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Evaluating Electronic Medical Record Implementation: Human Resource Readiness, System Efficiency, and Service Quality

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Abstract

The implementation of Electronic Medical Records (RME) is a strategic initiative in advancing digital health transformation in Indonesia. The primary healthcare level, especially in Puskesmas, the readiness and success of RME still face challenges. Limitations in infrastructure, insufficient human resource capacity, and the lack of consistent training are key issues impacting the effectiveness of RME implementation. This study aims to assess the actual implementation of RME in selected by reviewing insights from various scientific sources. It also highlights both the supporting and hindering factors influencing the digitalization process within primary health services. Systematic Literature Review (SLR) approach was analyzing peer-reviewed articles published from 2020-2024, focusing on RME readiness and implementation in Indonesian Puskesmas. The literature was examined based on study locations, research variables, methodologies. Findings indicate that RME is strongly shaped by staff training, technical capacity, leadership involvement, and policy support. Puskesmas with proactive management and adequately trained staff are more prepared. However, numerous health centers unprepared in terms of technical and operational capabilities. The success of RME implementation requires internal organizational competent human resources and robust technological infrastructure. Support from local and national governments is crucial to close the gap in readiness across regions.

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Introduction

The advancement of information technology has reshaped healthcare systems, including services at the primary care level such as Puskesmas. One of the most significant innovations is the Electronic Medical Record (RME), which replaces manual documentation with a more structured and secure system (Wati, 2024). This system is expected to improve the accuracy, efficiency, and accessibility of patient data. Through RME, health workers can manage medical information more systematically, thereby supporting faster clinical decision-making. The Indonesian Ministry of Health has promoted RME implementation as part of the national health digitalization agenda. However, the transition process is not without obstacles, particularly in facilities with limited resources. These conditions highlight the importance of evaluating the readiness of Puskesmas in adopting digital health technology.

Human resource readiness is one of the main determinants of successful RME adoption. Many Puskesmas still face shortages of personnel with adequate technical skills and knowledge to operate the system effectively (Eka Siti Hastuti et al., 2023). Without proper training, health workers may struggle to adapt, which can negatively impact service quality. This issue shows that digital transformation is not only about technology but also about developing the competence of users. Training programs and continuous mentoring are crucial to ensure staff can utilize the system optimally. Moreover, user perceptions strongly affect adoption; if the system is perceived as beneficial, adoption tends to be smoother. Conversely, if it is

considered complicated or burdensome, resistance is likely to occur. Therefore, addressing the human element is as important as strengthening infrastructure.

Infrastructure remains another critical factor in supporting RME implementation. Adequate facilities such as computers, stable internet access, and reliable applications are prerequisites for successful adoption (Widayanti et al., 2023). Unfortunately, many Puskesmas, especially in rural and remote areas, still operate with minimal infrastructure. Weak system interoperability with national platforms like SATUSEHAT also reduces the effectiveness of data integration. Limited resources not only hinder technical operations but also prolong service times, reducing patient satisfaction. To address this, investment in infrastructure and ensuring system compatibility are urgent needs. Government intervention is essential to close the digital divide between regions. Without addressing infrastructure gaps, the full benefits of RME cannot be realized.

Organizational and cultural aspects also strongly influence the outcome of RME implementation. Leadership commitment, managerial support, and effective communication within Puskesmas play a crucial role (Rusdiana, 2024). Studies have shown that resistance often stems not from weak technology but from a lack of organizational readiness. Staff may be reluctant to adopt new systems if there is no clear direction or strong support from management. Building a culture that embraces innovation and change is therefore vital. Encouraging participation, providing incentives, and involving staff in the planning process can reduce resistance. Moreover, system design must be user-friendly to minimize frustration and demotivation. A supportive environment ensures that RME does not remain as a formality but becomes embedded in daily practice.

