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# ELECTRONIC MEDICAL RECORDS AS DIGITAL TRANSFORMATION IN INDONESIAN HEALTH SERVICES 4.0

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**ABSTRACT**

The application of Electronic Medical Record in the era of Digital Transformation Indonesia 4.0 is the main pillar in revolutionizing health services. EMR presents a fundamental shift in medical information management by replacing traditional medical records with integrated electronic forms. Thus, this makes quickly access and share patient data, improve coordination between providers, and inform more accurate clinical decision making. This study aims to systematically review the implementation Digital Transformation in Indonesian as a planning to achieve Health Services 4.0. This study implements systematic reviews using Preferred Reporting Systematic Reviews and Meta-analysis (PRISMA) approach. Research articles published from google scholar, PubMed and sagepub. To take appropriate and relevant article research, relevant keywords or terms are constructed as the following words: Digital transformation OR digital revolution OR digital 4.0; Health services OR health care OR Health facilities; Digital medical records. 30 articles were collected from: Google Scholar, PubMed and Sagepub. The quality of these articles was evaluated, resulting in 7 articles being synthesized in the final literature review report.The results show that EMR analyzes in-depth data, supports the development of evidence-based health policies, and personalizes care according to patient characteristics. The adoption of EMR also presents challenges, including data security and privacy protection where cybersecurity and regulatory compliance are critical.

**Keywords**

**Electronic Medical Records, Digital Transformation, Health Services**

## INTRODUCTION

Digital transformation has brought profound changes in almost all aspects of human life, including healthcare. In Indonesia, digital transformation in health services, known as Health Indonesia 4.0, has become the main focus in improving accessibility, efficiency, and quality of health services for the community. One of the main pillars of this transformation is the application of Electronic Medical Records or Rapid Medical Evaluation (RME) as the foundation for modernizing health facilities (Ricciardi et al., 2019).

As an archipelagic country with a large population spread across various regions, Indonesia has challenges in providing equitable and quality health services. Digital transformation is the solution adopted to overcome these challenges. In Indonesia Health 4.0, the application of information and communication technology has shifted from conventional to technology-based systems. RME is a central component in this transformation, with its potential to change the way health services (Baetens, 2015; Doan et al., 2023).

RME is a medical information management system in digital form that records patient medical history, diagnoses, test results, treatment plans, and other patient-related information. The implementation of RME provides several significant benefits for health services, including administrative efficiency, better information accessibility, increased coordination between health services, and more accurate clinical decision-making. In the context of Indonesia Health 4.0, RME has a broad positive impact (Hapsari & Mubarokah, 2023). One of the main aspects of digital transformation in health services is increasing the accessibility of services for the community, especially those who are in remote or outmost areas (Laksono et al., 2023). Through the implementation of RME, patient health information can be accessed remotely by competent medical personnel, reducing the need for patients to travel long distances to get consultations or services. This has the impact of reducing costs and time required, as well as helping to bridge the service gap between urban and rural areas.

In addition, RME also contributes to increasing the operational efficiency of health facilities. Administrative processes that are sometimes complicated and time-consuming in conventional medical records can be simplified through digital systems. Patient medical records can be input, managed, and accessed quickly and easily, enabling medical personnel to allocate more focus on treatment and care.

The RME system also allows data integration between various health services, such as hospitals, clinics, pharmacies, and laboratories, which can improve service coordination and avoid unnecessary test repetitions. (Kurniadi & Pratiwi, 2017). Security and privacy aspects are also the major focus in implementing RME. Digital management of patient medical data requires strong protection against potential cybersecurity threats (Lase et al., 2021), especially for patient privacy rights and related regulations, such as the Health Act and the Personal Data Protection Act. In developing and implementing an RME system, it is important to ensure that sensitive patient data is safe and can only be accessed by authorized parties (Kementerian Kesehatan Republik Indonesia, 2020).

