it is crucial to record various information before, during, and after the disaster (Kementerian Kesehatan Republik Indonesia, 2010). Medical records are vital in the disaster data collection process.

Electronic medical records in disaster response have shown significant potential to improve healthcare delivery in challenging environments, unlike paper records that are prone to disaster damage (Horahan *et al.*, 2014), reduce errors, and increase data accuracy (Demers *et al.*, 2013). Well-designed and integrated electronic medical records can be a powerful tool

for improving healthcare systems and chronic disease outcomes in refugee settings (Buford *et al.*, 2022).

Development of electronic disaster medical records can result in faster and more accurate data calculation and delivery, accelerating and simplifying the process of managing disaster patient data, from disaster patient registration and assessment to web-based disaster patient reporting (Apriliyani, Feoh and Kartiko, 2020). Electronic disaster medical records can also be useful for emergency healthcare management during natural disasters (Baek *et al.*, 2021).

Electronic disaster medical records have been widely used in various countries and more than 37,500 patients in various places, including refugee camps and post-disaster relief efforts (Draugelis *et al.*, 2025a) and electronic disaster medical records must be prepared in advance before a disaster occurs (Oikawa, Murakami and Ochi, 2024). Previous research shows that several hospitals in several provinces have conventional disaster medical records (Lestari *et al.*, 2022);(Seha, Santoso and Susanti, 2018);(Christian *et al.*, 2015) and no electronic disaster medical records have been found. Although recent research has developed standardized disaster medical record documents and tested their suitability through pilot testing with medical records staff in several hospitals (Asih *et al.*, 2024), significant gaps remain in the digital transformation of emergency response tools. These gaps have substantial implications for disaster management effectiveness. Conventional paper-based systems during mass incidents risk lost documentation, data fragmentation, and delayed medical interventions, potentially compromising patient care outcomes and epidemiological surveillance (Ratwani, 2017). This study develops electronic disaster medical records to address the digital transformation gap. Its scientific contributions include developing a digital framework for resource-constrained settings, identifying the technological and operational needs of emergency digital health systems, and providing an evidence base for interoperability standards for disaster information exchange. Based on this, the aim of this study is to design electronic-based disaster medical record documents.

METHODS

This research is a software development study using the Prototyping method (Beaudouin-lafon, Paris-sud and Mackay, 2020). The study was conducted in two hospitals in South Kalimantan Province, selected through purposive sampling based on their information technology infrastructure readiness and experience in disaster management.

The study population consisted of 32 medical records staff who met the following inclusion criteria: (1) certified medical records professionals, (2) at least one year of work experience, and (3) direct involvement in disaster management protocols. Exclusion criteria included non-permanent staff and staff with less than one year of work experience. A total sampling technique was used, involving the entire population meeting the criteria.

System usability was evaluated using the validated System Usability Scale (SUS), consisting of 10 standardized questions on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Statistical analysis was performed by calculating the SUS score using a standard formula that yields a score of 0-100, with a score of ≥68 indicating acceptable usability and a score <50 indicating serious usability issues.

This study has obtained ethical approval from the Health Research Ethics Commission of Muhammadiyah University of Banjarmasin with letter number KEPK: 0128226371. Informed consent was obtained from all participants before data collection, and research permits were obtained from the management of each hospital.

RESULTS

Based on the evaluation using the System Usability Scale (SUS) with 32 respondents, the average usability score obtained was 79.31 (on a 0-100 scale). This score indicates that the electronic disaster medical record system prototype meets the criteria for acceptable usability according to SUS standards, where a score ≥68 is considered to fulfill system usability requirements.

Table 1. Respondent Questionnaire Results

Score Category	Number of Respondents	Percentage
≥ 80 (Excellent)	18	56.25
68-79 (Good)	8	25.00
50-67 (Marginal)	6	18.75
< 50 (Poor)	0	0,00

Source: Primary Data, 2025

The majority of respondents (81.25%) provided scores in the "Good" to "Excellent" categories, indicating positive acceptance of system usability. Approximately 18.75% of respondents rated the system in the "Marginal" category, suggesting specific areas for improvement in the user interface. No respondents scored below 50, indicating no serious usability issues with the developed prototype.

