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Challenges in Using Electronic Medical Records to Improve Hospital Service Quality: A Systematic Literature Review

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ABSTRACT

Meskipun Rekam Medis Elektronik (RME) berpotensi meningkatkan efisiensi dan keselamatan pasien, hambatan implementasi sering kali menghalangi tercapainya kualitas layanan yang optimal. Studi ini bertujuan mengidentifikasi, mengkategorikan, dan mensintesis hambatan utama yang membatasi efektivitas RME dalam meningkatkan kualitas layanan rumah sakit. Tinjauan literatur sistematis dilakukan mengikuti pedoman PRISMA 2020 dengan menganalisis 28 studi empiris yang diterbitkan dalam bahasa Inggris antara tahun 2020 hingga 2024 dari basis data Scopus dan PubMed. Sintesis naratif mengidentifikasi delapan tantangan utama, yaitu masalah kegunaan dan beban kerja; kesenjangan pelatihan; risiko interoperabilitas dan keamanan; tata kelola yang lemah; kendala infrastruktur; resistensi adopsi; manajemen perubahan yang tidak memadai; serta implikasi terhadap keselamatan pasien. Oleh karena itu, efektivitas implementasi RME bergantung pada strategi multidimensi di luar aspek teknis. Penguatan tata kelola, jaminan interoperabilitas, pelatihan berkelanjutan, serta kepemimpinan yang kuat dan manajemen perubahan proaktif sangat penting untuk mengatasi resistensi budaya dan memaksimalkan kontribusi RME terhadap kualitas layanan rumah sakit.

Despite the potential of Electronic Medical Records (EMR) to enhance hospital efficiency and patient safety, implementation barriers often hinder optimal service quality. This study identifies, categorizes, and synthesizes the primary barriers limiting EMR effectiveness in improving hospital service quality. A systematic literature review was conducted following the PRISMA 2020 guidelines, analyzing twenty-eight peer-reviewed empirical studies published in English between 2020 and 2024 retrieved from Scopus and PubMed. The narrative synthesis revealed eight dominant themes posing major challenges: usability and workload issues; training gaps; interoperability and security risks; weak governance; infrastructure constraints; resistance to adoption; insufficient change management; and negative implications for patient safety. Consequently, the effectiveness of EMR implementation depends on multidimensional strategies beyond technical capabilities. Strengthening governance, ensuring secure interoperability, and providing continuous user training, alongside strong leadership and proactive change management, are essential to overcome cultural resistance and maximize EMR contributions to hospital service quality.

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Introduction

The development of information technology has accelerated digital transformation in the health sector, including hospitals in Indonesia, which are required to provide fast, accurate, and integrated services (Ginting et al., 2025). This transformation is not limited to the use of digital devices, but also includes the integration of work processes, adaptive organizational culture, and human resource readiness (Koebe & Bohnet-Joschko, 2023). One of the main components of digital transformation is electronic medical records, a computerized system that enables the digital recording and management of patient information (Evans, 2016). With a structured data format, EMR provides quick access to patient information, which plays an important role in speeding up diagnosis and supporting clinical decision-making (Uslu & Stausberg, 2021).

The use of electronic medical records is not limited to administrative aspects. Research shows that this system can reduce duplicate examinations, strengthen coordination between medical personnel, and improve communication between hospital units (Abdekhoda et al., 2016). Furthermore, electronic medical record data can also be used for clinical research, mapping population health trends, and managing chronic diseases (Kruse et al., 2018). Thus, electronic medical records contribute to hospital efficiency and improved patient safety (Popescu et al., 2022). Despite its great potential, the implementation of electronic medical records still faces various challenges. Reported obstacles include infrastructure limitations, low interoperability between systems, and concerns about patient data privacy (Enaizan et al., 2020). In addition, resistance from health workers due to the additional workload of documentation and limited technical skills are also hindering factors (Jimma & Enyew, 2022).

Other factors that complicate implementation are a lack of training, high investment costs, and weak managerial support in hospitals (Bekele et al., 2024). In fact, disruptions to established clinical workflows can cause further resistance (Tsai et al., 2020). This shows that the use of electronic medical records cannot be separated from the organization's readiness to provide policy support, resources, and infrastructure. On the other hand, the quality of hospital services remains a key indicator of the health system, which is measured through patient satisfaction, treatment effectiveness, and safety of care (Alibrandi et al., 2023). Several studies confirm that good hospital management and the use of information technology, including electronic medical records, can improve patient satisfaction and clinical outcomes (Bhati et al., 2023). However, comprehensive studies that directly link barriers to the implementation of electronic medical records with the quality of hospital services are still limited (Li et al., 2022).