The application of RME also has a positive impact on clinical decision-making. By having easier and more comprehensive access to a patient's medical history, medical personnel can do a more precise diagnosis and a more appropriate treatment plan. Data collected from various patients can also be used for more in-depth analysis of disease trends, treatment effectiveness, and public health patterns, which in turn can help better health policy planning (Koten et al., 2020).

Some challenges may occur during implementation of RME, such as the lack of adequate technology infrastructure in some areas of Indonesia, lack of digital awareness and skills among medical personnel, and regulatory and compliance issues related to data privacy. Therefore, digital transformation in health services must be

followed by educational efforts, infrastructure investment, and development of appropriate regulations (Arie Gunawan, 2023). Governments need to play a role in providing enabling regulations, investing in technology infrastructure, and supporting training for medical personnel. Health institutions need to properly adopt and integrate the RME system, while ensuring the security and privacy of patient data (Yamin, 2018). The technology industry plays a role in developing RME solutions that are safe, reliable, and easy to use. Meanwhile, the community must be empowered through education to understand the benefits and how to use RME wisely (Herlina et al., 2022).

This study aims to systematically review the implementation Digital Transformation in Indonesian as a planning to achieve Health Services 4.0. This study focus on the utilisation of Electronic Medical Records as the Main Pillar of Health Facilities in the Modern Era.

## METHOD

This study was implemented systematic review design and illustrated using the *Preferred Reporting Systematic Reviews and Meta-analysis* (PRISMA) approach to collect and analysis the included documents, as presented in figure 1. *The Systematic Literature Review* (SLR) method is a systematic and structured approach to compiling and analysing literature that is relevant to a particular research topic or research question. This method is designed to provide a comprehensive and objective review of the existing literature, taking into account the strict research standards (Purnomo & Usman Husaini, 2008).

***Search criteria and sources***

Published article research from a wide range of database were used, including google scholar, PubMed and sagepub. To retrieve the appropriate and relevant article research, relevant keywords or terms were constructed as the following words: (1) Digital transformation OR digital revolution OR digital 4.0; (2) Health service OR healthcare OR Health facilities; (3) Digital medical record.

In the initial search, 30 articles were selected from two databases: Google Scholar, PubMed and Sagepub and examined based on inclusion and exclusion criteria as depicted in table 1. After going through the screening stage, 7 articles were included for the next step. The quality of these articles was evaluated, resulting in 7 articles being synthesized in the final literature review report.

Table 1. Inclusion and Exclusion Criteria

| Inclusion/Exclusion | Criteria |
|---|---|
| **Inclusion** | Article published between 2003 to 2023. |
| **Inclusion** | Article published in Indonesian and English. |
| **Inclusion** | Article published in reputable peer-reviewed journals. |
| **Exclusion** | Articles covering digital |
| **Exclusion** | transformation in health sectors. |
| | Duplication article from various databases. |
| | Short-paper, editorial and thesis report |

