

Electronic Medical Record Management in Health Services: A Systematic Review of Benefits, Challenges, and Data Security

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ABSTRACT

Electronic medical records (EMR) are a core component of modern health information management systems, replacing manual record-keeping systems that are prone to incomplete and delayed data. Although many benefits have been reported, EMR implementation in health service facilities still faces various technical, organizational, and regulatory obstacles. This study aims to systematically examine the development, benefits, barriers, and data security aspects of electronic medical record management based on national and international literature. The method used is a systematic literature review with a narrative synthesis approach applied to articles published between 2016 and 2026, retrieved through Google Scholar, Garuda, PubMed, ScienceDirect, and DOAJ using the keywords “electronic medical record,” “electronic health record,” and “health information management.” A total of 24 articles meeting the inclusion criteria were analyzed narratively. The review results show that EMR provides significant benefits for service efficiency, data accessibility, and coordination among healthcare workers, but implementation is still constrained by limited human resources, network infrastructure, user resistance, and suboptimal standard operating procedures. Patient data security and interoperability also remain major challenges. This review recommends strengthening regulations, providing ongoing training for medical record personnel, and developing integrated and secure systems as a policy basis for improving the quality of health information management.

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1. INTRODUCTION

Medical records are a fundamental component in the delivery of health services, functioning not only as clinical documentation but also as a legal, administrative, financial, and research instrument. Medical records contain patient identity information, examination results, diagnoses, treatments, and

service history, which form the basis for continuity of care between healthcare providers and facilities.

Along with the development of information technology, manual medical record management has begun to be abandoned and replaced by electronic medical records (EMR), which enable patient data to be recorded, stored, and retrieved digitally and in an integrated manner. This transformation is not only technical in nature but also touches on aspects of organizational governance, the work culture of healthcare workers, and the readiness of information technology infrastructure at each health service facility.

Regulation of the Minister of Health of the Republic of Indonesia Number 24 of 2022 concerning Medical Records has mandated the digital transformation of medical records across all health service facilities in Indonesia, in line with Law Number 17 of 2023 concerning Health, which promotes the establishment of a nationally integrated health information system through the One Indonesian Health Data initiative. This policy positions electronic medical record management as a strategic priority for improving the quality of health services as well as the efficiency of claims administration, including BPJS Kesehatan (Indonesia's national health insurance) claims, which require complete and timely data entry as a condition for verification.

Various studies show that EMR implementation provides broad benefits, ranging from improved operational efficiency and faster access to patient data, to strengthened coordination among healthcare workers. EMR is also regarded as the foundation for developing a broader, cross-facility integrated electronic health record (EHR), enabling patient data to be accessed in real time by authorized parties whenever needed.

On the other hand, the transition from manual to electronic systems is not a simple process. Various international and national studies report that EMR implementation still faces obstacles related to human resources, limited technology infrastructure, user resistance, data security concerns, and uneven organizational readiness across health service facilities, particularly in developing countries. This condition can hinder the achievement of optimal benefits from investments made in medical record digitization.

This phenomenon is also reflected in various implementation reports at the level of primary healthcare facilities (FKTP) and hospitals in Indonesia, where the completeness and timeliness of electronic medical record data entry remain important determinants of smooth administrative processes and healthcare financing claims. Disparities in readiness among facilities further widen the variation in medical record documentation quality nationally.

Given the importance of this issue and the large number of research findings scattered across various national and international journals, a systematic review is needed to summarize the developments, benefits, barriers, and security aspects of electronic medical record management. This article aims to comprehensively examine the current state of electronic medical record management based on published scientific evidence, as a basis for policy recommendations for health information management at health service facilities.

2. METHOD

This study used a systematic literature review method with a narrative synthesis approach. Article searches were conducted through the Google Scholar, Garuda, PubMed, ScienceDirect, and DOAJ

databases, using combinations of the keywords “electronic medical record,” “electronic health record,” “health information management,” combined using the Boolean operators AND/OR.

Inclusion criteria for articles were: (1) published between 2016 and 2026; (2) written in Indonesian or English; (3) discussing the implementation, benefits, barriers, or data security of electronic medical records in health service facilities; and (4) available in full text. Exclusion criteria included articles irrelevant to the topic of electronic medical record management, opinion pieces or editorials without a clear methodology, duplicate publications across different databases, and restricted-access articles whose full text could not be retrieved.