Although technically distinct, the terms Electronic Medical Records (EMR) and Electronic Health Records (EHR) are often used interchangeably in the literature. In this study, both terms are considered within the same conceptual scope to represent electronic documentation systems in healthcare settings.

Therefore, this study is important to systematically review the barriers and supporting factors for the implementation of electronic medical records in relation to hospital service quality. This study is expected to fill the literature gap by presenting the latest evidence on the role of electronic medical records, as well as providing a basis for policymakers and hospital management in formulating more effective implementation strategies.

Research Methodology

Research Design

This study uses a systematic literature review (SLR) design to comprehensively identify, assess, and synthesize available scientific research evidence (Booth et al., 2021). Through this systematic literature review (SLR) research design, it seeks to provide comprehensive results regarding the challenges in using Electronic Medical Records to improve the quality of hospital services. The systematic review approach was chosen because it provides methodological rigor, transparency, and replication in capturing the diversity of literature related to the implementation of electronic medical records and their impact on the quality of health services (Roehrs et al., 2017). The review process was conducted with reference to the Preferred Reporting Items for Systematic

Reviews and Meta-Analyses 2020 (PRISMA) guidelines, which provide a structured framework from identification, screening, eligibility assessment, to the selection of studies included in the research (Page et al., 2021). The use of PRISMA 2020 aims to provide a comprehensive overview through its wide acceptance in health research and its ability to improve the reliability and clarity of systematic review reporting. This approach has also been widely used in previous studies evaluating the impact of electronic medical record design and implementation on clinical practice and patient safety, thereby strengthening its relevance in this study (Cahill et al., 2025).

Search Strategies and Information Sources

The search strategy in this study was designed to obtain relevant literature related to the challenges of using electronic medical records in improving the quality of hospital services. The literature search focused on two reputable international databases, Scopus and PubMed. These databases were selected because they provide extensive coverage of literature in the fields of health sciences, medicine, nursing, and health information technology (Bramer et al., 2016). The query string used was formulated by combining the main keywords and their synonyms using Boolean operators (AND, OR). This strategy was employed to broaden the search scope (Scells et al., 2021). Table 1, presents a summary of the literature search strategy for this study. Through this search strategy, it is hoped that the latest and most relevant evidence regarding the various challenges in implementing electronic medical records in the context of improving the quality of hospital services can be obtained.

Table 1. Summary of Search Strategy

Database	Query String Components	Purpose of Search
Scopus Pubmed	"electronic medical records" OR "EMR" OR "electronic health records" OR "EHR"	Identify literature that discusses the use and implementation of electronic medical records in general in healthcare facilities.
	"challenges" OR "issues" OR "barriers" OR "obstacles"	Filtering articles that specifically focus on obstacles, constraints, and challenges in the implementation of electronic medical records
	"hospitals" OR "healthcare" OR "medical facilities" OR "clinics"	Ensuring that the research context is limited to healthcare institutions, particularly hospitals and clinics.
	"data privacy" OR "security" OR "interoperability" OR "usability"	Covering technical and operational aspects such as data privacy, security, interoperability, and system usability
	"implementation" OR "adoption" OR "integration" OR "training"	Exploring literature that highlights the process of implementation, adoption, integration, and training of health workers in the use of electronic medical records

Source: (Scells et al., 2021), *with modification*

Inclusion and Exclusion Criteria

This study used inclusion and exclusion criteria to ensure that the selected literature was relevant to the focus of this study (Swift & and Wampold, 2018). The inclusion and exclusion criteria were set in accordance with the PRISMA-ScR guidelines, which emphasize transparency and consistency in the literature selection process (Haddaway et al., 2022). Table 2, presents the inclusion and exclusion criteria established for this study. Therefore, only articles that meet the research topic, publication quality, and contextual suitability will be analyzed further.