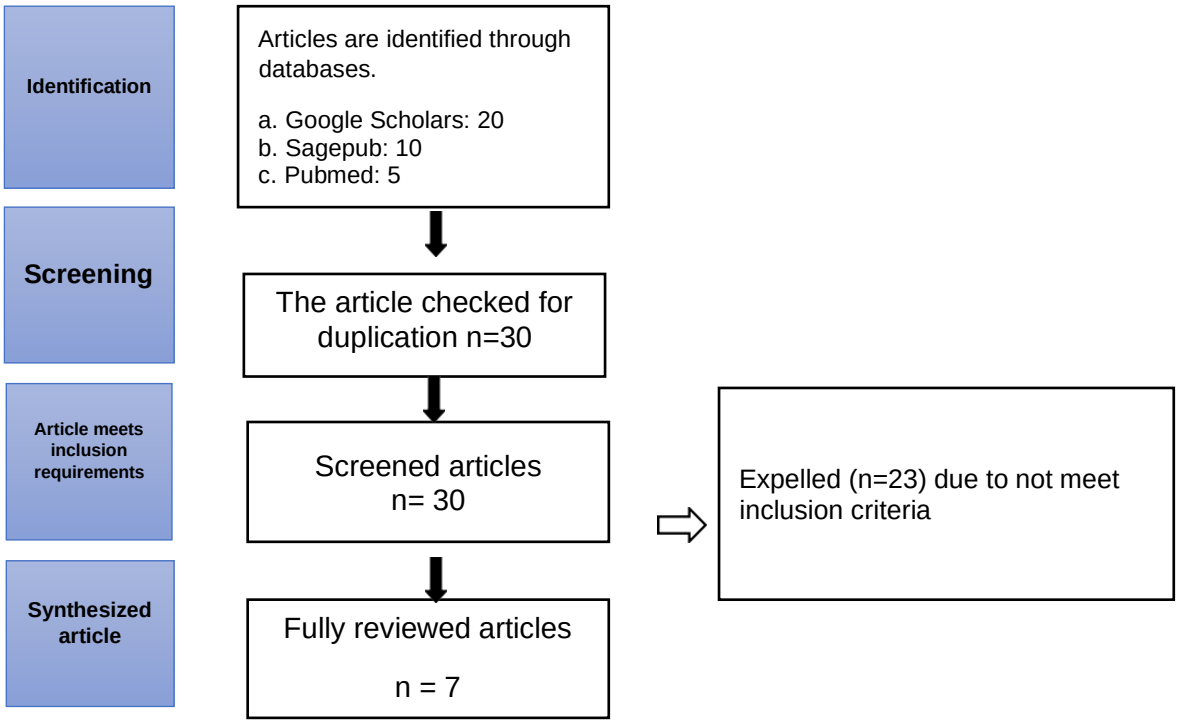


Figure 1. Diagram of PRISMA

Selected articles were extracted to gather data from prior to reviewed with a focus on two aspects, namely Digital Transformation in Indonesian Health Services 4.0: Electronic Medical Records as the Main Pillar of Health Facilities in the Modern Era.

**Table 2.** Articles of Digital Transformation in Indonesian Health Services 4.0 Included in Review

| Title and Researcher | Objective | Results |
|---|---|---|
| Analysis of Readiness for Electronic Medical Record (RME) Implementation (Hapsari & Mubarokah, 2023) | To evaluate the readiness of implementing RME through the Doctor's Office Quality-Information Technology (DOQ-IT) approach at the Polkesmar Primary Clinic. | The results showed that the Primary Polkesmar clinic had achieved a high level of readiness to adopt RME, reflecting strong readiness in the aspects of human resources, organizational work culture, governance and leadership, and IT infrastructure. Human resources show high enthusiasm for RME. Leadership policies also motivate staff to comply with RME provisions. Adequate IT infrastructure has also supported the implementation of RME. |
| Analysis of Patient Information Security Aspects in the Implementation of RME in Health Facilities | To understand how the level of security of patient data information in the context of implementing RME, seen from the perspective of | The results of the analysis of the articles reviewed regarding 6 aspects of information security show that it focuses on things such as usernames and passwords, actions to change data by administrators, application of electronic signatures and PINs, use of data backup processes to prevent hacking, restrictions on access rights through the use of IDs user and password, and log file utilization. In general, health facilities have taken |