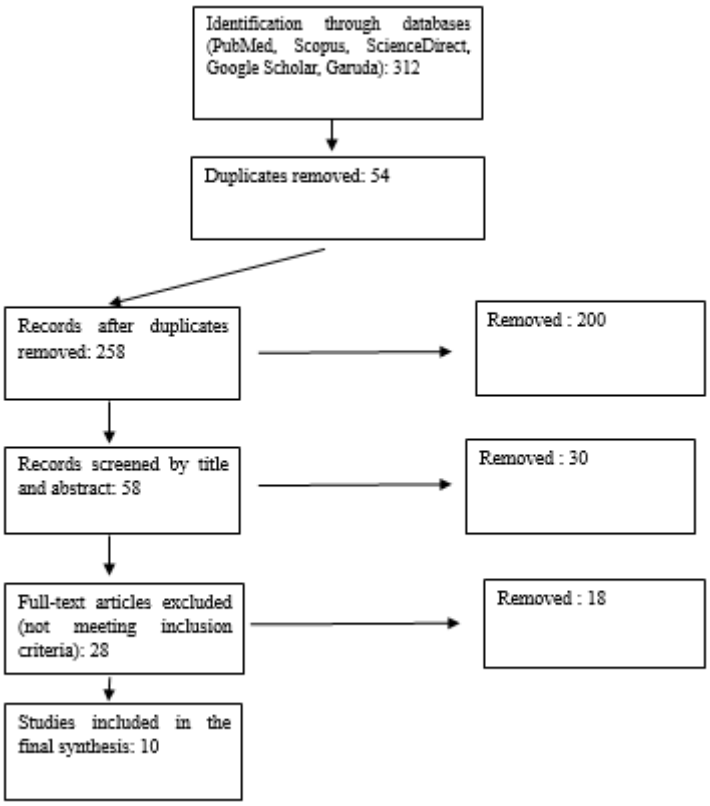
Finally, issues of service efficiency and data security cannot be overlooked. Ideally, RME should streamline workflows, shorten service times, and reduce administrative burdens. However, in practice, poorly optimized systems can create duplication of work and additional stress for staff (Widayanti et al., 2023). Data security is another major concern, as digitization increases the risk of leakage or unauthorized access. Protection mechanisms such as authentication, encryption, and audit logs must be integrated into the system (Rusdiana, 2024). At the same time, health workers need awareness of privacy principles and data protection protocols. Comprehensive evaluation of RME implementation is necessary to assess its impact, identify challenges, and develop targeted solutions. With strong infrastructure, trained human resources, and robust policies, RME has the potential to significantly improve healthcare quality in Indonesia.

Methods

This study employed a Systematic Literature Review (SLR) to evaluate the implementation of Electronic Medical Records (EMR) in community health centers, focusing on human resource readiness, information system infrastructure, and their impact on service quality. SLR was selected because it allows for a structured, transparent, and comprehensive synthesis of previous research. The review process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to ensure methodological rigor and accountability. The literature search was conducted across PubMed, Scopus, ScienceDirect, Google Scholar, and Garuda (for Indonesian publications). Keywords included combinations of “Electronic Medical Record”, “EMR”, “Puskesmas”, “primary health care”, “human resource readiness”, “health information system infrastructure”, and “service quality.” The search was limited to studies published between 2013 and 2023, in both English and Indonesian.

Inclusion criteria were: (1) peer-reviewed journal articles; (2) studies on EMR implementation in primary health care; (3) analysis of HR, infrastructure, or service quality; and (4) full-text availability. Exclusion criteria were: (1) studies focusing only on tertiary hospitals or laboratories; (2) editorials, commentaries, or non-scientific reports; and (3) irrelevant articles. From the initial search, 312 records were identified. After removing 54 duplicates, 258 records remained. Screening by title and abstract excluded 200 records, leaving 58 articles for full-text review. Following detailed eligibility assessment, 30 articles were excluded. A further 18 articles were removed because they did not meet inclusion criteria. Finally, 10 studies were included in the synthesis.

All included studies were critically appraised using appropriate quality assessment tools, such as the Critical Appraisal Skills Program (CASP) checklists for qualitative and quantitative research. Data were coded and categorized into three thematic areas: HR readiness, system infrastructure readiness, and the impact on service quality. A thematic analysis was conducted to identify patterns, barriers, and enablers of EMR implementation. To enhance validity, triangulation and cross-verification among reviewers were applied. Documentation of each step ensured replicability and transparency, providing an evidence-based overview of factors influencing EMR implementation at the primary healthcare level.