The average SUS score of 79.31 exceeds the acceptable usability threshold and demonstrates that the system meets basic usability principles in terms of ease of use, efficiency, and user satisfaction. These results support the feasibility of the prototype for further development and implementation in disaster settings.

DISCUSSION

The results of an evaluation of the usability of the electronic medical records system for disasters, with 32 respondents, showed an average score of 79.31. This score, when interpreted using the Acceptability Scale developed by (Bangor, Kortum and Miller, 2008), places the system in grade B with a "good" rating. This indicates that from a user perspective, the system has met basic usability aspects and is well-accepted. However, a score that does not reach grade A (excellent) also indicates that there is still room for improvement and refinement, particularly in usability elements such as efficiency, ease of memorization, or subjective user satisfaction, to create a more optimal user experience in the high-stress context of disaster situations.

Disaster medical records should contain at least complete victim data, including personal identification and location of the victim, to information about the person who

discovered the patient (Kementrian Kesehatan Republik Indonesia, 2019). The main challenge for disaster medical records is limited resources during humanitarian crises, especially since many efforts still rely on paper-based record-keeping (Shrestha *et al.*, 2022). Electronic medical records are a digital evolution of paper-based medical records that store patient histories in a computerized manner, enabling faster, safer, and more efficient access to healthcare services (Edmund, Ramaiah and Gulla, 2009).

Electronic disaster medical records can assist with patient management during emergencies, predictive analytics to anticipate patient needs, preventive guidance to mitigate the impact of potential health threats, and personalized care plans tailored to individual patient needs (Gaebel, Schreiber and Neumuth, 2024). Electronic disaster medical records can improve the quality of care and provide a source of clinical and management data for public health planning (Draugelis *et al.*, 2025b), disease surveillance, and serve as a population-level data source to guide response and research to improve disaster mitigation (Checchi *et al.*, 2017), (Perakslis, 2018).

The use of the SUS has proven effective in evaluating the usability of electronic disaster medical records. A study by (Meidani *et al.*, 2023) showed a similar result, with a significant increase in the SUS score from 67.22 to 80.00. It is crucial to obtain user feedback for ease of use in the SUS (Perrig *et al.*, 2024).

In the context of disasters, the implementation of electronic RME has demonstrated advantages over paper-based documentation methods. Research by (Chan *et al.*, 2011) identified significant improvements in tracking patient acuity and decontamination status when using an electronic system. Various previous studies have developed electronic medical record platforms (Mamlin *et al.*, 2021), designed clinical documentation templates (Shinchi and Ashida, 2003), (Schnall *et al.*, 2011), and established minimum dataset standards for disaster situations (Castulik, 2017). Furthermore, electronic disaster-based medical records need to be incorporated into national health data systems such as Satu Sehat (Faisal and Nakayama, 2024) in order to standardize health data collection during disasters.

Recent advances in emergency medical informatics have redefined usability expectations through context-aware systems that can dynamically adjust interface complexity (Ghosh, Yan and Lin, 2025). Furthermore, previous research emphasizes that truly effective disaster systems must integrate predictive analytics and real-time decision support, functionality that is missing from our current implementation (Arena and Bora, 2022)

Modern frameworks require seamless interoperability between disaster medical record systems and broader digital health infrastructure, including emergency operations centers and resource management platforms (Demir Özbek, Yomralıoğlu and Ateş Aydar, 2023). The development of these systems is a crucial step in the digital transformation of disaster response. However, their moderate usability scores underscore the crucial consideration that successful adoption hinges on exceptional user experience design, not simply adequate functionality (Almasi *et al.*, 2022). As disaster response increasingly relies on data-driven decision-making, the usability gap between adequate and superior systems can ultimately determine operational viability during a real crisis. This highlights the urgent need for next-generation systems that not only meet basic usability standards but also excel in the stressful and time-sensitive environments characteristic of disaster scenarios.

CONCLUSION

The development of a web-based electronic medical records system for disasters has successfully produced a viable and user-acceptable prototype, with a usability score of 79.31 (Good category). This research reveals the limitations of conventional usability approaches in a disaster context and recommends transformative strategies including the development of interfaces to simplify documentation during a crisis, the integration of AI-based data validation mechanisms, and the development of standard APIs for interoperability within the emergency response ecosystem. These innovations are necessary to transform electronic disaster medical records from mere digital replicas into intelligent, responsive systems.

ACKNOWLEDGMENTS

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