| | | |
|---|---|---|
| (Sofia et al., 2022) | information security aspects. | steps to secure data in their information systems. System managers need to consider developing methods to maintain data security more effectively, focusing on the six aspects of information security in the use of electronic medical records. |
| Electronic Medical/Health Records (RMKE): Health System Integration (Gunawan et al., 2020) | This article will explain in detail the use of electronic medical or health records, the essential steps for implementing them, as well as potential problems that may arise in the implementation process. | The use of electronic medical records has changed the way conventional health services, interactions between doctors and patients, and the utilization of health information and data. There are three main aspects in the application of electronic medical records related to medical ethics, namely privacy, confidentiality, and security. Health care providers need to develop a comprehensive electronic medical record system and carry out effective outreach efforts. Full support from all parties involved is very important to ensure smooth handling of potential problems. |
| Electronic Medical Records as a Support for Patient Service Management at Gadjah Mada University Hospital (Rika Andriani et al., 2022) | Investigate experiences and positive impacts felt by users on the implementation of Electronic Medical Records (RME) in managing patient care. | The results of the study show that the advantages of implementing RME in patient care management involve support for patient safety, reduction of double examinations, smoothness of care and service planning, efficiency in service, and collaboration across health workers. To optimize this benefit, it is necessary to develop a reminder feature for patients. In addition, periodic training conducted by the SIRS Installation and IT team, for both new and experienced staff, is also required. |
| Perceptions of Health Workers on the Role of Electronic Medical Records as Supporting Patient Service Management (Rosyada et al., 2017) | This study aims to investigate the views of health workers on the use of electronic medical records in managing patient care, as well as to investigate barriers and successful approaches to implementing electronic medical records from the perspective of health workers. | Problems that still arise lie in the input and process stages of using electronic medical records, where difficulties in entering complete medical record data are still an obstacle, and there are errors in the process that disrupt services. Within the UTAUT framework, this problem falls under the category of "facility conditions". To increase the full adoption rate of Electronic Medical Records, it is necessary to improve the behavioral aspects of use or acceptance. This can be achieved by improving the path of the factors that influence these aspects. |
| Electronic Media Records: Exploring Benefits in the Context of Basic Health Services | The purpose of this study was to evaluate the advantages of using an electronic-based system in terms of time efficiency and | Even though the implementation of the electronic-based system has just started for two weeks, it appears that the socio-technical aspects provide significant support for the successful transition from paper medical records to electronic medical records. The main advantage of this switch is the |

| | | |
|---|---|---|
| (Erawantini et al., 2022) | completeness of patient medical records in basic health care facilities. The research will also examine socio-technical factors in the adoption of electronic medical records. | improvement of patient medical records, effectively supporting clinical decision making and potentially improving patient safety. |
| Implementation of Electronic Medical Records with Clinical Decision Support Systems (Erawantini & Wibowo, 2019) | The purpose of this study is to implement the Electronic Medical Record (RME) application in educational clinics and assess the level of user satisfaction with the implementation of the RME application. | Over a period of 2 months, RME with the support of a clinical decision system was implemented in the Educational Clinic without eliminating the use of paper medical records. The evaluation results from users of RME applications with clinical decision support systems show that users agree with the content, format, ease of use, and the application's ability to provide timely data. The RME application also has clinical decision support features such as blood pressure assessment, risk of Diabetes Mellitus, risk of stroke, drug interactions with a history of allergies, as well as alerts for abnormal laboratory and radiological examination results. |

## RESULTS & DISCUSSION

### The Implementation of Electronic Medical Records (RME) in Health Facilities

The implementation of Electronic Medical Records (RME) in the era of digital transformation in Indonesian health facilities has had a significant impact on operational efficiency and accessibility of health services. Concretely, the use of RME has resulted in administrative efficiency that frees medical personnel from routine administrative work. The process of making medical records, visiting schedules, and prescription management can be automated, providing more space for medical personnel to focus on direct services to patients (Prasetya, 2019).

RME expands the accessibility and mobility of health services, especially for those who are in remote or hard-to-reach areas. With digital facilities, patients can easily access their medical records and communicate with medical personnel remotely, reducing geographical barriers and travel costs that are often an obstacle. In addition, this platform also enables medical professionals who work mobile or are based in various places to engage in patient care without barriers (Mursalat et al., 2022).

Improving the quality of health services is another key aspect affected by the implementation of RME. With quick and detailed access to patient medical information, medical professionals have more powerful tools to make informed diagnostic decisions and plan more individualized care. This impact contributes to a better quality of care and reduces the potential for medical errors (Nirwana & Ata, 2023) .