Table 2. Summary of Inclusion and Exclusion Criteria

Category	Inclusion Criteria	Exclusion Criteria
Year	2020 - 2024	before 2020 and after 2024
Document Type	Article Empirical	Conference Paper, Article Review, Book, Book Chapter, Conference Review, Note, Editorial, Letter,
Language	English	does not speak English
Accessibility	Open Access	Limited access
Relevance of the topic	Discussing the implementation, adoption, obstacles, or challenges of using electronic medical records in hospitals or healthcare facilities.	Discussing other information systems unrelated to electronic medical records in hospitals or healthcare facilities.

Source: (Page et al., 2021), *with modification*

Selection and Reporting

The article selection process was carried out in stages by referring to the predetermined inclusion and exclusion criteria and adopting the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The stages began with initial identification through database searches, followed by screening according to the specified criteria, and then the remaining articles were examined in full text to ensure compliance with the established inclusion and exclusion criteria (Page et al., 2021). Figure 1, presents this selection process in the form of a PRISMA 2020 flow diagram that illustrates the number of articles at each stage, including the number of articles excluded and the reasons for their exclusion. This approach was used to ensure transparency, accountability, and replication in the reporting of systematic reviews (van Dinter et al., 2021).

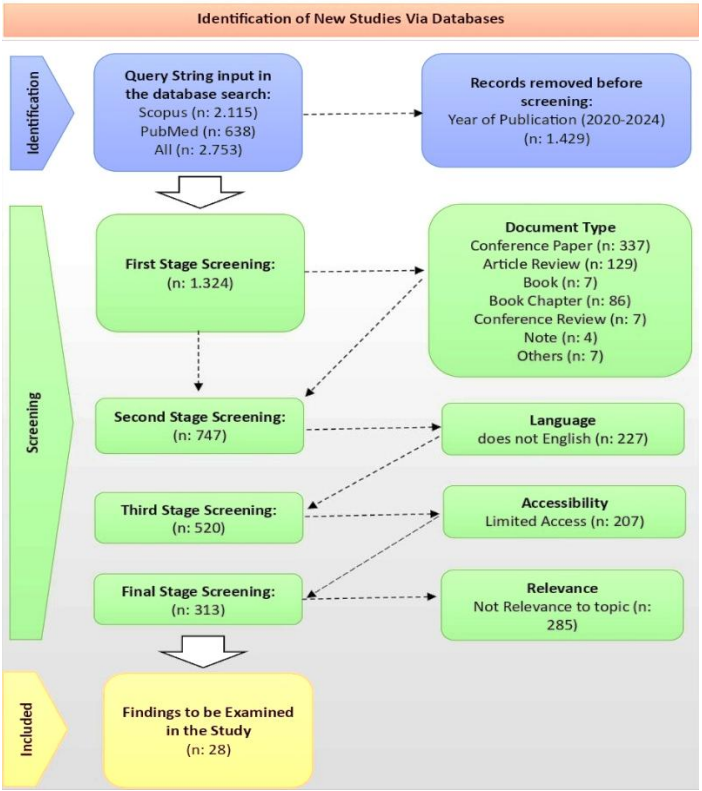

Figure 1. Flowchart PRISMA 2020
Source: (Page et al., 2021), with modification

Consensus Validity

This study ensured the reliability and validity of the findings in this systematic literature review on the challenges in using electronic medical records to improve the quality of hospital services. A consensus validity approach was applied throughout the research process. Two independent researchers conducted an initial screening of titles and abstracts, followed by a full-text evaluation using predetermined inclusion and exclusion criteria. Disagreements regarding study selection were resolved through structured discussions and consultation with a third researcher when necessary. The assessment of study quality was conducted jointly by the research team using a standard critical appraisal tool, with regular meetings held to discuss and reach agreement on study quality assessments and data extraction procedures (Snyder, 2019). This collaborative approach to validation ensures that the synthesis of challenges and recommendations reflects a balanced and comprehensive understanding of the literature, minimizes individual researcher bias, and enhances the credibility of the systematic review conclusions (Mohamed Shaffril et al., 2021).