The article selection process followed the stages of identification, title and abstract screening, full-text eligibility assessment, and determination of eligible articles, referring to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) principles. The initial search yielded 96 articles, which were then narrowed down to 52 articles based on title and abstract screening. After full-text assessment for topic relevance and methodological quality, 24 articles meeting the inclusion criteria were obtained, consisting of 15 national journal articles and 9 international journal articles.

Data extracted from each article included author name, year of publication, study design, research location or context, and key findings, which were then compiled into a data extraction table. Analysis was conducted thematically by grouping findings into four major categories: (a) development and implementation of EMR, (b) benefits of EMR for health services, (c) barriers to EMR implementation, and (d) data security and interoperability. Article quality assessment was carried out qualitatively, considering the clarity of methodology, topic relevance, and credibility of the publication source.

Table 1. Summary of Reviewed Articles

Author (Year)	Design	Location/Context	Key Findings
Andriani et al. (2022)	Case study	Universitas Gadjah Mada General Hospital	EMR supports patient care management and improves the efficiency of clinical documentation.
Aprilisia et al. (2021)	System development	RSUD Dr. Iskak Tulungagung	A web-based outpatient and medical record information system accelerated the medical record process.
Astuti et al. (2019)	Implementation study	Klinik Sehat, Salatiga City	EMR implementation at a primary clinic improved the speed of registration services.
Muhlizardy (2020)	Compliance analysis	Hospital (Indonesia)	Compliance with EMR completeness was still lower than manual medical records in several units.
Della et al. (2024)	Descriptive analysis	Puskesmas X, Surabaya	Completeness and accuracy of EMR data were influenced by the discipline of data-entry staff.
Laila et al. (2024)	Narrative review	Hospital (Indonesia)	Main inhibiting factors: human resources, facilities and infrastructure, and user resistance.
Ardianto, Sabran & Nurjanah (2024)	Security analysis	Hospital X	Physical and logical access controls were still suboptimal, risking data leakage.
Widyastuti et al. (2020)	System evaluation	RS Primasatya Husada Citra, Surabaya	The evaluation found obstacles in the reporting module and inter-unit integration.

Author (Year)	Design	Location/Context	Key Findings
Kusumah (2022)	Comparative study	Hospital (Indonesia)	EMR outperformed manual medical records in access speed but required a large initial investment.
Tiorentap (2020)	Systematic review	Developing countries	EMR provided benefits for service efficiency, but implementation was hindered by limited resources.
Boonstra & Broekhuis (2010)	Systematic review	Multiple countries (1998–2009)	Eight categories of barriers to physicians' acceptance of EMR: financial, technical, time, psychological, social, legal, organizational, and change-process barriers.
Kruse et al. (2016)	Systematic review	Multiple countries	Barriers to EHR adoption included cost, user resistance, and limited interoperability.
Asmare et al. (2021)	Systematic review	Ethiopia	17 barriers to EMR adoption were identified, dominated by training and IT-literacy issues.
Nguyen et al. (2014)	Impact evaluation	Multiple countries	Organizational contingency factors influenced the success of EHR implementation.
Li et al. (2022)	Systematic review	High-income countries	EHR interoperability affected patient safety and quality of care.
Neves et al. (2020)	Systematic review & meta-analysis	Multiple countries	Patient access to EHR had a positive effect on chronic disease control.
Alharbi (2025)	Systematic review	Multiple countries	EHR improved hospital efficiency and patient outcomes in most of the studies reviewed.
Rahmawati et al. (2025)	Literature review	Multiple countries (2013–2023)	EMR improved service quality but carried risks of input errors and data leakage.
Reyes-Gonzalez et al. (2024)	Scoping review	Multiple countries	Completeness, format conformance, and value plausibility were the most frequently studied EHR data-quality indicators.
Santoso et al. (2022)	Review	Indonesia	Blockchain technology has the potential to strengthen electronic medical record data security.
Munthe & Suryati (2022)	Descriptive analysis	RS St. Elisabeth, Medan	Incompleteness of diagnosis data was influenced by staff workload and lack of supervision.
Jepisah et al. (2022)	Descriptive study	RSUD Riau Province	EMR played a significant role in supporting the Hospital Management Information System (SIMRS).
Sarraf & Ghasempour (2025)	Systematic review	Multiple countries	Use of artificial intelligence in EHR contributed to increased workload and burnout among healthcare workers when not properly managed.
Woldemariam (2023)	Systematic review & meta-analysis	Multiple countries	EHR had a positive impact on a number of healthcare-quality indicators in aggregate.