Health service integration is also enhanced through RME. Medical data can move seamlessly between different healthcare facilities, avoiding unnecessary duplication of checks and treatments. This saves time, costs, and resources, and allows healthcare providers to have a more holistic

view of a patient's condition. In addition, the application of RME enables long-term health monitoring in a more effective manner. Medical personnel can monitor disease progression and response to treatment over time, especially important in the management of chronic diseases (Erawantini et al., 2022).

However, while recognizing the benefits, implementing RME also faces challenges that must be overcome. Substantial investment in technology infrastructure and training of medical personnel is required to ensure smooth implementation. Data security and patient privacy are also a top concern, given the potential risks of cyberthreats and privacy breaches (Kusnadi et al., 2021). Therefore, close cooperation between governments, healthcare institutions, and the technology industry is essential in addressing this challenge, while ensuring that the benefits of RME are maximized without compromising patient safety and privacy.

**Positive Impacts and Obstacles: Security, Privacy, and Patient Data Protection Aspects of RME**

The adoption of Electronic Medical Records (RME) in Indonesian health services requires a mature approach to respond to positive impacts and overcome obstacles that arise. The main focus should be placed on several key aspects. First, data security and protection is a priority with the adoption of advanced cybersecurity technologies such as end-to-end encryption and strong authentication protocols to prevent cyberthreats and hacking of patient data. Second, it is important for health facilities to comply with data privacy regulations and related laws, so revisions to the RME system need to be made in order to comply with applicable legal standards (Silalahi, 2022).

In-depth training efforts for medical personnel and staff are key. They need to gain a solid understanding of data security, electronic medical information management, and ethics in the use of RME. Not only that, the privacy awareness program also needs to be emphasized so that all parties understand the importance of maintaining the confidentiality of patient data (Amin et al., 2021). Close cooperation with the authorities and related institutions also cannot be neglected. Their involvement in developing regulatory compliant RME implementation guidelines will help ensure regulatory compliance. Support from the authorities will also facilitate enforcement and oversight.

Equally important, there needs to be an effort to bring the technology to remote areas. The government and related institutions must prioritize the development of technological infrastructure in the region. This includes providing affordable internet access, technology training, and providing the necessary equipment. By overcoming technological barriers in remote areas, digital transformation in healthcare can be more equitable.

RME implementation through this approach, has the potential to provide significant positive impacts, while successfully overcoming obstacles that may arise. Collaboration between the government, health institutions, the technology industry and the public will build a solid foundation for the digital transformation of healthcare services in Indonesia, while upholding the integrity, security and privacy of patient data.

**An Effective Clinical Decision Making, Patient Management, and The Quality of Medical Care**

The application of Electronic Medical Records (RME) in the era of digital transformation in the health sector has a significant impact on clinical decision making and more effective patient management, as well as making a real contribution to improving the overall quality of medical care. In various interconnected aspects, RME presents positive changes that benefit patients, medical personnel, and the health care system as a whole (Dhopeshwarkar et al., 2018).

Quick and centralized access to patient information through RME allows doctors to access patient medical data more easily. This helps in making more informed and responsive clinical decisions, especially in emergency or treatment situations that require prompt action. Then, RME also enables more robust data-driven decision making. By analysing data from multiple patients, medical personnel can identify disease trends, response to treatment, and expected outcomes (Tan et al., 2017). Decisions based on evidence and data reduce the risk of misdiagnosis and improve the quality of care. Furthermore, RME enables better personalization of care. With access to more complete information about each patient, doctors can design treatments that suit individual needs and preferences. This results in more effective care and ensures patients feel individually treated.

The use of RME also helps in monitoring patients in real-time. Doctors can monitor patient health parameters continuously and respond quickly if there are changes that require medical intervention. In addition, coordination between healthcare providers is enhanced through centralized sharing of medical information. This ensures that patients receive holistic and coordinated care, avoiding unnecessary duplication of tests or treatments (Sari & Rahman, 2018).