Data Synthesis

Data from articles that met the inclusion criteria were analyzed using a narrative synthesis approach. Each selected article was extracted based on key information such as author, year of publication, country, research objectives, methods, and findings related to the challenges of using Electronic Medical Records in improving the quality of hospital services. The narrative synthesis approach was chosen because it allows for the combination of various types of studies with different designs, both qualitative and quantitative (Snilstveit et al., 2012). This provides a comprehensive picture of the barriers to the implementation of electronic medical records in various healthcare contexts. In addition, the collected data was then grouped into main themes. The results of this synthesis will be presented in the form of summary tables and descriptive descriptions, which aim to provide a comprehensive understanding of the patterns found in various studies. Thus, this synthesis is expected to contribute to academic and practical understanding of strategies for improving hospital service quality through the use of electronic medical records (Thomas et al., 2012).

Results

Based on the results of a literature search in the Scopus and PubMed databases, 19 articles from Scopus and 9 articles from PubMed were found to meet the inclusion criteria for this study. Therefore, a total of 28 articles will be analyzed in this study for further discussion. This article review is presented in Table 3 to provide a comprehensive overview of the methods, study focus, and main findings related to the challenges of using electronic medical records in improving the quality of hospital services and their relevance to the objectives of this study.

Table 3. Review of Article Findings

Reference	Method	Study Focus	Main Findings	Relevance
(Antor et al., 2024)	Mixed Methods	Usability evaluation of EMR systems in hospitals	Identified usability challenges that hinder effective EMR utilization	Usability challenges directly impact hospital service quality
(Campione & Liu, 2024)	Quantitative	Training & support for EHR use and patient safety	Training gaps lead to reduced EHR effectiveness in clinical practice	Training challenges are critical for improving service quality
(Ademola et al., 2024)	Conceptual Framework	Interoperability, privacy, and security in EHR	Technical barriers disrupt care coordination and safety	Technical challenges hinder quality improvement
(Mensah et al., 2024)	Qualitative	Healthcare workers' perceptions of EHR in clinics & hospitals	User acceptance affects EMR adoption and efficiency	User perceptions are key for service quality enhancement
(Ibrahim et al., 2024)	Policy Analysis	Balancing patient confidentiality with care coordination	Ethical and legal dilemmas limit EMR effectiveness	Ethical issues influence service quality outcomes
(Elizondo, 2024)	Case Study	Governance of shared care records in NHS	Governance remains a core challenge in EMR adoption	Governance issues impact system reliability and quality
(Abdulrahman et al., 2024)	Cross – sectional	EMR adoption rate in Dubai hospitals	Identified barriers and facilitators of EMR adoption	Adoption barriers affect service quality improvement
(Laukvik et al., 2024)	Mixed Methods	Nursing standards in EHR use	Documentation standardization improves safety but faces challenges	Documentation issues impact quality and patient safety
(Mejía-Granda et al., 2024)	Quantitative	Security vulnerabilities in EMR systems	Data security gaps reduce trust in EMRs	Security concerns directly affect service quality
(Köse et al., 2023)	Cross – sectional	Basic EHR implementation in Turkey	Identified early-stage adoption barriers	Early implementation challenges limit hospital quality improvements
(Akwaowo et al., 2022)	Mixed Methods	EMR adoption in Nigeria	Low adoption rates linked with infrastructure and training issues	Adoption barriers reduce quality of care
(Agrawal et al., 2022)	Case Study	EHR implementation in Nepal	Limited resources hinder implementation success	Resource challenges impact hospital service quality
(Alami et al., 2022)	Mix – method	Usability challenges in pediatric EHR services	Poor usability negatively affects pediatric care outcomes	Usability issues compromise safety and quality
(Abdulah & Perot, 2022)	Qualitative Study	Barriers & benefits of EMR in public hospitals	Structural challenges limit benefits realization	Structural barriers reduce quality service delivery
(Windle et al., 2021)	Roadmap design study	Designing useful and usable EHR systems	Identified system design flaws and improvement pathways	Design issues relate to quality improvement
(Pai et al., 2021)	Framework development	Standardized implementation of EHR in India	Proposed standardization reduces errors and improves outcomes	Standardization challenges link to service quality
(Kutney-Lee et al., 2021)	Quantitative	Relationship of EHR usability with nurse and patient outcomes	Usability associated with nurse workload and patient care quality	Usability challenges reduce service quality
(Palojoki et al., 2021)	Incident classification study	Safety incidents linked to EHR	Identified system-related patient safety incidents	Safety challenges compromise hospital service quality