Picture 1. PRISMA Flow Diagram

Results

Based on the results of the literature search, 28 relevant articles were obtained, then 10 articles were taken for further analysis.

Table 1. Systematic Review

No.	Title/Autor / Year	Variabel	Methods	Results
1.	*Readiness Analysis of Electronic Medical Record Implementation at Baki Health Center*	Readiness of RME implementation	Descriptive qualitative (interview, observation).	There are strengths and weaknesses in implementation readiness; the main obstacles are finance and methods.
2.	*Analysis of the Readiness Level of RME Implementation at* Boyolali *Health CenterEka* Siti Hastuti et al. (2023)	HR, work culture, governance, infrastructure	Quantitative, analytic observational, questionnaire	Readiness is in the "very ready" category with a score of 101.03; the instrument is valid and reliable..
3.	*Readiness of Samigaluh I Health Center in the Transition to* RMEWidayanti et al. (2023)	Readiness to transition to RME	Descriptive qualitative (interview, observation)	The main obstacles are money and method aspects; there are strengths and weaknesses in readiness
4.	*Analysis of RME Implementation Based on HOT-FitRusdiana* (2024)	Human, Organization, Technology-Benefit factors	Unclear (truncated abstract)	Cannot be concluded because the abstract is incomplete.
5.	*Analysis of Readiness to Implement RME in Kasihan II BantulPutri* et al. (2023)	Man, machine, material, money, method	Descriptive qualitative.	Many readiness challenges; need monitoring and evaluation.
6.	*Readiness Challenges of*	Education, work	Mixed-method:	Only 47.8% ready;

No.	Title/Autor / Year	Variabel	Methods	Results
	RME Implementation in PadangSiswati et al. (2024)	experience, knowledge, perception	quantitative (cross-sectional), qualitative (purposive)	uneven training; need to improve computer skills and comprehensive training.
7.	*Implementation of Medical Record Digitalization in Baloi* PermaiMulyana et al. (2021)	Digitalization of medical records	Demonstration, counseling, training	Training successfully transferred RME digitization technology; divided into presentations, discussions, and simulations.
8.	*Literature Review: E-Puskesmas Implementation in* IndonesiaLarasati & Jiu (2025)	Implementati on of e- Puskesmas	Literature review	No full abstract available, but focused on evaluating the implementation of e-Puskesmas.
9.	*Implementation of Generic SIKDA for RME in CampakaRusmana* & Sari (2023)	Implementation of SIKDA for RME	Qualitative (observation, interview, documentation)	SIKDA has been implemented since 2017, but not yet effective; HR constraints and slow updates.
10.	*Readiness for RME Implementation at Puskesmas CirebonKhasanah* & Budiyanti (2023)	Readiness of RME implementation	Not explained (incomplete abstract).	Results are mentioned related to readiness category; details are lacking because the abstract is truncated.

From the systematic search across five databases, a total of 312 records were identified. After removing 54 duplicates, 258 records remained for screening. Title and abstract screening excluded 200 articles due to irrelevance, leaving 58 full-text articles assessed for eligibility. Following the eligibility review, 30 articles were excluded, and an additional 18 articles were removed for not meeting the inclusion criteria. In the end, 10 studies were included in the final synthesis. The reviewed studies consistently highlighted three key factors influencing the implementation of Electronic Medical Records (EMR) in Indonesian community health centers: human resource readiness, information system infrastructure, and service quality impact. Most studies emphasized that limited staff training and low digital literacy remain major barriers, while sufficient managerial support and structured training programs enhance adoption. Infrastructure issues such as unstable internet, insufficient hardware, and lack of interoperability with national platforms were also widely reported. At the same time, successful cases demonstrated that EMR implementation can improve efficiency, accuracy, and decision-making in primary health care when supported by strong leadership, adequate resources, and continuous government involvement.

Discussion

The review of ten articles shows that Puskesmas in Indonesia are generally still in the transition process from manual to electronic medical records. This transition occurs unevenly, with some health centers demonstrating readiness while many others continue to face substantial challenges. Readiness varies according to internal factors such as human resources, infrastructure, and financial support. Most studies applied descriptive qualitative or quantitative designs to capture conditions in the field. The overall findings indicate a persistent imbalance that reflects the uneven distribution of digital transformation capacity across first-level health facilities. This suggests that the success of Electronic Medical Records (EMR) implementation cannot be separated from organizational preparedness and resource allocation (Wati, 2024; Widayanti et al., 2023).