It is also important to note that RME helps in reducing the risk of human error that can occur in the management of physical medical records. Data that is structured and easily accessible through electronic systems reduces the potential for misinterpretation or loss of information (Irmawati, 2018). RME also allows for more accurate tracking of medication history. Doctors can easily access medical history and previous medical procedures for patients, ensure proper follow-up care and avoid duplication of procedures.

The implementation of RME (Real-Time Medical Evaluation) in healthcare practice has yielded significant positive outcomes. It not only facilitates well-informed clinical decision-making and personalized care but also enhances patient management, minimizes the risk of errors, and contributes to the overall enhancement of medical care quality. By leveraging this technology, the healthcare system can progress towards a future characterized by increased efficiency, effectiveness, and responsiveness to patient requirements.

**Technical, Regulatory and Social Challenges of RME**

Facing the complex challenges of adopting Electronic Medical Records (RME) as an integral part of digital transformation in Indonesian health services 4.0, proactive and collaborative steps are urgently needed. Technical, regulatory and social challenges require a holistic and integrated approach to ensure the success and sustainability of RME implementation. In addressing the technical challenges, the government and related institutions need to do things such as invest in technology infrastructure, especially in remote areas, to ensure adequate connectivity for RME adoption. Develop uniform and compatible interoperability standards to ensure smooth exchange of data between health facilities. As well as, providing intensive and ongoing training to medical personnel and health staff so that they are able to operate RME properly and understand the principles of cybersecurity.

However, addressing regulatory challenges also requires steps such as collaborating with regulators in formulating guidelines and regulations that are in line with the dynamics of digital transformation in the health sector. In fact, it can also form a special team that is responsible for monitoring and quick adaptation to regulatory changes that may occur. Meanwhile, in overcoming social challenges, efforts are needed to increase public understanding and acceptance of RME, namely conducting a comprehensive educational campaign that highlights the benefits of RME in improving the quality of health services and maintaining patient data security. Presents successful real-life case examples to strengthen the evidence that

RME is safe and beneficial. Also, involve various parties such as community leaders, health experts, and influencers in order to build public confidence and support for the adoption of RME.

The involvement of all stakeholders, including governments, healthcare institutions, technology providers, regulators, as well as the community, is critical to creating an ecosystem that supports the successful adoption of RME. By prioritizing transparency, data security, public education, and prudent regulations, the implementation of RME can be a milestone in providing better, more efficient and affordable health services for all Indonesians in the era of digital transformation 4.0 (Wulandari et al., 2019).

## CONCLUSIONS

Indonesia's Digital Transformation Era 4.0, the application of Electronic Medical Records (RME) has brought profound changes in health services, as it plays a key role in improving the efficiency, accuracy and quality of medical care. These advantages are realized through more informed clinical decision making based on integrated data and in-depth analysis. The ability to access real-time patient information allows for better coordination between healthcare providers and better personalization of care according to individual needs. However, challenges related to data security and privacy must be taken seriously through sophisticated cybersecurity measures and regulatory compliance. The application of RME must prioritize transparency, trust, and safety of patient data. With all the challenges and potentials, RME brings positive changes in Indonesian health services. This encourages the healthcare system to become more adaptive, responsive and patient-focused.

**Declaration**

**Ethical Approval and Consent Participant**

Not Applicable

**Conflict of Interest**

The authors declared that there is not any conflicting interest in this study.

**Availability of Data and Materials**

Data and material research can be provided at open data repository (Google Scholar, PubMed and Sagepub). Data Sharing is not applicable to this article as no new data were created or analysed in this study.

**Author Contributions**

Authors have made substantial contributions to the conception; design of the work; the acquisition, analysis, and interpretation of data; the creation of new software used in the work and have drafted or substantively revised it.

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