Reference	Method	Study Focus	Main Findings	Relevance
(Pohlmann et al., 2020)	Qualitative	Personal EHR in Germany: prerequisites & challenges	Identified challenges in adoption and system readiness	Adoption readiness influences service qualit
(Huang et al., 2020)	Survey Study	Transitions from one EHR system to another	Found significant productivity loss and safety risks during transition	Transition challenges affect hospital quality outcomes
(Bekele et al., 2024)	Mixed Methods	Barriers & facilitators of EMR in Ethiopia	Infrastructure gaps and limited training hinder adoption	Low-resource setting challenges reduce service quality
(Abore et al., 2022)	Cross-sectional	Readiness of health professionals for EMR (Ethiopia)	Identified low readiness among staff to adopt EMR	Readiness challenges slow quality improvements
(Jung et al., 2021)	Mixed Methods	Barriers & facilitators to EHR in behavioral hospitals	Identified workflow and infrastructure challenges	Context-specific barriers limit quality improvements
(Alhur, 2024)	Cross-sectional	EMR adoption challenges in Saudi Arabia	Reported financial and organizational barriers	Adoption challenges affect overall hospital service quality
(Bersani et al., 2020)	Intervention Study	Patient safety dashboard integrated into EHR	Dashboard improved detection of safety events	EHR enhancements can improve hospital service quality
(Pilares et al., 2022)	Technical Framework	Blockchain & IPFS-based EHR system	Proposed decentralized storage to enhance security	Technical innovation addresses trust and quality issues
(Mejía-Granda et al., 2024)	Security Analysis	Vulnerabilities in medical devices and software	Found critical security gaps in healthcare IT	Relevant: cybersecurity barrier
(Esmaeilzadeh & Mirzaei, 2021)	Field study	EMR and clinician burnout in COVID-19	EMR mitigated burnout but usability problems remain	EMR has an impact on burnout due to its use.

Source: Database Scopus & PubMed

Based on a review of the 28 articles listed in Table 3, it was found that the challenges of implementing Electronic Medical Records in improving the quality of hospital services can be categorized into several main themes. The most dominant challenge that emerged was related to usability and user experience, where the complexity of the system and interface design often added to the workload of health workers and even triggered burnout. Furthermore, gaps in training and human resource support are serious obstacles, as the low technical competence of healthcare workers reduces the effectiveness of Electronic Medical Records implementation in the field. On the other hand, technical obstacles related to interoperability, privacy, and data security are also widely reported, especially those related to low integration between systems, information security vulnerabilities, and legal issues related to patient confidentiality. Additionally, governance factors, implementation standards, and organizational policies are also obstacles that hinder the consistent use of Electronic Medical Records. Infrastructure and resource limitations, especially in developing countries, further widen the gap in the implementation of Electronic Medical Records. Meanwhile, the level of adoption and acceptance by healthcare workers is influenced by resistance to change and the readiness of organizations to adapt to digitalization. Ultimately, all these factors have direct implications for patient safety and the quality of hospital services, as Electronic Medical Records play a crucial role in preventing medical errors, improving patient identification accuracy, and strengthening safety incident detection systems. These findings are then mapped in Figure 2, Thematic Mapping, which illustrates the relationships between major themes and their sub-themes. This mapping clarifies that the challenges of implementing Electronic Medical Records are not only technical in nature, but also involve organizational, human resource, and work culture aspects. Thus, a strategy to strengthen service quality through Electronic Medical Records requires a multidimensional approach that includes technological support, training, regulation, and organizational culture change.