3. RESULTS AND DISCUSSION

The characteristics of the 24 articles reviewed (Table 1) show variation in study design, ranging from case studies and descriptive analyses to system evaluations, systematic reviews, and meta-analyses. The geographic distribution of the studies also varied, covering hospitals and community health centers (puskesmas) in Indonesia, as well as multi-country studies from the international literature. Findings from all the articles were synthesized into the following five discussion sub-themes.

3.1 Development and Implementation of Electronic Medical Records

A review of the national literature shows that the transition from manual to electronic medical records in Indonesia has occurred gradually and varies among health service facilities. Large hospitals in major cities have generally implemented EMR as part of their Hospital Management Information System (SIMRS), while many community health centers and clinics in outlying areas still operate hybrid systems that combine manual and electronic record-keeping. Several implementation case studies, such as those at RSUD Dr. Iskak Tulungagung and clinics in Salatiga, illustrate that the success of EMR implementation depends heavily on the readiness of technological infrastructure and institutional policy support.

The legal basis provided by Regulation of the Minister of Health Number 24 of 2022 has become the main driver accelerating the nationwide digitization of medical records. Nevertheless, research shows that the readiness of health facilities to implement this policy remains uneven, with primary healthcare facilities (FKTP) generally at an earlier stage of adoption compared to referral hospitals. This difference in adoption stage is further influenced by budget availability, local government support, and the degree of urbanization of the area in which the facility is located.

A descriptive study of a regional general hospital found that EMR plays a significant role in supporting the overall integration of the Hospital Management Information System, facilitating internal reporting, and accelerating the documentation audit process. However, the data-migration process from manual to electronic systems in the early implementation phase often gave rise to data duplication and inconsistencies between modules, requiring an adjustment period.

3.2 Benefits of Electronic Medical Records for Health Services

The international literature consistently reports that EMR contributes positively to improving the quality of health services, particularly by accelerating access to patient data, reducing administrative costs, and strengthening coordination among healthcare workers. A meta-analysis-based systematic review found that patient access to EMR can have a positive effect on several quality-of-care domains, including chronic disease control. Other studies confirm that the benefits of EMR are clearly evident in operational efficiency and in faster, more accurate data-driven clinical decision-making.

In the national context, EMR is considered capable of improving the professionalism and management performance of health facilities through three types of benefits: general benefits, operational benefits, and organizational benefits. EMR also plays an important role in supporting the smooth processing of BPJS Kesehatan claims, since the completeness and timeliness of data entry are the main requirements for verifying both inpatient and outpatient claims, thereby indirectly helping to maintain the cash-flow stability of health facilities.

A large-scale review of EHR implementation across various countries also found improvements in hospital efficiency and a number of patient outcomes, although the magnitude of impact varied depending on the context of each country's health system. These benefits are generally more pronounced at facilities that have integrated EMR with other supporting modules, such as clinical decision-support systems and laboratory information systems.

3.3 Barriers to Electronic Medical Record Implementation

Despite their broad benefits, various studies report relatively consistent barriers to EMR implementation in both developed and developing countries. A classic study grouped barriers to EMR acceptance among medical personnel into eight major categories—financial, technical, time, psychological, social, legal, organizational, and change-process barriers—with organizational factors and the change process acting as mediators for the other barriers.

In the context of developing countries, the most commonly reported barriers include insufficient training, limited access to computers and internet networks, low information-technology literacy among healthcare workers, minimal management support, and disruptions to the electricity supply. Similar findings were also identified in national studies, which pointed to obstacles such as limited human resources, facilities and infrastructure, user groups resistant to change, unstable network connections, the absence of standardized Standard Operating Procedures (SOPs), system disruptions, financial constraints, and computer-security issues.

An analysis of clinical staff compliance at several hospitals found that the level of EMR completeness was, in fact, still lower than that of manual medical records during the transition period, which is thought to be related to the dual workload of staff who had to fill in documents in parallel on both systems during the changeover. This underscores the importance of careful transition planning, including the provision of adaptation time and technical assistance for staff.

3.4 Security and Interoperability of Electronic Medical Record Data

Patient data security is an important concern in EMR management. A national study of EMR implementation at hospitals highlighted the risks of data-entry errors and potential data leakage as consequences of digitization not accompanied by adequate physical and logical access controls. International studies further confirm that interoperability between EMR systems remains a significant challenge even in high-income countries, affecting patient safety and quality of care whenever data are exchanged across facilities.