A significant finding was reported in Boyolali District, where Eka Siti Hastuti et al. (2023) used the DOQ-IT method to assess the readiness of eight health centers. The study concluded that readiness was in the very ready category, with a score of 101.03 and strong instrument validity. Readiness in this case was supported by leadership involvement, positive work culture, and adequate infrastructure. Putri et al. (2023) emphasized that this result demonstrates how organizational maturity contributes to successful adoption of health information technology. These findings provide a model that other districts could replicate to accelerate digitalization in primary care.

By contrast, research in Puskesmas Baki and Samigaluh I revealed serious difficulties in implementation. Wati (2024) and Widayanti et al. (2023) found that budget limitations and methodological weaknesses prevented optimal procurement of hardware and effective training of human resources. Furthermore, the absence of clear work guidelines created confusion and resistance among staff members. These studies highlight that national instructions alone are insufficient to achieve smooth transitions, and that practical technical assistance and structured mentoring are required to support the workforce in adopting new systems.

Siswati et al. (2024) in Padang City reported results that show readiness at only 47.8 percent among health workers. Most of those categorized as ready were medical record officers rather than physicians or nurses. The determinants of readiness included education, length of work experience, and participation in training. The lack of equitable and direct training opportunities reduced confidence in using computerized systems. These findings underscore the importance of targeted and inclusive training that reaches all categories of health workers in order to ensure effective EMR adoption.

Further evidence was provided by Putri et al. (2023) at Puskesmas Kasihan II Bantul, which identified five factors influencing readiness: man, machine, material, money, and method. Among these, inadequate system preparedness and the lack of medical record professionals were the dominant challenges. The absence of clear policy documents and operational procedures compounded these problems. Siswati et al. (2024) reinforced that successful implementation depends on integrated planning and structured management that align resources, technical capacity, and policy frameworks.

Mulyana et al. (2021) at Puskesmas Baloi Permai demonstrated how gradual training and technology transfer can strengthen readiness. Activities included counseling, simulation, and the integration of scanning devices with EMR. This approach increased staff knowledge and confidence in managing digital documents. Meanwhile, at UPTD Puskesmas Campaka, Rusmana and Sari (2023) showed that the Generic SIKDA system, although in place since 2017, was still ineffective due to insufficient system development, limited personnel, weak management, and inadequate facilities. These two cases illustrate that system provision alone is not enough without continuous support, monitoring, and sustainability measures.

Khasanah and Budiyanti (2023) examined 22 Puskesmas in Cirebon City and found varying levels of readiness across categories, although details on human resource involvement were incomplete. The results point to significant differences that require further evaluation to design regional training strategies and provision of facilities. Finally, Larasati and Jiu (2025) provided a literature review emphasizing the national e-Puskesmas policy. They argued that synchronization between central government policy and local capacity is crucial, as policy without concrete regional implementation risks widening health service gaps. Together, these studies demonstrate that while some Puskesmas show promising progress, many remain constrained by limited resources and lack of structural readiness. The findings suggest that to support the SATUSEHAT policy and align with global evidence on EMR in primary health care, Indonesia requires adaptive strategies that integrate training, infrastructure, leadership, and local capacity building (Adler-Milstein & Jha, 2017; WHO, 2021).

Conclusion

Based on the results of the review of various studies, it can be concluded that the implementation of Medical Records Electronic (RME) in PHC still faces significant challenges, especially in the aspects of human resource readiness, technological infrastructure, and organizational management. The level of readiness of Puskesmas in adopting RME varies widely between regions, reflecting gaps in training, supporting facilities, and policies implemented. Factors such as limited understanding of technology, lack of training, and uneven distribution of training are the main barriers to optimal implementation of RME. On the other hand, some health centers that have run training programs systematically and have good managerial support show positive progress in the use of RME systems. Therefore, the success of digitizing health services at the primary level depends on a comprehensive and sustainable approach that includes strengthening human resource capacity, providing adequate infrastructure, and supporting policies that are responsive to local conditions.

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