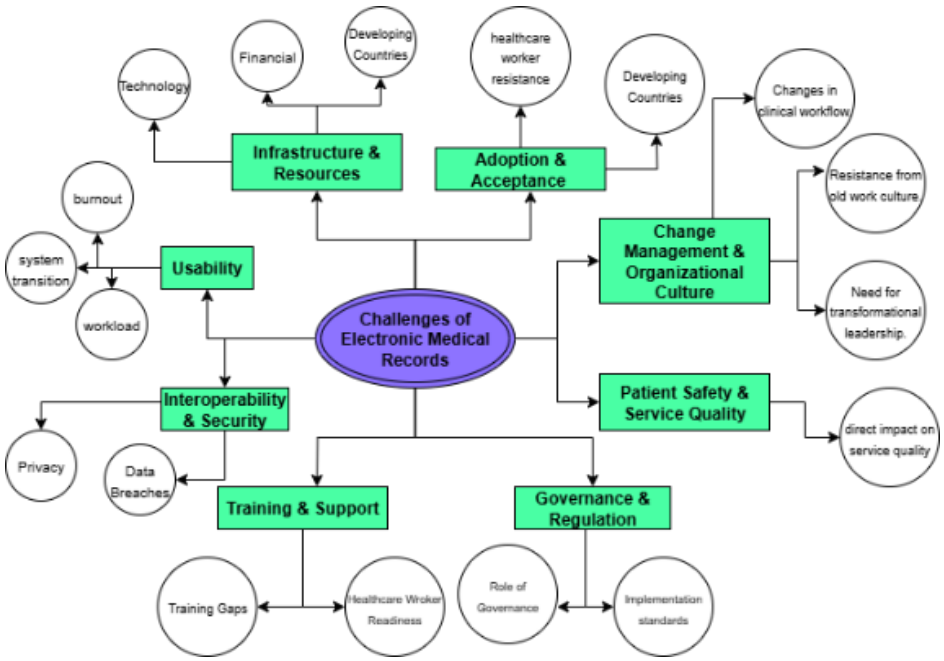

Figure 2. Thematic Mapping
Source: Researchers, 2025

Based on Figure 2, it shows that the main challenges in implementing electronic medical records in hospitals can be grouped into eight major domains: infrastructure and resources, adoption and acceptance, change management and organizational culture, patient safety and service quality, interoperability and security, and training and support, with the additional role of governance and regulation as an important foundation. Each domain is interconnected and forms a complexity that needs to be overcome in order for the electronic medical record system to run optimally.

Discussion

A literature search in the Scopus and PubMed databases identified 19 articles from Scopus and 9 articles from PubMed that satisfied the inclusion criteria for this investigation. The challenges of implementing electronic medical records are multidimensional, involving technical, resource, organizational culture, and regulatory factors. First, the usability aspect of the system remains a major obstacle. The complexity of the user-unfriendly interface adds to the workload of healthcare workers. Dunn Lopez et al. (2021), reported that the transition to a digital system increased the workload because the interface design did not meet clinical needs. This condition has implications for increased burnout and reduced interaction time with patients (Olakotan et al., 2025). In line with the research diagram, usability issues are directly related to increased workload and patient safety risks. Therefore, the involvement of healthcare workers in the system design stage is very important so that the system truly supports clinical practice, not just an administrative burden.

Second, the aspects of interoperability, security, and data privacy are crucial in ensuring the benefits of electronic medical records. Ademola et al. (2024), emphasize that interoperability is not only technical but also semantic, so that the risk of data misinterpretation can threaten patient safety. This challenge is even greater when linked to the risk of data leaks (Rothstein & Tovino, 2019). The research diagram also shows that privacy and data breaches are major obstacles. Therefore, the success of the system depends not only on technical aspects but also on strong data protection regulations and global security standards adapted to the local context.

Third, training and ongoing support are determining factors for successful implementation. Woods et al. (2024), emphasize that limited access to training, especially in hospitals with limited resources, hinders the optimal use of the system. Ngusie et al. (2022), also highlight the gap between understanding the benefits of electronic medical records and the practical skills of health workers in operating them. The research diagram shows that training gaps and the readiness of health workers are key issues. This reinforces the argument that training should not only be carried out at the initial stage of implementation, but should be designed to be continuous, equipped with technical support, and reinforced by hospital management.

Fourth, governance and standardization are fundamental to implementation. Kierkegaard (2015), states that countries with strong governance and regulations tend to be more successful in adopting electronic medical records. However, Hossain et al. (2025), found that in Indonesia, the culture of manual recording is still dominant, resulting in low consistency in digital implementation. The research diagram reinforces this by emphasizing the weak role of governance and the absence of clear implementation standards. Therefore, harmonization of national policies and the establishment of uniform technical regulations are very important to prevent system fragmentation between hospitals.

Fifth, adoption, acceptance, and organizational culture are very decisive non-technical challenges. Dunn Lopez et al. (2021), found that resistance from healthcare workers arises because the system is perceived to slow down workflows. Hossain et al. (2025), added that the culture of manual recording reinforces resistance to digitization. The research diagram also confirms that resistance to old work cultures and changes in clinical workflows are major obstacles. Therefore, adoption strategies must include change communication, motivating incentives, and transformational leadership capable of driving organizational cultural change.