Data-quality dimensions have also received attention, with completeness, format conformance, and value plausibility being the indicators most frequently studied when assessing EMR data quality. The use of artificial-intelligence-based technology has begun to be reported as a promising approach for improving EMR data quality and performance, although its implementation in Indonesian health facilities remains limited and requires more mature data-governance readiness.

On the other hand, the application of artificial-intelligence-based technology in EMR has also been reported as potentially increasing the workload of healthcare workers if not accompanied by user-friendly interface design and adequate training, thereby risking burnout rather than easing administrative tasks. These findings indicate that technological innovation needs to be balanced with user-centered system design.

3.5 Implications for Health Information Management

Overall, this review shows that the success of electronic medical record management does not depend solely on the availability of technology, but also on the readiness of human resources, regulatory support, and adequate data-security governance. Health service facilities need to strengthen ongoing training for medical record and health information personnel, develop clear EMR implementation SOPs, and build periodic data-quality monitoring systems.

Strengthening coordination among medical record officers, IT staff, clinicians, and BPJS Kesehatan verifiers is also key to optimizing the benefits of EMR without compromising the security and accuracy of patient data. In addition, the government and professional medical-record associations can play a role in developing more detailed and contextual technical guidelines for EMR implementation, particularly for primary healthcare facilities, which generally have more limited resources than referral hospitals.

From a quality-management perspective, integrating periodic audits of EMR completeness and accuracy with a continuous quality-improvement cycle can be an effective long-term strategy for maintaining the reliability of health information systems while supporting evidence-based decision-making at the managerial level.

3.6 Limitations of the Review

This review has a number of limitations. First, the literature search was limited to five databases and may not have covered all relevant publications, including grey literature. Second, variation in methodology and context among the studies reviewed made quantitative generalization of findings difficult, so the synthesis was conducted narratively. Third, most national studies were descriptive or single case studies, meaning the level of evidence is relatively lower than that of large-scale experimental or cohort studies.

3.7 Comparison of National and International Findings

A comparison between the national and international literature shows a relatively consistent pattern in the types of barriers faced, although they differ in the level of system maturity. Studies from developed countries have generally moved on to advanced interoperability issues and the integration of artificial intelligence, while national studies are still largely focused on basic issues such as data-entry completeness, availability of facilities and infrastructure, and human-resource readiness. This difference in maturity stage is important to consider so that the policy recommendations developed remain contextually relevant to the actual conditions of health service facilities in Indonesia, rather than adopting solutions from developed countries wholesale without adjustment.

Nevertheless, a fundamental commonality exists across all the reviewed literature: the success of EMR is not solely a matter of technology, but also a matter of people and organizations. Leadership, top-management commitment, and a work culture adaptive to change are consistently cited as determinants of successful implementation, in both developed and developing country contexts.

4. CONCLUSION

A systematic review of 24 national and international articles shows that electronic medical records provide significant benefits for the efficiency of health services, data accessibility, and the quality of clinical documentation, including supporting the smooth processing of BPJS Kesehatan claims.

Nevertheless, implementation still faces barriers related to human resources, technology infrastructure, user resistance, as well as challenges in data security and interoperability.

Strengthening regulations and operational standards, building the capacity of medical record and health information personnel, and sustained investment in information technology infrastructure are needed for electronic medical record management to operate optimally. Short-term strategies that can be implemented immediately include developing standardized SOPs, providing routine staff training, and conducting periodic data-completeness audits, while long-term strategies include developing a nationally integrated system that meets strict data-security standards.

Further research is recommended to empirically evaluate the effectiveness of EMR implementation across various types of health service facilities in Indonesia, particularly at the primary healthcare facility level, and to examine the long-term impact of EMR on cost efficiency and quality of care using study designs with a stronger level of evidence.

Beyond technical and managerial recommendations, financing is also an important consideration for policymakers. The initial investment required for EMR infrastructure—including hardware, software licensing, and staff training—often poses a particular challenge for health facilities with limited budgets, especially community health centers and small private clinics. Therefore, phased financing schemes and subsidy support from both central and local governments could be one strategy to accelerate the equitable adoption of EMR across all levels of health service facilities, without neglecting the aspect of post-implementation operational sustainability.

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