Sixth, infrastructure and resources remain real obstacles. report that transitioning without adequate infrastructure support actually increases the workload of healthcare workers (Niazkhani et al., 2020). Meanwhile, Ngusie et al. (2022), emphasized that a lack of digital skills is a major obstacle. The research diagram also shows financial and technological limitations as major constraints in developing countries. This indicates that infrastructure strengthening needs to be accompanied by innovative financing strategies and cross-sector partnerships so that the implementation of electronic medical records does not widen the health service gap between regions.

Finally, all these challenges have implications for service quality and patient safety. Uslu & Stausberg (2021), emphasize that electronic medical records can improve coordination, speed up clinical communication, and reduce duplication of examinations. Li et al. (2022), add that system interoperability plays an important role in reducing clinical errors, especially in medication management and diagnosis. This opinion is reinforced by Fauziyah et al. (2025), who state that electronic medical records show a correlation between EMR use and user satisfaction, with a strong correlation in improving service quality in hospitals. This condition is further emphasized by Setyawati & Haksama (2025), whose reviewed studies show several key strategies for improving the quality of health services through patient safety. This indicates that the success of change management lies not only in training and internal policies, but also in the system's ability to demonstrate tangible benefits in clinical practice. The research diagram concludes by emphasizing that service quality and patient safety are the primary outcomes of the entire implementation process. Thus, electronic medical records are not merely an administrative tool, but a key strategy in transforming the quality of hospital services.

Limitations

This study has several limitations that should be acknowledged to properly contextualize the findings. First, search bias may have occurred due to the restriction of databases and language. The literature search was limited to two major databases using Scopus and PubMed and only included articles published in English. As a result, potentially relevant studies indexed in other databases such as CINAHL, Web of Science, or Embase, as well as those published in non-English languages, might have been overlooked.

Second, publication bias is possible because the review only included peer-reviewed empirical journal articles and excluded grey literature sources such as conference proceedings, dissertations, technical reports, and policy documents. Such materials often contain valuable insights regarding implementation failures, practical experiences, and organizational challenges that are less likely to appear in published journal articles. Third, the selected date range (2020–2024), although intentionally chosen to ensure the currency of the findings, excludes a substantial body of earlier foundational research on electronic medical record (EMR) implementation. Important historical or contextual insights from studies published before 2020 may therefore not be captured in this synthesis.

Finally, the narrative synthesis approach used in this review is inherently interpretative and subjective, relying on qualitative analysis rather than quantitative meta-analysis. While this method allows for a comprehensive integration of diverse study designs, it may introduce interpretative bias based on the researchers' judgment in identifying and categorizing themes. Despite these limitations, the systematic and transparent application of the PRISMA 2020 framework and the inclusion of multiple independent reviewers helped to enhance the credibility, reliability, and reproducibility of the findings.

Conclusion

The findings show that electronic medical records have great potential to improve the quality of hospital services, but their implementation still faces complex challenges. Eight main themes were identified, including usability, training and support, interoperability and data security, governance and standardization, infrastructure, adoption and acceptance, organizational culture, and implications for patient safety. These obstacles are interrelated, ranging from workloads due to user-unfriendly systems, limited training and infrastructure, to resistance from old work cultures and weak governance. Nevertheless, evidence shows that with strong governance, clear standards, ongoing training, and the active involvement of health workers, electronic medical records can improve efficiency, patient safety, and service quality. Therefore, successful implementation requires a multidimensional strategy that integrates policy, infrastructure investment, human resource capacity building, and organizational culture transformation. This comprehensive approach is key to maximizing the benefits of electronic medical records in driving continuous improvement in hospital service quality.

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Conflict of Interest
The authors declare that they have no competing interests.

Credit Author Statement
Hani Purwo Ariyanto: Conceptualization, Methodology, Software, Validation, Format Analysis, Investigation, Resources, Data Curation, Writing – Original Draft, Writing – Review and Editing, Visualization, Project administration, and Funding acquisition. **Yunus Alam Romadhon:** Conceptualization, Review & Editing, Visualization and Supervision. **Aflit Nuryulia Praswati:** Data Curation, Validation, Review & Editing, Visualization and Supervision.

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